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ADVANCED FIREPOWER CONCEPTS FOR MILITARY OPERATIONS IN BUILT-UP AREAS. VOLUME II. TECHNICAL DOCUMENTATION

George Schecter

Ketron, Incorporated

Prepared for:

Advanced Research Projects Agency
Army Missile Command

28 September 1973

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VOLUME II

TECHNICAL DOCUMENTATION

ADVANCED FIREPOWER CONCEPTS FOR MILITARY OPERATIONS IN BUILT-UP AREAS

28 September 1973

This research was supported by the Advanced Research Projects Agency of the Department of Defense and was monitored by the U.S. Army Missile Command under Contract Number DAAH01-72-C-1063.

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ARPA Order Number 2163
Contractor: Ketron, Inc.
Amount of Contract: $210,362.00
Effective Date of Contract: 27 June 1972
Contract Expiration Date: September 1973
Project Scientist: George Schecter
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APPENDIX A

TECHNICAL PROBLEM RESUMES

This appendix contains 26 Technical Problem Resumes (TPR). Each TPR presents a situation and one or more events (paragraphs 1, 2 and 4), analyzes the applications of firepower in the situation (paragraphs 5 and 6), recommends further analyses (paragraph 3), and suggests alternative responses (paragraph 7).

WESTERN EUROPE - METROPOLIS

TECHNICAL PROBLEM RESUME

Problem: Firepower 3	Date: 1 Dec 1972	Sheet 1 of 7
Operational Area: METROPOLIS		
Title: Commit the Battalion Reserve		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 3	Date: 1 Dec 72	Sheet 2 of 7
Operational Area: METROPOLIS		
Title: Commit the Battalion Reserve		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, par. 3.4.a(6)..
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Lester, Dick M., Walton, William W., Jr., and Ruppenthal, Roland G., Vulnerability of the Seventh U.S. Army During Deployment (U), Research Analysis Corporation, McLean, Va., Tech. Memo. RAC-T-481 (FOE), July 1966. Secret

2. DESCRIPTION OF PROBLEM

Upon initiation of hostilities the civilian vehicle traffic fleeing the city will create such heavy congestion as to make mechanized troop movement almost impossible.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

Rapid military movement through heavy civilian vehicular traffic, especially under enemy air artillery fire, appears to be a major unsolved problem that will be encountered in future city combat. Solutions should be sought from traffic and network theory and mobility science first, and then from firepower means. Cornell Aeronautical Labs, the MOBA Mobility contractor should work directly with Ketron in pursuing this problem.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

At 2230 the 4th Battalion of the Burgundian 3rd Mechanized Infantry Division was ordered to move immediately from their permanent camp on the western suburban area of Metropolis through the city on Highway 75 and take a position at the old wall gate on Highway 75 in the eastern sector. The Metropolis police were ordered to divert all civilian traffic off the Highway; but because of the near panic situation within the city, the dissident actions of sabotage, and traffic blockages, severe police and military actions were necessitated to get these forces transported during the night.

b. Characteristics of the Area of Operations

The city built-up area starts from the port area and extends south for some 20 blocks before a broken pattern of individual houses begins. This same pattern extends east-west from the Moch River mouth for approximately 15 blocks in each direction. Some 20 parks are scattered through the central city which breaks up the solid building pattern. The highest complex of buildings extends five blocks south of the port area and contains the main shopping, financial and business buildings of the city. This area includes a number of 12 to 15 story buildings. Five main streets emanate from the hub of the port area, and form the main avenues through the city to the southeast through the southwest. These streets are intersected by an east-west grid of streets running parallel to the coast line. Except for the five north-south and the three east-west avenues, all secondary streets are relatively straight, but narrow. Metropolis is cut by the Moch River which flows north through the city but breaks into two channels before entering the sea. There are three main road bridges and one railroad bridge crossing the river in the central part of Metropolis. In addition, there are four small foot bridges for crossing the river. The nearest bridge to the south of Metropolis is the Caldorf bridge, 10 km. distant.

c. Description of Own Forces

The TOE of the 4th Battalion of the Burgundian 3rd Mechanized Infantry Division is given in Ref a. The battalion has 80 tracked and 75 wheeled vehicles.

d. Description of Civilian Traffic

The civilian traffic consists of over three hundred thousand private automobiles moving west across the Moch River at the bridges in Metropolis. Another three hundred thousand cars are trying to cross over the bridges south of Metropolis. The cars are predominantly compacts. Each car is packed with personal belongings, food, and people. Civilian service stations are out of gas.

5. PROBLEM ANALYSIS

The 4th Bn became increasingly slowed as it moved toward the Highway 75 bridge. Police were unable to clear a lane. The battalion commander at this point ordered the 1st mounted infantry platoon of Company A to clear the way using any force required. The infantrymen were ordered to force cars individually to the road side. Each infantryman would approach a car and direct it to the side of the road and force the driver to stop the engine, and get out. As the infantry proceeded down the cleared lane any driver who had returned to his seat was rougly removed. A police helicopter with loudspeakers was enlisted to precede the battalion, instructing the drivers to move to the side and dismount.

The technique enabled the battalion to advance to the Highway 75 bridge at 5 km/hr. But at the bridge their progress was completely halted

for 45 minutes while the bridge was cleared (by sending one platoon across to stop all on-flowing traffic).

As the battalion began to cross the bridge, air strikes from 1st Lenonian Tactical Fighter Wing became intense, forcing the infantry to dismount. Thirty percent of the vehicles were destroyed in the next two hours. The infantry proceeded across the bridge and down Highway 75 on foot, but were forced to leave most of their heavy weapons. The stalled and destroyed vehicles, together with continued aerial harassment, completely halted vehicle movement until the U.S. established aerial superiority over the bridge five hours after it was cleared of civilian traffic. At that point the surviving battalion vehicles proceeded across the bridge, but were able to clear a path through the civilian traffic at a rate of only one km every three hours since large numbers of cars had been abandoned. The battalion vehicles arrived at the FEBA twenty-two hours after departure from its base ten kilometers to the west! In that time the infantry battalion along the FEBA had taken heavy casualties from Lenonian tank and direct fire artillery, which met virtually no opposition due to the Burgundian lack of heavy weapons.

6. RESULTS OF ANALYSIS

It seems unlikely that any firepower response will be effective in clearing roads. This is true since it is impossible for the drivers to quickly clear the road even when they are motivated to do so. Thus gas, strafing, or other firepower responses tend only to cause the drivers to abandon their cars -- which we have seen is probably the worse thing that can happen.

A number of alternate tactical concepts should be evaluated using historical data if available.

The battalion should spread out and move down parallel avenues in order to reduce vulnerability to air attack and to prevent the entire column from being stopped at any one time. Any vehicular kills from enemy air or artillary become independent events and do not add to the congestion already faced by the manuevering unit.

In order to avoid the civilian traffic the battalion should move along railroad routes and across railroad bridges when possible.

7. ALTERNATIVE RESPONSES

Evaluate equipment modification concepts which could improve the utility of military vehicles in the city. These include dozer blades and quick hook-up magnetic or grappling devices.

Evaluate methods of helicopter mobility in city combat. In this event the battalion and all of its weapons can move into position by helicopter. The 52nd Infantry Division has three helicopter battalions assigned, with 64 troop-carrying helicopters. Flying a short turnaround shuttle over friendly territory, the first infantry company can be delivered on position in a few minutes. The balance of the battalion can be lifted in within an hour or two, depending on the number of helicopters assigned to the mission. Only the 1/4 ton trucks can be airlifted with the battalion, but they are enough to provide mobility for AT weapons, power for key radios, and ammunition distribution within the battalion area. The battalion can be airlifted and be combat effective in the defensive role assigned. The balance of its vehicles can join the battalion by a long bypass through the countryside, since time is less important in their movement once the combat elements are in position.

Another alternative response is foot movement of the battalion. This would mean leaving the 4.2" mortars and AT weapons (TOW or 106 mm recoilless rifles) to move by airlift or with the battalion's vehicles. Except for these weapons, the battalion can be in position in about 4 hours. Foot movement over considerable distances is faster than vehicular movement in many urban situations, provided that routes are carefully selected. Short cuts via underground passages, footbridges, parks, and even through buildings are available. Mobility patterns for dismounted movements can be studied and developed.

TECHNICAL PROBLEM RESUME

Problem: Firepower 4	Date: 9 Oct 1972	Sheet 1 of 7
Operational Area: METROPOLIS		
Title: Protect the River Against Infiltration		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 4	Date: 9 Oct 72	Sheet 2 of 7
Operational Area: METROPOLIS		
Title: Protect the River Against Infiltration		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, par 3.4.a.(7).
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972 pgs. C-8,9.

2. DESCRIPTION OF PROBLEM

Due to high volume of river traffic, the patrol boats are unable to check all boats. The searching of suspicious vessels is slow and hazardous operation.

3. RECOMMENDATION FOR FURTHER ANALYSIS

a. A study should be instigated to review the use of chemical incapacitants in searching potentially hostile enclosures such as small boats. The study should compare own force, hostile, and neutral casualties using these chemical agents vis-a-vis grenades, small arms, and other current weapons.

b. The most pressing problem in this operation is the detection and identification of hostile personnel concealed below decks. We recommend this problem be pursued as a surveillance problem.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

At 2230, the Burgundian Navy was ordered to divert six of their 10 patrol boats from coastal patrol to inland water patrol to protect against the infiltrators and munitions runners operating on the Moch River and the Eastern Channel. All private and commercial water traffic was to be stopped and diverted to the

western side to prevent possible capture.

During the first twenty tour hours of the river patrol operation only 60% of the river traffic was successfully diverted, due to the overwhelming volume of traffic.

Eight hostile boats attempted to ferry men and equipment across the Moch. Two were stopped, one was slowed and suffered casualties, and the remainder were unimpeded.

b. Characteristics of the Area of Operations

The Moch River enters the Metropolis urban area from the south and exits into the North Sea at the northern coast line of Metropolis. The Moch River, Eastern Channel, and wharf channels average 200 meters in width. All have a deep channel providing passage for small ships and barges. The city built-up area starts from the port area and extends south for some 20 blocks along the river. Then a broken pattern of individual houses and separate buildings occur.

There are three vehicle bridges and one railroad bridge crossing the river in the central part of the city. There are also four foot bridges and two ferries for crossing the river.

c. Description of Own Forces

Six patrol boats, KW 15, KW 16, KW 17, KW 18, KW 19 and KW 20; of 45 tons standard displacement each, 25 knots speed, two 20 mm AA guns capable of depressed fire, and two heavy.50 cal. machine guns. Each boat is also equipped with:

2 - AN/PVS-4 - NV Sight, Individual Weapon

2 - AN/TVS-5 - NV Sight, Crew Served Weapons

1 - AN/VTT-3 - Searchlight, IR, Xenon, 1 kw

4 - M-18 - Binocular, IR, M-18

1 - MTI Radar

d. Description of Enemy Forces

Lenonian army personnel in uniform and carrying individual weapons are using any available boats to cross the Moch River. These enemy personnel move in small teams (three to five individuals) and usually carry one handie-talkie radio per team. The Lenonians are being assisted by Burgundia dissident civilians in crossing the river.

5. PROBLEM ANALYSIS

The analysis is summarized in Figure 1.

The patrol boats must intercept all traffic and divert it to the western bank to avoid capture. In addition suspicious craft must be boarded and searched and destroved if resistence if offered.

The key problem is approaching and boarding craft. This is an extremely hazardous operation. Hostile personnel cannot run and must therefore resist or be captured. Further, hostile personnel generally outnumber the patrol crew, and they have the element of surprise. The obvious hostile tactic is to keep most of the armed hostiles hidden below and to spring forward when boarding commences to engage the patrol boat crew.

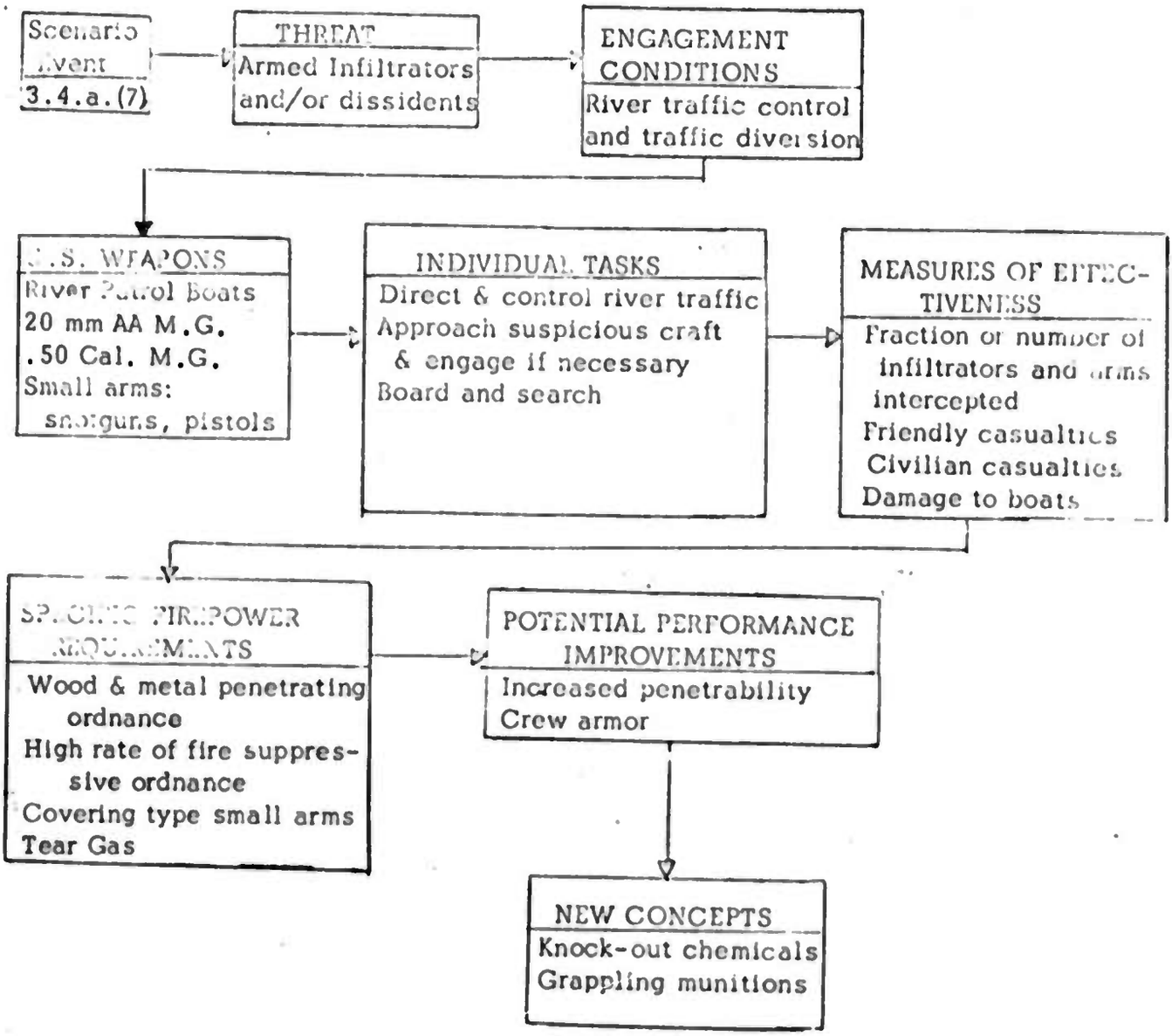
A suggested patrol boat tactic is to approach within megaphone range and instruct the crew of the suspicious craft to come to topside. Keeping the crew under guard of the .50 cal. M.G. and small arms, the patrol boat should cautiously approach, its own crew covered as well as possible. If there is suspicion of hostiles below decks, a gas grenade should be used.

Only one person should be sent aboard to search. If he is fired on then the boat should be engaged with heavy firepower, particularly grenades.

Note that identification of friend or foe (IFF) is the key problem since the patrol boats have sufficient firepower to defeat an enemy vessel from a distance with minimal casualties, but without better surveillance capabilities the patrol boat must come to close range where the firepower advantage is reduced.

Note also that the crew may be neutrals hijacked by hostiles. Thus the threat to kill the topside crew on advent of resistance may be empty.

There is a good chance that the patrol boats will be unable to intercept all hostile traffic due to length of time to engage and divert or search river traffic.



Patrol River & Halt Infiltration

Figure 1

One tactic which would decrease friendly losses at a slight expense in image and possible civilian casualties is to fire across the bow of the suspicious boat, being careful not to hit it. This tends to draw a hostile response at a range where friendly forces still have a decided offensive advantage. If no response is forthcoming, the chances are greater that the boat is not hostile, although a cautious search is still required. This strategy looses its effectiveness when discovered by the hostiles.

The most needed equipment lies in the field of surveillance, viz. a device to identify concealed hostiles at long range. Barring such a device, the first verification of hostiles will come in the form of sudden, lethal, hostile fire. In this case the firepower response must be immediate and potent. A matrix of claymore mines aimed at the hostile craft would provide such a response.

One device which would be useful and within the state of the art is a mechanical arm containing a television camera and integral weapon. This would probably be very expensive, however, since it would have to be provided a capability of riding with the two ships' motions, possibly requiring computer assisted control.

Perhaps the most useful "wish list" firepower item would be a non-lethal, short duration knock-out gas. A wish list would include knock-out chemicals (gas or hypodermic darts), improved body armor (resistant to knives and clubs), dogs to controlcrews or to locate and break detonator wires.

Finally, grappling munitions should be examined to determine whether improvements in this area are possible.

6. RESULTS OF THE ANALYSIS

Patrolling and controlling riverine traffic was found to be a significant problem in SE Asia. The specific events examined here support the conclusion that this type of action is slow and hazardous. There are some concepts which could reduce the hazard and which should be examined further. First, chemical munitions capable of penetrating a boat's superstructure would be effective in shipping the cover from hostiles that might be inside. Non-lethal

munitions would reduce casualties in cases where the boat has been hijacked and the crew held as hostages. A second concept includes the rapid identification of hostile personnel or combatant on boats. A study should be undertaken to examine the spectrum of devices available. For instance, for wooden structures, see-through radar might be effective in identifying military hardware. Sniffers and listening devices may be useful and should be examined. Since this latter function is a surveillance problem, it should be pursued as a joint effort with GTE Sylvania.

7. ALTERNATE RESPONSES

There are other concepts which could contribute to the problem of improving riverine patrol capability. Search techniques should be reviewed. Several strategies could be selected such as opening fire at relatively long range to coax a premature response, taking hostages immediately upon boarding, using claymore mines as a close range deck sweeper, improved grappling munitions, and using dogs to assist in controlling personnel. A study of each of these areas could identify potential concepts which would reduce the hazard of river patrol.

Another alternative possible in this event is to herd all small craft off the river and alongside westbank docks. The searching can be done by forces on the docks with less vulnerability to the searchers. Since this event is a one-time (or at least, short duration) clearance of all river traffic and its diversion to the westbank, the search need not be done by the patrol boat crews.

TECHNICAL PROBLEM RESUME

Problem: Firepower 5	Date: 10 Oct 1972	Sheet 1 of 8
Operational Area: METROPOLIS		
Title: Remove Dissidents from Government Center		

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TECHNICAL PROBLEM RESUME

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Operational Area: METROPOLIS		
Title: Remove Dissidents from Government Center		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, par. 3.4.a.(8)
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Fort Benning, Ga.
d. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, March 64.

2. DESCRIPTION OF THE PROBLEM

U.S. and Burgundian forces are not able to swiftly clear a building occupied by armed dissidents without inflicting heavy casualties on the dissidents. They are unable to prevent the occupying dissidents from causing heavy damage to the building using explosives or fire.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. There is a need for repulsion weapons for use against dissident personnel. A study should be performed to determine (1) the technical feasibility and expected costs of such weapons, (2) the frequency with which such weapons would be useful, including secondary roles, or (3) the probable results of using these as opposed to current weapons. Candidates for repulsion weapons include: electric "cattle prods"; chemically irritating shields, prods, or uniforms; and thermal prods (road flares might prove excellent).

b. A review of methods for locating and disabling hidden explosive caches and emplaced charges should be accomplished, with emphasis on charges located within buildings.

c. A review of the use of animals for crowd control and explosives detection should be accomplished, with emphasis placed on operations in buildings.

d. A study should be made of the psychological and sociological implications of a very rapid, high lethality approach to dissident control. When will this turn a significant number of neutrals into hostiles? When will it discourage further dissident activities? How has it worked in the past?

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

Several militant dissident groups had occupied key sections of the government center building and threatened to disrupt the military headquarters. At the time the government center was crowded with night workers and military staff members. At 2200 hours, one company of the U.S. 76th Infantry was ordered to join one company of the 1st Battalion, 1st Infantry of the Burgundian 3rd MID. Their mission was to clear the Government Center building of an estimated 100 armed and unarmed dissidents before they disrupted or captured the military communication center on the 4th floor. Their orders were to capture the dissidents rather than kill, if at all possible.

b. Characteristics of the Area of Operations

The Government Center building is a four-story steel-framed stone-faced office building with two levels of basement. The building is approximately 500 feet square with a central courtyard approximately 130 feet square for light and ventilation. The floor plan is symmetrical on every floor, including the first basement. The second basement houses the utilities for the building and incidental storage facilities. The office spaces are arranged in three concentric rings with two main corridor rings separating the spaces. There are many radial corridors leading into the clusters of offices and interconnecting the main corridor. There are four main clusters of stairs and elevators, one in the center of each side of the building. The military departments of Burgundia are located in various clusters of offices spread throughout the building in a haphazard growth pattern. The combined Army-Navy-Air Force communication center is located in the inner ring of the 4th floor, north side, with many antennas located on the roof of the building.

c. Description of Own Forces

One infantry company of the US 76th Infantry was ordered to support one infantry company of the Burgundian 3rd Motorized Infantry Division to clear and patrol the building. The U.S. company was equipped as shown in Figure 1. The Burgundian company was similarly equipped but with older U.S. equipment.

d. Description of Enemy Forces

The militant dissidents were the main threat to disruption of the military communication center. Only a few of the militant leaders were known to the police and military and every Burgundian national in the Government Center was suspect. The dissidents brought in small hand weapons and munitions useful for sabotage, which had been supplied by the Lenonians via underground means.

The types of weapons in the hands of the dissidents are shown in Figure 2.

5. PROBLEM ANALYSIS

The analysis is summarized in Figure 3.

Consider the following scenario: Dissidents have captured the first three floors of the Government Center and barricaded the first floor entrances. They have broken onto the fourth floor but are being held at bay by armed police and unarmed (except for hastily improvised weapons) military personnel. The two infantry companies can probably clear the building adequately with present TO&E. A likely procedure would be to gas (e.g. CS) the first floor. Locate easiest entry (probably window) and secure. Send three gas-masked platoons to the fourth floor, using tear gas and hand weapons to move through dissidents. Secure central fourth floor, third floor, and upper floors. Have three more platoons follow and subdue the dissidents, using clubs, then remove barricades and herd dissidents to personnel carriers.

Under a slightly different scenario the problem appears insoluble. If the dissidents have explosives, they could wire the ceiling of the third

floor, directly under the communications center. Using either a short time fuze or remote detonator, it appears that the dissidents could succeed in destroying the communications center. They may effect similar destruction by building fires on the third floor, although these might be brought under control by the counter-attacking force.

Due to the criticality and vulnerability of the communication center it might behoove the U.S. and Burgundian forces to use rifle fire and grenades to clear a way rapidly and bloodily to the communications center and the surrounding rooms.

6. RESULTS OF THE ANALYSIS

During the past few years, a family of non-lethal weapons has been devised for use by military or civilian police in controlling rioters. A comprehensive study should be undertaken to evaluate these devices to determine applicability and improvements.

The need to quickly locate and neutralize implanted explosives is present in most of these relief actions. The use of animals in effective search tactics should be studied. This is a sensor problem. Finally, the psychology of mob violence should be studied in detail. Are tactics fitted to the crowd needs or pitted against the crowd's weaknesses more likely to succeed? This is a civil interaction problem.

7. ALTERNATE RESPONSES

Several weapon concepts that can be added to the existing inventory appear below. In each case, an engineering feasibility study is necessary as the initial step in the development of the concept.

Knock-out chemicals

Improved body armor (resistant to knives, clubs), head and face protection.

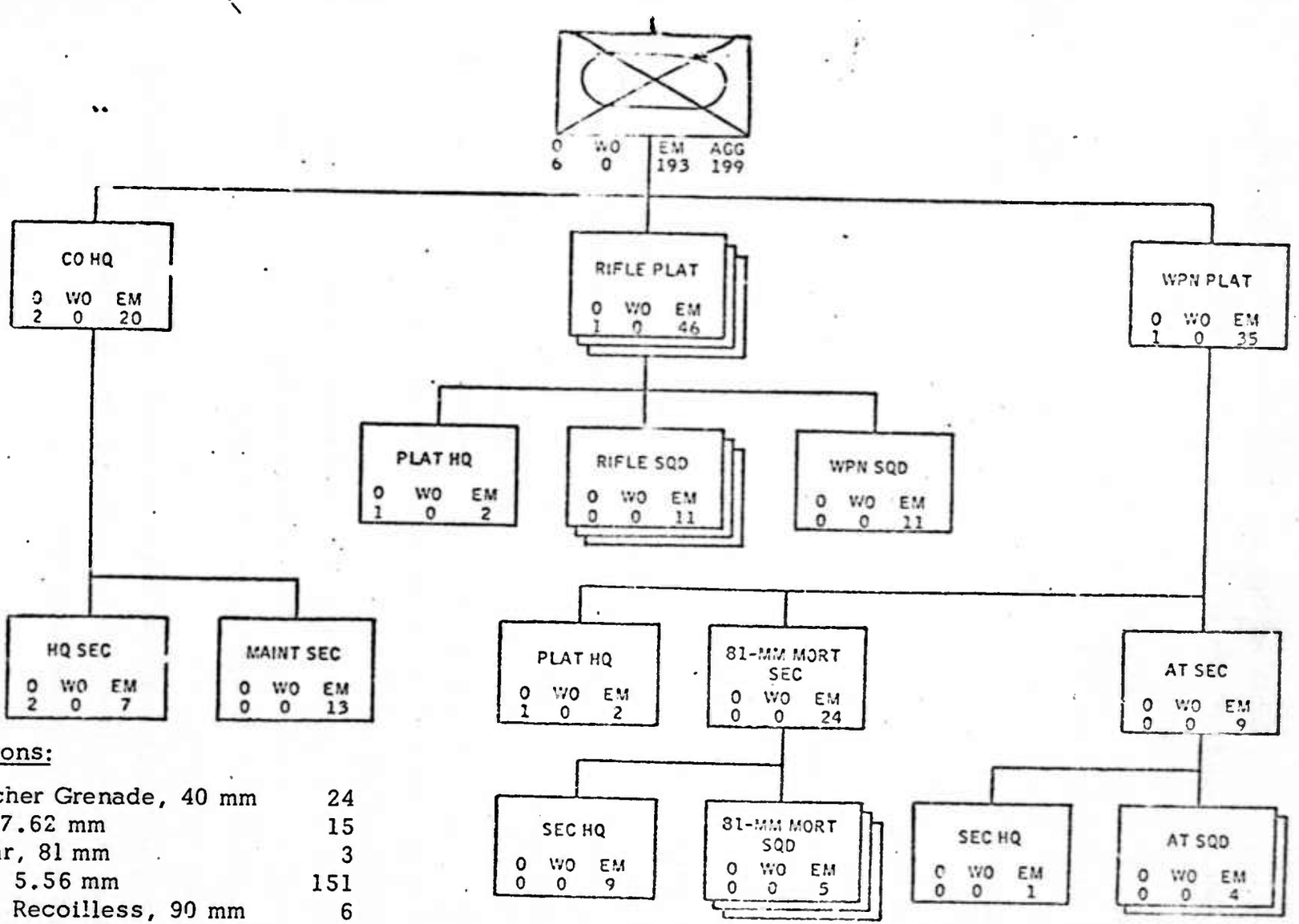
Animals to control crowd or to locate and remove explosives.

Radiant heaters for inverse range pain.

Propelled nets.

Foam to restrain or temporarily blind crowd.

Armored cherry picker for upper floor entry or neutralization.



Weapons:

Launcher Grenade, 40 mm	24
MG, 7.62 mm	15
Mortar, 81 mm	3
Rifle, 5.56 mm	151
Rifle, Recoilless, 90 mm	6
Rifle, Recoilless, 106 mm	2

RIFLE COMPANY, INFANTRY BATTALION (MECHANIZED)

Figure 1

Pistols

9 mm Makarov (E. German)

Submachine Guns

7.62 mm SMG M1941 PPSh (Soviet)

Rifles

7.62 mm Assault Rifle - M1958 (Czech)

7.62 mm Carbine - Akm (Soviet)

7.62 mm Carbine - SKS (Soviet)

Grenades

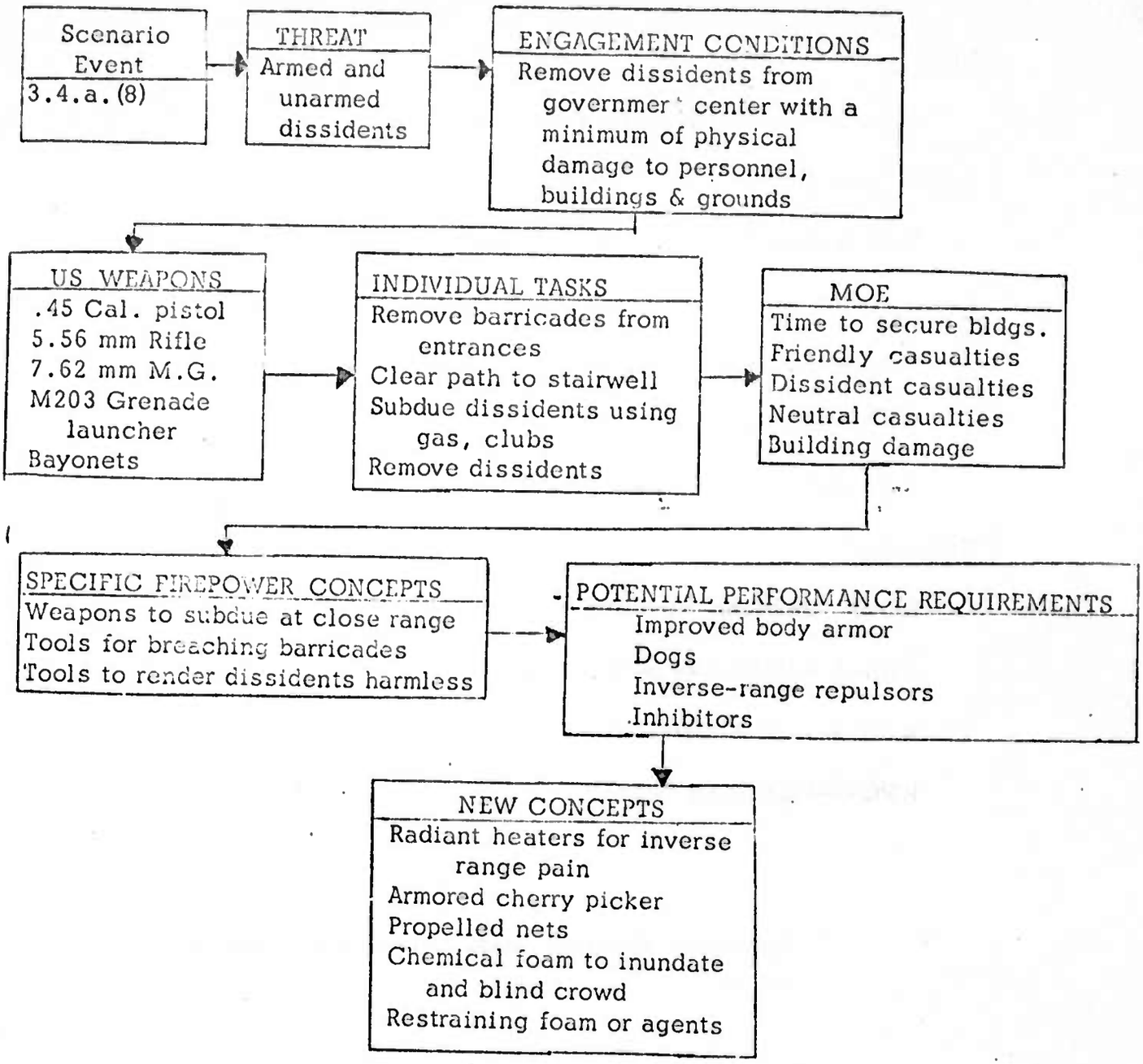
RG-4 - Jedlicka offensive (Czech)

RGD-5 - Defensive (E German)

RPG-40-AT (E German)

RPG-6-heat (E German)

Figure 2. Weapons List, Lenonian Insurgents



Remove Dissidents from Government Sector

Figure 3

TECHNICAL PROBLEM RESUME

Problem: Firepower 6	Date: 22 Oct 1972	Sheet 1 of 13
Operational Area: METROPOLIS		
Title: Defend Eastern Train Station		

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TECHNICAL PROBLEM RESUME

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Title: Defend Eastern Train Station	

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built-Up Areas, July 1972, Para. 3.4.a.(9).
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, March 64.

2. DESCRIPTION OF PROBLEM

The three company defense is deplorably inadequate to counter the Lenonian assault, which is employing a mechanized Infantry Division to capture the key railroad tunnel and its access points.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. A study should be conducted on the use of helicopter gunships in city combat, quantifying and comparing armor, armaments, flight techniques, and tactics of employment.

b. A study should be conducted to determine the value of "smart" munitions to a city defense. A technical analysis should be performed to determine the implications of the severe city topography on delivery error and munitions effectiveness.

c. A study should be made to determine improvements for man-portable large caliber rockets and recoilless rifles to allow use from closed rooms (possibly even through closed windows). The problem may be attacked using blast-channelling devices. Perhaps more promising would be the design of a large caliber, closed-breech gun or rocket system, using the interior building structures to absorb recoil.

d. New armor doctrine and tactics should be developed and refined. Munitions for city fighting should be reviewed and improved munitions developed.

A vulnerability analysis should be conducted, aimed at devising equipment and procedures to reduce vulnerability.

e. An in-depth analysis of the mobile city defense vis-a-vis the more traditional area defense is needed. A hand played or computerized simulation would be especially useful to compare quantitatively casualty rates, collateral damage, and parameters of weapon, munition, and vehicle suitabilities.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

In Metropolis the railroad tunnel runs through the city and feeds to the railroad bridge which is a key route across the Moch River (Figure 1). The Lenonian 7th Motorized Rifle Division has been ordered to capture the bridge, the tunnel and its accesses on both sides of the river and to secure the surrounding areas. The tunnel must not receive major structural damage. It must be cleared to permit rapid transit. The streets over the tunnel must be secured to protect the tunnel at its numerous access points.

Two Burgundian Navy river patrol boats, reinforced with one rifle platoon equipped with automatic weapons, take up defensive positions around the railroad bridge. The river patrol boats cruise under the railroad bridge, providing fires against the east bank and the highway bridge. One rifle squad deploys onto the railroad bridge, also providing fires against the east bank and the highway bridge. A second rifle squad deploys to the north of the exposed RR line and covers that line. A third rifle squad is held in reserve. The weapons squad deploys in buildings overlooking the tunnel entrance. The rifle platoon establishes an artillery fire zone as shown, coordinated with the 3rd Infantry Division (Mech) Artillery.

3rd Bn, 2nd Infantry of the Burgundian 3rd Mechanized Infantry Division is assigned the defense of the station and tunnel. Company A deploys around the buildings along the west side of the entire route of the tunnel. Company B is assigned security duty in and around the train station. Company C deploys between the train station and the eastern channel of the Moch River. It guards against an enemy sweep through this position to the rear of Company A; it also provides a reserve force (See Figure 1).

At 0600 the Lenonian force concentrates its attack on the train station. Using tanks and point blank artillery fire to neutralize heavy weapons emplacements, the train station is quickly overrun and secured. Relying heavily on grenade launchers, the tunnel is quickly cleared.

The 17th Motorized Rifle Regiment is sent to clear and secure the avenue over the tunnel but meets severe resistance from the buildings on the west. The regiment then resorts to the use of direct fire artillery to reduce each of the buildings facing the street, followed by an infantry assault to secure positions amid the rubble. A team from the 7th Engineer Bn., with heavy protection, is sent down the avenue to weld shut all potential entrances to the railroad tunnel. Meanwhile the leading elements of the 17th MRR proceed to engage and quickly reduce the rifle platoon protecting the river entrance to the tunnel. Again, large caliber direct fire artillery is used to demolish the buildings which the defense had prepared. Each of the patrol boats is sunk by recoilless rifle fire.

By 1100 the entire route from the eastern station to the river is secure to Lenonian forces. The remnants of the Burgundian force is contained in the area west of the tunnel. The defense was a complete failure.

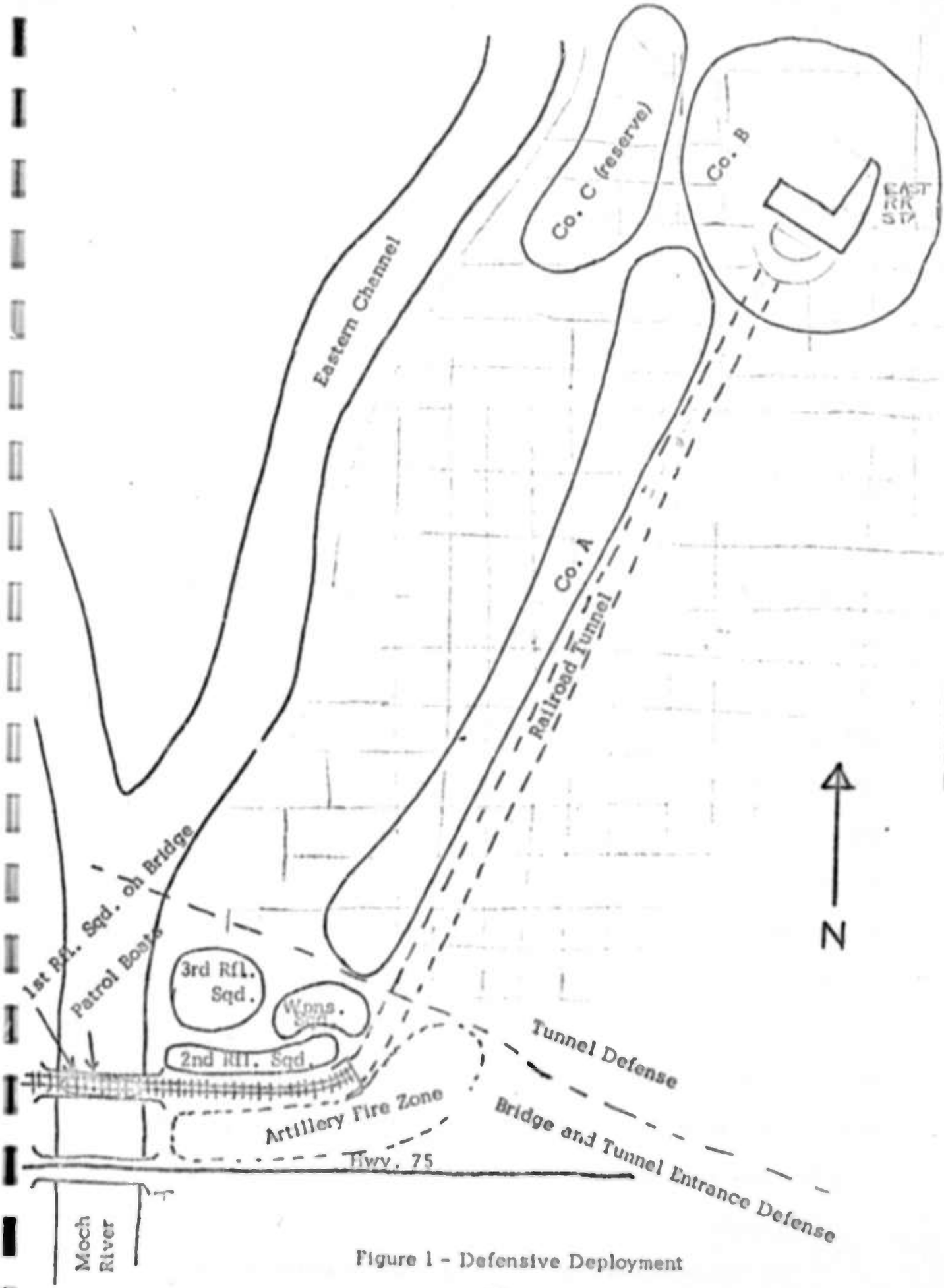


Figure 1 - Defensive Deployment

b. Characteristics of the Area of Operation

(1) The Eastern train station is a two-level station with four train platforms below ground level for the tunnel train and ten train platforms in the station itself, being the termination of the three rail lines coming from the east and south. There is a switching yard northwest of the station for storage and assembly of passenger trains and freight trains. The spur lines from the wharf and docks feed the switch yard. The No.1 tunnel platform track continues under the station and rises into a junction in the switching yard. The tunnel itself accommodates two tracks for its entire run and expands to four tracks at the station for the platforms. The tunnel was completed over 25 years ago and designed for electric locomotives which are still in use. The tunnel is an open excavation-type construction with concrete and steel sides supporting steel beam roof covered with concrete and fill dirt. The tunnel averages 35 feet in depth and runs under a large avenue. The tunnel has heavily-grilled air shafts every 150 meters. There are covered man-access shafts along the tunnel for emergency use. The condition of these accesses and whether they are locked is not currently known. Many of these access exits are in the form of manholes, but some enter basements of old railroad maintenance buildings near the station and river front.

(2) The avenue over the tunnel runs through a predominantly residential area consisting of closely packed apartment houses averaging five stories in height. The area around the river entrance to the tunnel is in the last stages of decline and is largely uninhabited.

c. Description of Friendly Forces

(1) The Burgundian force involved is the 3rd Battalion, 2nd Infantry

of the 3rd Burgundian Mechanized Infantry Division. The rifle platoon attached to the patrol boats is from Company C of the battalion. The organization and equipment of the battalion are given in Figure 2.

(2) The patrol boats are 45 ton each, 25 knot speed, armed with two 20mm AA guns, two .50 cal. heavy machine guns, plus individual rifles and handguns.

d. Description of Enemy Forces

The organization and equipment of the 7th Lenonian Mechanized Infantry Division is given in Figure 3.

5. PROBLEM ANALYSIS

The defense will be thin. Battalions are usually assigned frontages of from four to eight city blocks and a depth of three to six city blocks (ref., c. p. 51). The tunnel is about twenty blocks in length and the train station calls for a defense of an additional frontage of about ten blocks. If the station alone is provided a surface defense, then a frontage of at least fifteen blocks should still be defended.

The primary problem is a lack of strength. The defense is outnumbered by more than ten to one and even with the advantages accruing to any city defense, their task is hopeless. A defense of three battalions instead of three companies might be successful. The defender's weakness is multiplied by his lack of time for preparation. Barriers, mines and fortifications are not used in this case study due to the hasty nature of the defense.

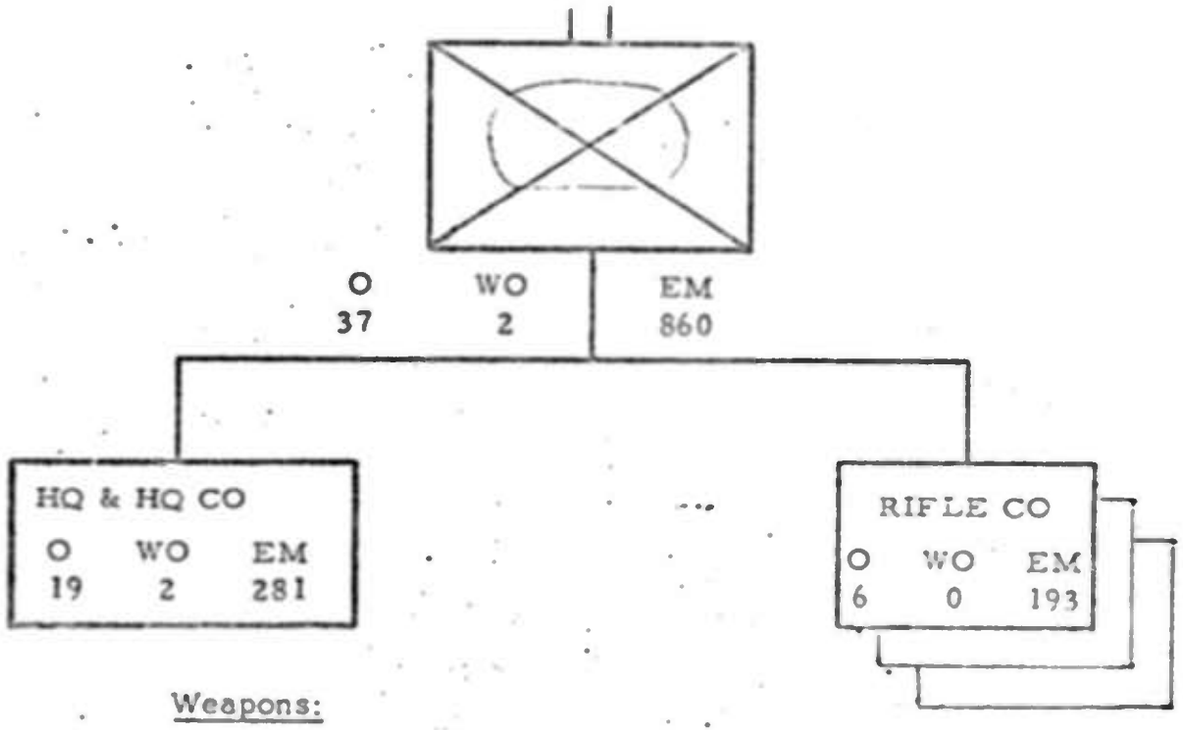


Figure 2
31

Weapons:

Flamethrower, portable	9
Launcher, grenade. 40mm	94
MG, 7.62 mm	49
Mortar, 81mm	9
Mortar, 4.2"	4
Rifle, 5.56mm	700
Rifle, Recoilless, 90mm	18
Rifle, Recoilless, 106mm	6

INFANTRY BATTALION (MECHANIZED),
BURGUNDIAN INFANTRY DIVISION

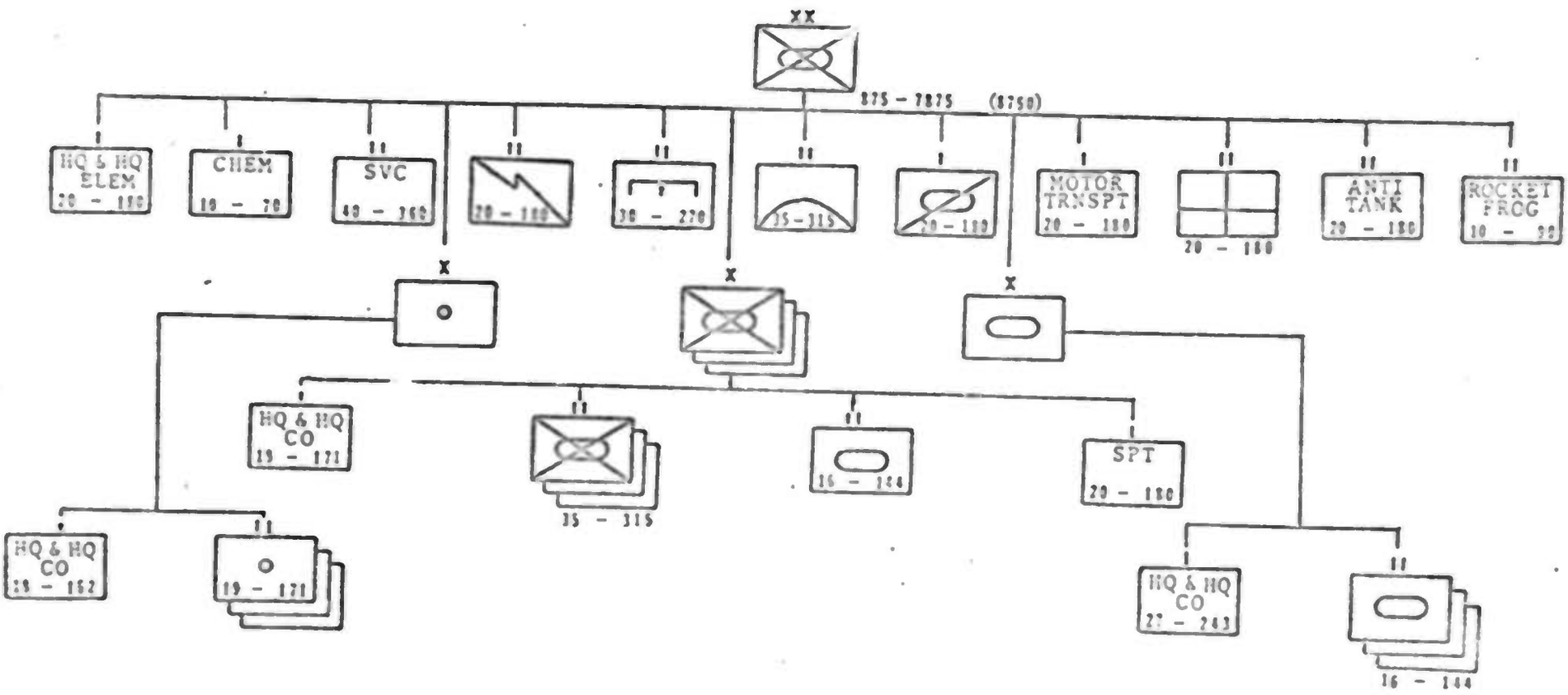


Figure 3

Lenonia - 7, 8 and 9th Motorized Rifle Division Organization

A static area defense is probably eventually doomed against a superior, determined enemy, for as each pocket of resistance is located it may be methodically destroyed with heavy weapons. This suggests that a mobile defense is desirable, based on (1) a light force defending each building from "walk-in" occupation and (2) a heavy, mobile reserve to engage attacker concentrations. The reserve may consist of combinations of foot and mechanized infantry, armor, and airmobile infantry. It should be supported by tactical air, helicopter gunships, and artillery (especially with guided munition). The key to such a mobile defense is to encircle and cut off the attacker, and to inflict heavy casualties on him and deny him retention of any building or area. The area and its new inhabitants are destroyed by artillery, tactical air, or previously emplaced explosives followed by infantry assault. The attacker must learn that capture of an area means death. In order to save the city, the defender must be willing to accept damage to it. It should be mentioned that this is essentially the type of defense successfully employed at Stalingrad.

Direct fire weapons have the most telling effect against the defense. If the attacker is deprived of these weapons, the outnumbered, dug-in defense will be far more successful. Thus improved antitank weapons for infantry use should receive top priority. Perhaps large cannon-launched guided projectiles or "smart" air delivered munitions, used in conjunction with man portable laser designators would prove most promising. A soldier with a thirty pound "flashlight" thus gains the firepower of a 155 mm howitzer--providing the howitzer is actually operational. Recoilless rifles or rockets designed to allow use from closed rooms would be very useful. Possibly a large-caliber closed-breech gun or rocket system could be designed to use building interior structures to absorb recoil.

If the enemy refrains from the use of heavy artillery and tank firepower, the defender's task becomes more feasible. The enemy will probably use smoke as cover while entering a tunnel access. For this reason it may behoove the defender to defend the tunnel from within rather than from without, although this may make him highly vulnerable to FAX, fragmentation, blast, and chemical attack unless adequate countermeasures are undertaken.

The train station is difficult to prepare for a defense due to the lack of upper stories. There will be only a few, easily identified positions suitable for weapon emplacement. For this reason the defender may elect to surround his position with smoke to prevent dislodgement by large caliber direct fire weapons.

The patrol boats are highly vulnerable to anti-armor fire. They find some safety in maneuver, but there is little room on the river. The boats are basically out of place. They could realize some utility as mortar platforms, but are not armed with mortars in this event.

6. RESULTS OF ANALYSIS

Several factors discussed above should be pursued to develop better defensive capability in urban areas. The use of helicopter gunships should be examined. Determination of exposure times and exposure ranges as a function of several helicopter missions could form the basics for determining the utility vs vulnerability in the urban environment.

The use of smart munitions could help slow the advance of a superior force by keeping the enemy from massing troops for an assault. Tube and rocket launched smart munitions should be carefully examined.

Tactics for defeating enemy armor and self propelled artillery pieces should be carefully studied. A stiff defense can be defeated by the use of heavy direct fire weapons. AT munitions of all types should be carefully evaluated to determine characteristics that are particularly valuable in city combat.

The entire problem of an integrated city defense could best be studied using a simulation model. Often the simulation is the only feasible method of examining the big picture and the interactions among all of the components present. Such a simulation would be useful in examining trade-offs between various weapons and tactics as a function of friendly and neutral losses and collateral damage. A comparison between area and mobile defense would be particularly valuable.

The use of small craft in combat on city waterways needs careful evaluation. The patrol boats in this action were armed only with flat trajectory, direct fire weapons. Firing from the river surface, they could only fire upwards and therefore could not get grazing fire. Furthermore, with neither armor nor maneuver room on the narrow waterways, they were quickly sunk by enemy recoilless rifles. A more suitable type of boat might be the fire support boats used by the U.S. Navy riverine force in Vietnam, with armor and armament specially designed for their mission. Even these or other special boats might not be cost-effective on city waterways.

7. ALTERNATE RESPONSE

A deliberate area defense is a feasible alternative. Since this event concerned a hasty defense, the weakness of area versus mobile defense

was accentuated. With time for preparation--even when restrained from damaging property--an area defense can be made much stronger. A careful evaluation of a deliberate area defense, making full use of barriers, mines, demolitions, and fortifications would be profitable.

TECHNICAL PROBLEM RESUME -

Problem: Firepower 7	Date: 29 Nov 72	Sheet 1 of 14
Operational Area: METROPOLIS		
Title: Counterattack to Slow Enemy Advance		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 7	Date: 29 Nov 72	Sheet 2 of 14
Operational Area: METROPOLIS		
Title: Counterattack to Slow Enemy Advance		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, par. 3.4.c.(1) and (2).
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, March 64.

2. DESCRIPTION OF PROBLEM

Slowing and canalizing enemy movement through the city is one requirement in city defense. This may be done by creating barriers and defiles or by capitalizing on existing ones, such as bridges. In either case, the barrier or defile must be covered by firepower. It is often desirable that neither the creation nor the covering of the obstacles cause severe damage to structures.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

A study should be instigated to determine best equipment and methods for impeding the thrust of a superior enemy into the city. One portion of this analysis should employ network analysis to develop simple techniques and heuristic rules for selecting points to block. The role of the private auto for both planned and unplanned congestion should be analyzed.* A second portion of the analysis

* To indicate the potential, consider a metropolitan area which can press 200,000 autos into service. A quick calculation shows that typically these could form a cordon 10 km in radius and three blocks deep in the sense that the enemy would have to drive over or remove three blocks of solid cars in order to enter the city. (This calculation assumes that he cannot drive across a city block, but is confined to the streets.)

should focus on the best methods of covering defiles and obstacles with fire. Mixes of air and ground weapons should be studied.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

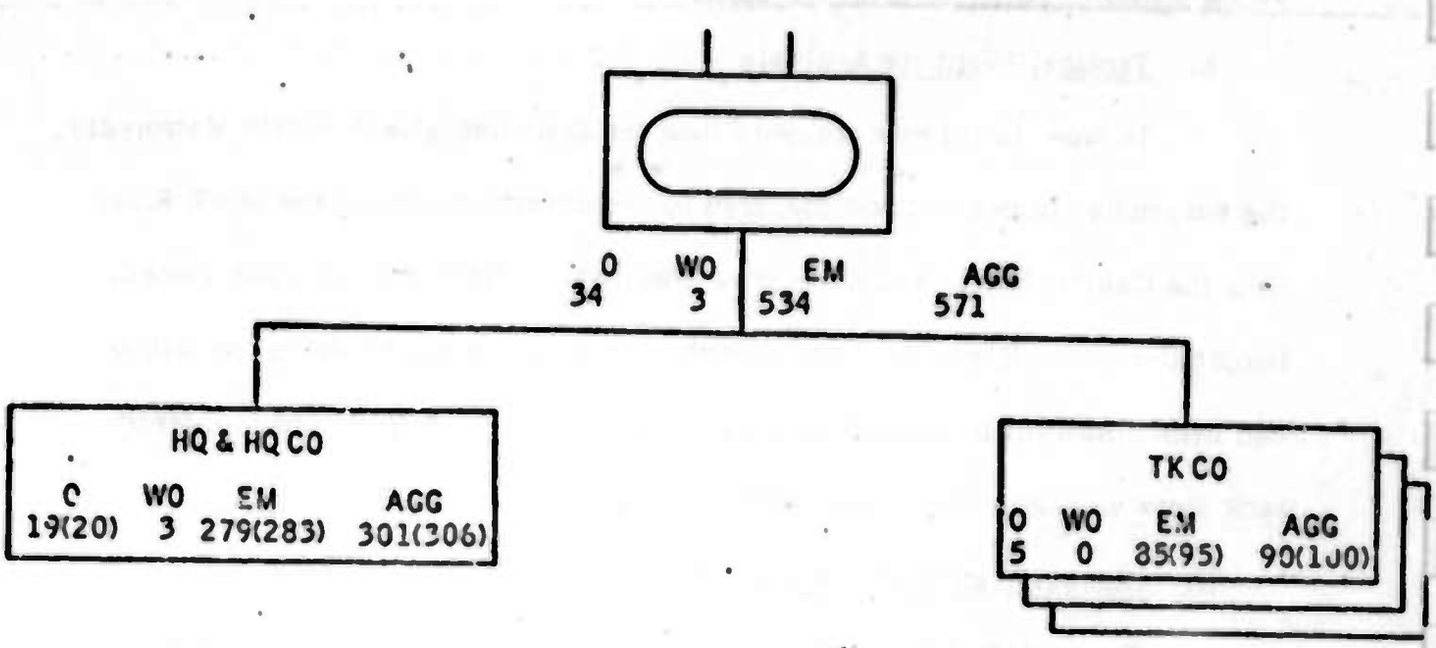
In order to relieve pressure from the Lenonian attack within Metropolis, the Burgundian high command prepared to counterattack across the Moch River near the Caldorf Bridge and then drive northeast to flank the Lenonian forces. Burgundian surveillance reported that the Lenonian forces covering the bridge had been drawn off to support operations in the north. A U.S. armor-infantry task force was ordered to counterattack at 1935.

b. Characteristics of the Area of Operation

The eastern bank of the Moch River is a flat alluvial plain. North of the Caldorf Bridge the towns become increasingly larger and more frequent until they merge into a suburban residential "sprawl" fifteen kilometers south of the Old Wall. The buildings in this outer suburb are primarily two story wood frame residential dwellings, with numerous business centers of one and two story reinforced concrete buildings.

c. Description of Own Forces

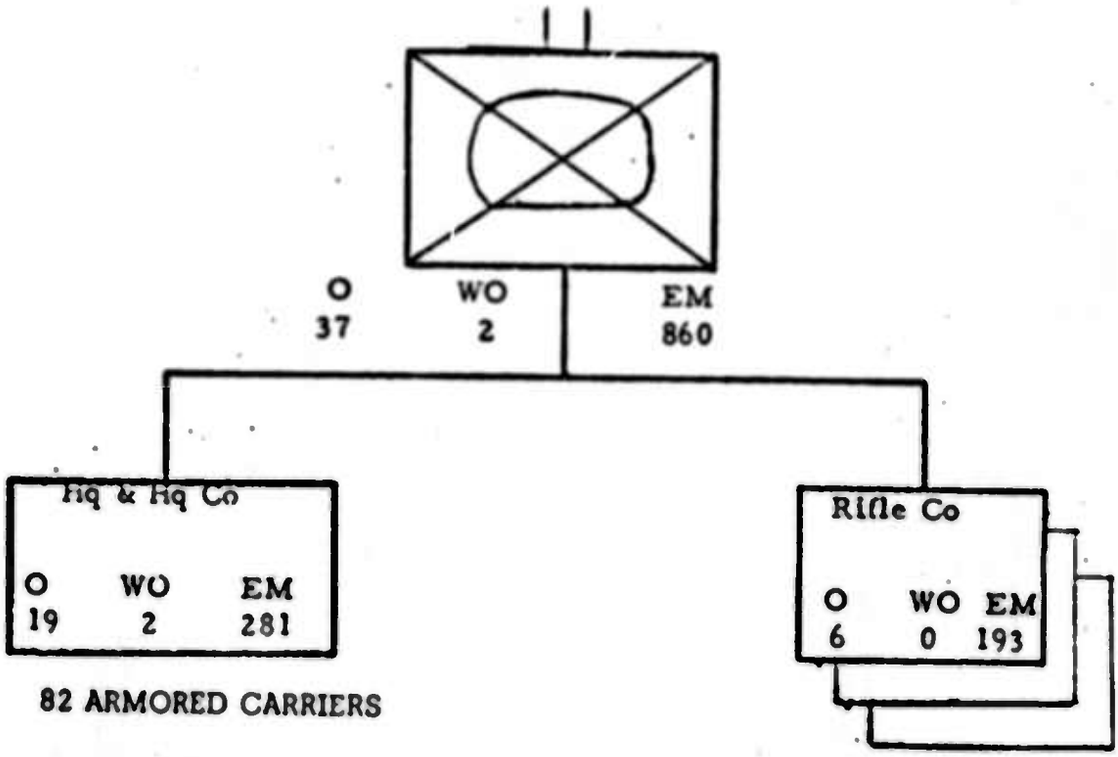
2nd Battalion, 5th Armor with 2nd Battalion (Mechanized), 76th Infantry, attached and 156th Assault Helicopter Battalion in support. All forces are from 52nd U.S. Infantry Division and receive normal support from division. Figures 1, 2, and 3 and Tables 1 and 2.



54 TANKS, 105 MM GUN

Armor Battalion

Figure 1

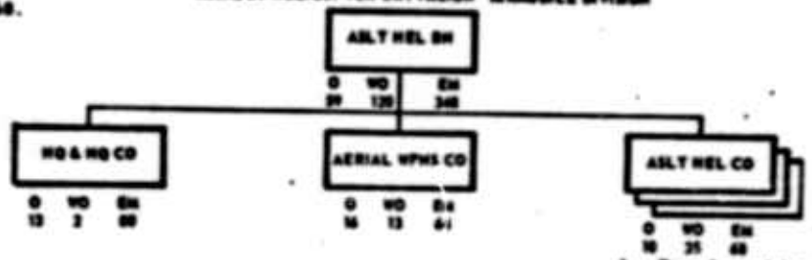


INFANTRY BATTALION (MECHANIZED)

Figure 2

TOE 1-155T dated 22 June 1965 thru
change 1 dated 1 July 1968.

ASSAULT HELICOPTER BATTALION AIRMOBILE DIVISION



1. MISSION

To provide tactical mobility for combat troops, supplies, and equipment of the division during the conduct of combat and airmobile operations.

2. ASSIGNMENT

Organic to the Aviation Group, Airmobile Division, TOE 1-100.

3. CAPABILITIES

a. Provides continuous (day and night) operations during visual and marginal weather conditions and limited operations under instrument weather conditions in support of the division in the forward areas of the combat zone.

b. Based on eighty percent aircraft availability, provides in a single lift, airlift for the assault elements of one infantry battalion.

c. Augments aero-medical evacuation from the immediate battlefield.

d. Provides armed aerial escort airmobile operations within the combat zone.

4. MOBILITY

This unit is one hundred percent air transportable in Army and/or U.S. Air Force Aircraft.

SUMMARY OF EQUIPMENT

ELECTRONICS COMMAND

Beacon Radio AN/GRN-17	18
Beacon Radio AN/TRN-24	9
Data Analysis Control AN/TYM-1	1
Electronic Teletypewriter Security Equipment TSEC/KW-7	2
Radiac Set AN/PDR-27	8
Radiacmeter IM-93/UD	44
Radiacmeter IM-174/PD	22
Radio Set AN/PRC-25	35
Radio Set AN/URC-10	75
Radio Set AN/VRC-24	4
Radio Set AN/VRC-46	15
Radio Set AN/VRC-47	8
Radio Set AN/VRC-49	1
Radio Set Control Group AN/GRA-39	22
Radio Set Control Group AN/GRA-74	2
Radio Teletypewriter Set AN/VSC-2	2
Receiver-Transmitter Control Group AN/GRA-6	6
Switchboard Telephone Manual SB-22/PT	6
Telephone Set TA-312/PT	48
Transmitter Infrared AN/CVX-1	4

MOBILITY COMMAND

Helicopter Observation OH-6A	3
Helicopter Utility UH-1B	12
Helicopter Utility UH-1D	60
Scooter Motor Rough Terrain 2 Wheel WE	4
Trailer Cargo 1/4 Ton 2 Wheel WE	10
Trailer Cargo 3/4 Ton 2 Wheel WE	43
Trailer Cargo 1-1/2 Ton 2 Wheel WE	11
Truck Ambulance 1/4 Ton 4x4 WE	1
Truck Cargo 3/4 Ton 4x4 WE	43
Truck Cargo 2-1/2 Ton 6x6 WE	12
Truck Platform Utility 1/2 Ton 4x4 WE	12
Truck Tank Fuel Servicing 2-1/2 Ton 6x6 W/N WE	4
Truck Utility 1/4 Ton 4x4 WE	20

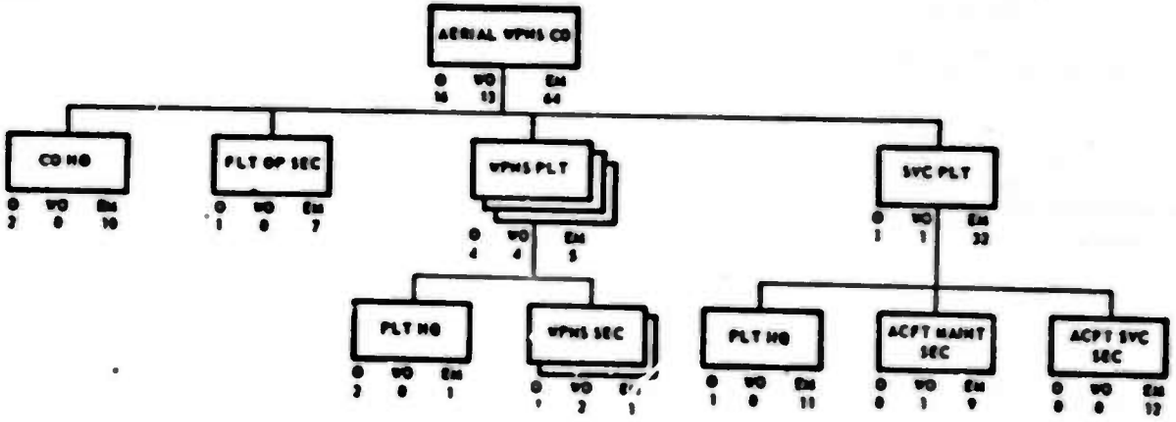
WEAPONS COMMAND

Armament Subsystem Helicopter 7.62MM Machinegun Door Mounted	50
Armament Subsystem Helicopter 7.62MM Machinegun High Rate	3
Armament Subsystem Helicopter 7.62MM Machinegun 2.75 Rocket Launcher	12
Launcher Grenade 40MM	24
Pistol Cal .45 Automatic	33
Pistol Pyrotechnic	4
Revolver Cal .38 4 Inch Barrel	251
Rifle 5.56MM w/Bipod	243

FIGURE 3

TOE 1-157T dated 22 June 1965 thru
change 8 dated 15 January 1971

AERIAL WEAPONS COMPANY, ASSAULT HELICOPTER BATTALION, AIRMOBILE DIVISION



1. MISSION

To provide security for airmobile forces and to participate in offensive, defensive, and delaying actions as part of a highly mobile combined arms team.

2. ASSIGNMENT

Organic to the Assault Helicopter Battalion, Airmobile Division. TOE 1-155.

3. CAPABILITIES

a. Provides armed aerial escort and aerial suppressive fire support of airmobile forces.

b. Participation in semi-independent operations as required.

c. Provides effective aerial suppressive fires for anti-guerrilla forces.

4. MOBILITY

This unit is one hundred percent air transportable in Army and/or U.S. Air Force Aircraft.

SUMMARY OF EQUIPMENT

ELECTRONICS COMMAND

Beacon Radio AN/GRN-17	16
Beacon Radio AN/TRN-24	3
Radiac Set AN/PDR-27	1
Radiacmeter IM-93/UD	10
Radiacmeter IM-174/PD	5
Radio Set AN/PRC-25	6
Radio Set AN/URC-10	12
Radio Set AN/VRC-24	1
Radio Set AN/VRC-46	2
Radio Set AN/VRC-47	1
Radio Set Control Group AN/GRA-39	3
Receiver-Transmitter Control Group AN/GRA-6	1
Switchboard Telephone Manual SB-22/PT	1
Telephone Set TA-312/PT	6
Transmitter Infrared AN/CVX-1	1

MOBILITY COMMAND

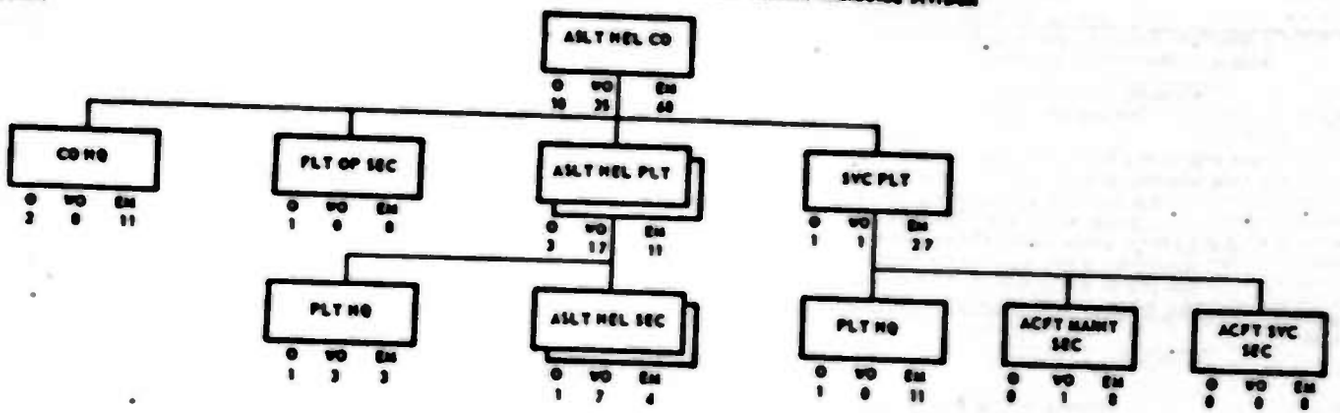
Helicopter Utility UH-1B	12
Scooter Motor Rough Terrain 2 Wheel WE	1
Trailer Cargo 1/4 Ton 2 Wheel WE	2
Trailer Cargo 3/4 Ton 2 Wheel WE	11
Trailer Cargo 1-1/2 Ton 2 Wheel WE	2
Truck Cargo 3/4 Ton 4x4 WE	11
Truck Cargo 2-1/2 Ton 6x6 WE	2
Truck Platform Utility 1/2 Ton 4x4 WE	3
Truck Tank Fuel Servicing 2-1/2 Ton 6x6 WWN WE	1
Truck Utility 1/4 Ton 4x4 WE	3

WEAPONS COMMAND

Armament Subsystem Helicopter 7.62MM Machine gun 2, 75 Inch Rocket Launcher	12
Launcher Grenade 40MM	5
Pistol Cal .45 Automatic	5
Pistol Pyrotechnic	1
Revolver Cal .38 4 Inch Barrel	41
Rifle 5.56MM W/Bipod	47

TOE 1-158T dated 22 June 1968 thru change 5 dated 1 July 1968.

ASSAULT HELICOPTER COMPANY, ASSAULT HELICOPTER BATTALION, AIRMOBILE DIVISION



1. MISSION

To provide tactical mobility for combat troops, supplies and equipment of the division during the conduct of airmobile operations.

2. ASSIGNMENT

Organic to Assault Helicopter Battalion, Airmobile Division, TOE 1-155.

3. CAPABILITIES

a. Provides continuous (day and night) operations during visual and marginal weather conditions and limited operations under instrument weather conditions in support of the units in a combat zone.

b. Based on eighty percent availability of organic aircraft, provides in a single lift, airlift for one rifle company including infantry supporting weapons.

c. Provides air movement of troops, supplies, and equipment within the combat zone.

d. Augments aero medical evacuation from the immediate battlefield.

4. MOBILITY

This unit is one hundred percent air transportable in Army and/or U.S. Air Force Aircraft.

SUMMARY OF EQUIPMENT

ELECTRONICS COMMAND	
Beacon Radio AN/TRN-24	2
Radiac Set AN/PDR-27	2
Radiacmeter IM-93/UD	10
Radiacmeter IM-174/PD	2
Radio Set AN/PRC-25	8
Radio Set AN/URC-10	20
Radio Set AN/VRC-24	3
Radio Set AN/VRC-46	2
Radio Set AN/VRC-47	1
Radio Set Control Group AN/GRA-39	4
Receiver-Transmitter Control Group AN/GRA-6	1
Switchboard Telephone Manual SB-22/PT	1
Telephone Set TA-312/PT	5
Transmitter Infrared AN/CVX-1	1
MOBILITY COMMAND	
Helicopter Utility UH-1D	26
Trailer Cargo 1/4 Ton 2 Wheel WE	1
Trailer Cargo 3/4 Ton 2 Wheel WE	3
Trailer Cargo 1-1/2 Ton 2 Wheel WE	8
Truck Cargo 3/4 Ton 4x4 WE	2
Truck Cargo 2-1/2 Ton 6x6 WE	8
Truck Platform Utility 1/2 Ton 4x4 WE	2
Truck Tank Fuel Servicing 2-1/2 Ton 6x6 WWN WE	3
Truck Utility 1/4 Ton 4x4 WE	1
WEAPONS COMMAND	
Armament Subsystem Helicopter 7.62MM Machinegun Door Mounted	3
Launcher Grenade 40MM	26
Pistol Cal .45 Automatic	4
Revolver Cal .38 4 Inch Barrel	4
Rifle 5.56MM W/Bipod	65
	44

d. Description of Enemy Forces

Lenonian 17th and 18th Motorized Rifle Regiments (Figure 4) with normal support from their parent divisions (Reference a).

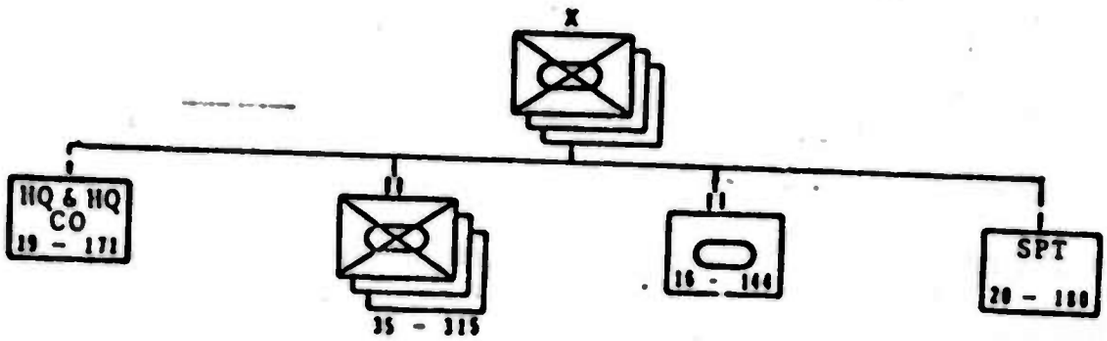
5. PROBLEM ANALYSIS

The US infantry battalion crossed the Moch River in an unsupported night airmobile assault, seized the Caldorf Bridge against negligible opposition, and was immediately joined by the rest of the task force. Moving north on multiple axes, armor and helicopter reconnaissance elements reported no enemy defenses south of the city wall (Figure 5). The Burgundian command ordered the force to attack north and seize the high ground in the city of Metropolis that dominates the Highway 75 bridge from the east bank. The force was then to set up a defensive perimeter and interdict by fire all enemy movements across the bridge.

The 18th Lenonian Motorized Rifle Regiment (MRR) was in position one kilometer south of and parallel to Highway 75. Their FEBA started at the east bank of the Moch River and stretched twenty blocks eastward: their position was two blocks deep, with small local reserves for counterattacks.

The U.S. task force attacked this position and penetrated it at three points, with the main attack just east of the river. Tank-infantry teams knocked out or suppressed enemy strongpoints, bypassed them where possible, and continued moving towards their objective. Simultaneously, a reinforced company of 2nd Bn, 76th Infantry airlanded in a park and three soccer fields in the objective area. The area had not been organized for defense by the Lenonians, and the company rapidly cleared it of the few defenders that they found.

By 0200 the lead tanks of the task force entered the objective area and linked up with the airlanded company. Although losses had been considerable



LENONIAN MOTORIZED RIFLE REGIMENT (MRR)

Figure 4

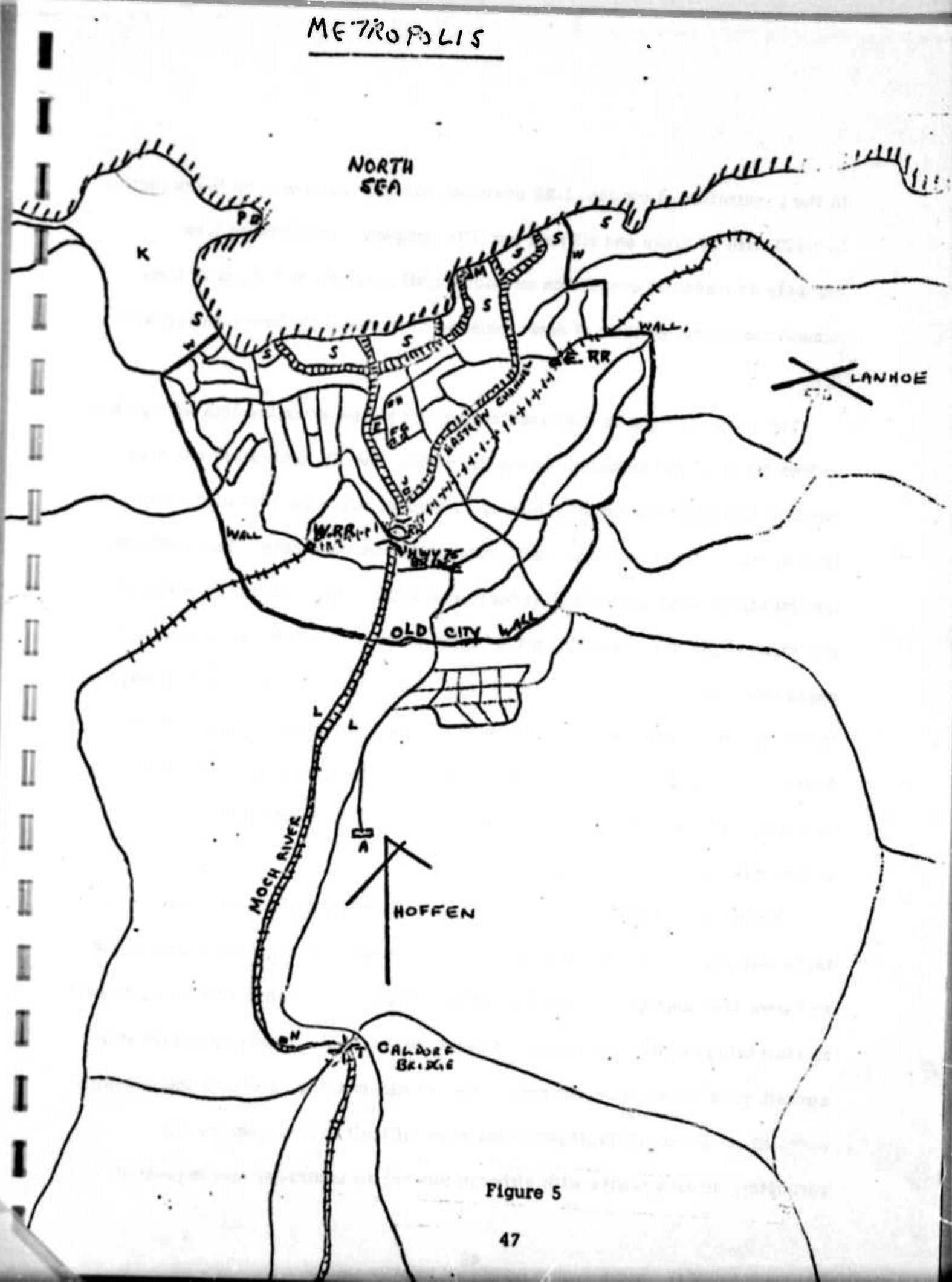

METROPOLIS
NORTH SEA
K
WALL
LANHOE
S.E. RR
W.RR
OLD CITY WALL
MOCH RIVER
HOFFEN
CALDORF BRIDGE

Figure 5

in the penetration of the 18th MRR position, the task force was on the objective by 0500 with 37 tanks and 115 men per rifle company. Helicopters flew resupply and medical evacuation missions until daylight, but the task force commander cancelled them at dawn because of increasingly heavy antiaircraft fire.

The tempo of fighting increased around the perimeter as the 18th MRR probed to find out what had happened during the night. The US force sited one tank company for direct fire on the Highway 75 bridge, while the rest of the force took up positions in buildings and behind barricades of rubble. Tanks crashed into buildings when possible in order to fire from cover. One tank platoon and one infantry platoon were held in task force reserve. US artillery and mortar observers found positions from which they could adjust fire onto the highway bridge and its approaches. Gunships of the Aerial Weapons Company, 159th Assault Helicopter Battalion, operating from their base west of the Moch River, attacked traffic on the bridge with a mixture of 2.75" rockets and antitank guided missiles.

During the morning, the 17th MRR was diverted to attack the US force. US tanks and artillery became more and more concerned with their defensive battle and were less able to interdict the bridge. Helicopter gunship attacks continued to slow bridge traffic, but could not completely stop it. Lenonian mobile anti-aircraft guns moved onto both river banks at mid-morning, and took the gunships under fire. The antiaircraft positions were difficult to find from the US perimeter, so an airstrike with airborne forward air controller was requested.

Burgundian fighter-bombers attacked the antiaircraft positions and had some success in destroying them, but it proved difficult to coordinate their antiaircraft suppression missions with the antivehicle attacks of the US Army gunships.

The results of the action were indecisive. The Lenonians were able to keep a trickle of armored vehicle traffic moving on the bridge, but were taking losses there and in their attacks on the US perimeter. The Americans were successfully holding their position, but were not able to stop bridge traffic by antivehicle fire. Neither command was satisfied with the situation, and both were planning further action as the morning ended.

6. RESULTS OF ANALYSIS

The purpose of the US attack was to slow the Lenonian buildup across the Moch and thus interfere with the continuation of their offensive. Although this was partially accomplished, the most effective means of interdiction was the attack by gunships based on the west bank. The US perimeter on the east bank diverted Lenonian resources (17th MRR) but contributed relatively little to the interdiction of bridge traffic. They caused considerable property damage and some civilian casualties during their penetration of the 18th MRR position and the subsequent defense of their perimeter. When the gunships needed help in suppressing the enemy antiaircraft fire, Burgundian fighter-bombers had to be called in. The combination of fixed and rotary wing air attacks proved to be the most effective and least expensive method of accomplishing the interdiction mission.

There are many other situations in which defiles and barriers can be used to canalize or slow the advance of the enemy. The action described above is typical. On a larger scale, cities can be used as strategic barriers to slow and weaken a rapidly advancing superior force. Means of utilizing cities as barriers and strongpoints, and actions to be taken when the enemy elects to bypass and isolate them should be studied. Specific recommendations appear in Sections 3 and 7.

7. ALTERNATIVE RESPONSES

Determine the characteristics desired in smart munitions when used to support a defensive action at a defile or barrier. Smart munitions fired from the west bank and guided by devices within the US perimeter on the east bank may have been effective in this example.

Determine optimum methods of using mines/boobytraps in strategic barriers in conjunction with defended cities.

Examine the role of helicopter gunships in support of operations at defile and barriers.

TECHNICAL PROBLEM RESUME

Problem: Firepower 8	Date: 27 Dec 72	Sheet 1 of 14
Operational Area: METROPOLIS		
Title: Combat in Utility Tunnels		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 8	**Date:** 27 Dec. 72 **Sheet 2 of 14**
Operational Area: METROPOLIS	
Title: Combat in Utility Tunnels	

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built-Up Areas, July 1972, par. 3.4

b. KETRON/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.

c. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, March 1964.

d. Deschner, Gunther, Warsaw Rising, Ballatine Books, 1972.

2. DESCRIPTION OF PROBLEM

A reinforced infantry company defending the isolated City Government Building is attacked simultaneously by Lenonian forces on the surface and below ground.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. A system for data gathering should be developed on urban underground utilities and included in the intelligence collection effort.

b. Both the communications technology and the operations techniques for coordinating supporting fire for underground operations should be reviewed, analyzed, and developed.

c. Better use of blast effects and of other effects peculiarly useful to underground combat requires basic research. Some other effects include sonic, thermal, and pneumonic.

d. Coordination should be made with those Federal, industrial and academic organizations which have developed data bases on underground operations, particularly on the use of explosives and the protection of personnel. These include mining, transportation, construction, fire, rescue and civil defense organizations.

e. Barriers that can be rapidly deployed in tunnel systems need to be developed. This includes quick locking devices and sealers for access doors

and use of compressed obstacles.

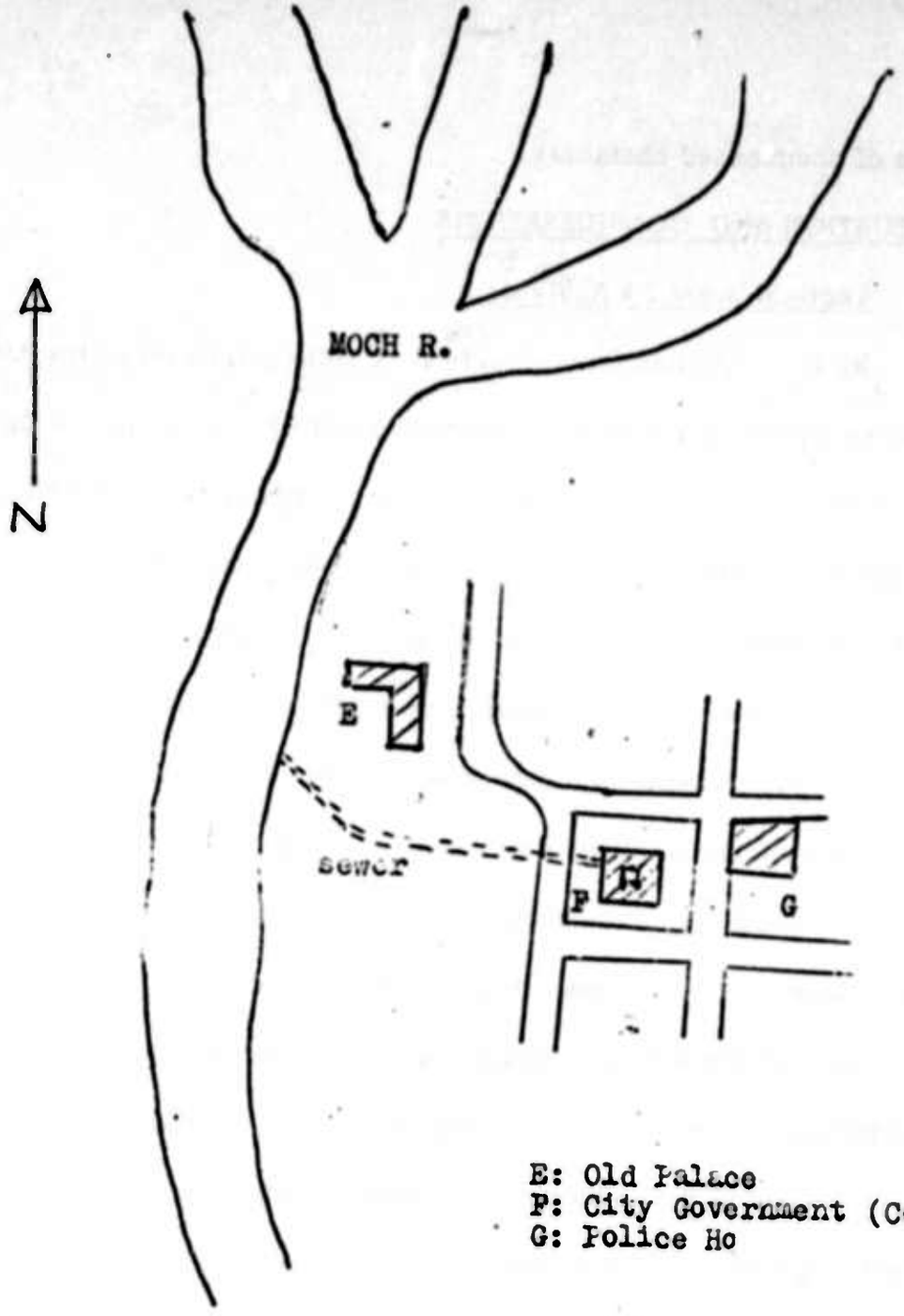
4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

By D+5 Lenonian forces held all of Metropolis east of the Moch River, with the exception of the City Government Building, known as the Councilhaus (Map, Figure 1). There a Burgundian infantry company, reinforced with 120 Municipal Police officers, had held out inside the barricaded building. The Lenonian command was reluctant to destroy the Councilhaus because of its symbolic importance, and had ordered that only small arms, recoilless rifles, and light antitank rockets would be fired into it. The Lenonian regiment assigned to seize the building had tried night and day assaults, but had been stopped each time from crossing the surrounding plazas by the defenders' barbed wire, automatic weapons, and command-detonated Claymores.

On D+8 the Lenonian regimental commander ordered a combined surface and subsurface attack on the Councilhaus for D+10. Lenonian patrols started a reconnaissance of the underground systems leading into the Councilhaus. The regimental intelligence officer tried without success to locate people with a detailed knowledge of these tunnels. The regimental operations officer asked for and got the attachment of one combat engineer company from the division engineers. They came with a supply of demolitions and flamethrowers, and with special tunnel blasting systems using a fuel-air explosive mixture (FAX).

The Burgundian defenders, aware of the possibility of underground attack, had sealed off all but one of the underground utilities serving the Councilhaus. In each tunnel large enough for men to crawl through, they had first installed breakwire intrusion sensing devices, backed these with



E: Old Palace
F: City Government (Council
G: Police Ho

FIGURE 1

command-fired Claymores, and then filled the rest of the space up to the access doors with barbed wire. Theywelded or barricaded shut the access doors and posted a sentry at each door to listen for enemy activity, read out the intrusion sensing devices, and report to the garrison commander by field telephone. The sentries were ready to fire the Claymores on order. Within the cellars of the building, barricades and firing positions had been built to slow and canalize any attackers emerging from the tunnels. These positions included remotely fired machine guns sighted on the tunnel access doors.

The only approach that was left open by the defenders was a sewer tunnel running west to the Moch River. The sewer was prepared as an emergency evacuation route for the garrison. They had built a blast wall across the sewer tunnel that extended down into the water for several inches. Their evacuation plan was to swim under the blast wall and then fire demolitions charges in the roof of the tunnel, blocking the tunnel between the Councilhaus and the blast wall. This was hoped to give the defenders time to retreat down the sewer to its mouth and then to cross the river without pursuit.

Lenonian reconnaissance patrols on D+9 located three usable sewer/ utility tunnels leading into the Councilhaus. In one of these, their patrol tripped the Burgundian intrusion sensing device and was eliminated by the blast and fragmentation of the command-fired Claymores. In the other two, the patrols found and reported the intrusion devices, Claymores, and barbed wire. The regimental intelligence officer also discovered through prisoner interrogation that the Burgundians had left one sewer open as an escape route. A Lenonian patrol located the mouth of that sewer, but was not able to enter it without detection by the defenders' outpost there.

The Lenonian attack plan was to blast open the three tunnels and the escape sewer and assault into the cellars of the Councilhaus while making simultaneous surface attacks across the surrounding plazas into the cellars. In preparation, the combat engineers sealed the three tunnels off from all air shafts and branches and then filled them with FAX. The detonation of the FAX would neutralize the intrusion sensors and Claymores, weaken the barricaded access doors, and kill any defenders in the tunnels. Next, the engineers would reenter the tunnels and push pole charges and bangalore torpedoes through the barbed wire and up against the access doors. Sealing off that portion of each tunnel with a prefabricated blast wall, they would climb back out of the tunnels and set off their charges with the intent of blowing open the access doors. Infantry assault teams would then quickly move through the tunnels, clear out the rubble and barbed wire, and assault into the cellars.

The time of detonation of the pole charges and bangalores by the engineers was designated as H-Hour, and was set at 0210 hours on D+10. At that time, the surface attack on the Councilhaus would start with a short direct fire preparation by machine guns and recoilless rifles firing into the cellar windows. Artillery would then fire smoke concentrations on the open plazas and infantry/engineer assault teams would cross the plazas. They would break into the cellar windows and doors with shaped charges and flame throwers and join the subsurface assault teams to fight their way up into the Councilhaus in a room-by-room, floor-by-floor clearing operation. Also at H-Hour, the Lenonians planned to enter the Burgundian escape sewer by blowing

open the five manholes closest to the Councilhaus that led into it. An assault team would enter each manhole and fight up the sewer into the cellar. Simultaneously, a rifle company would attack the Burgundian outpost at the mouth of the sewer and reinforce the assault teams.

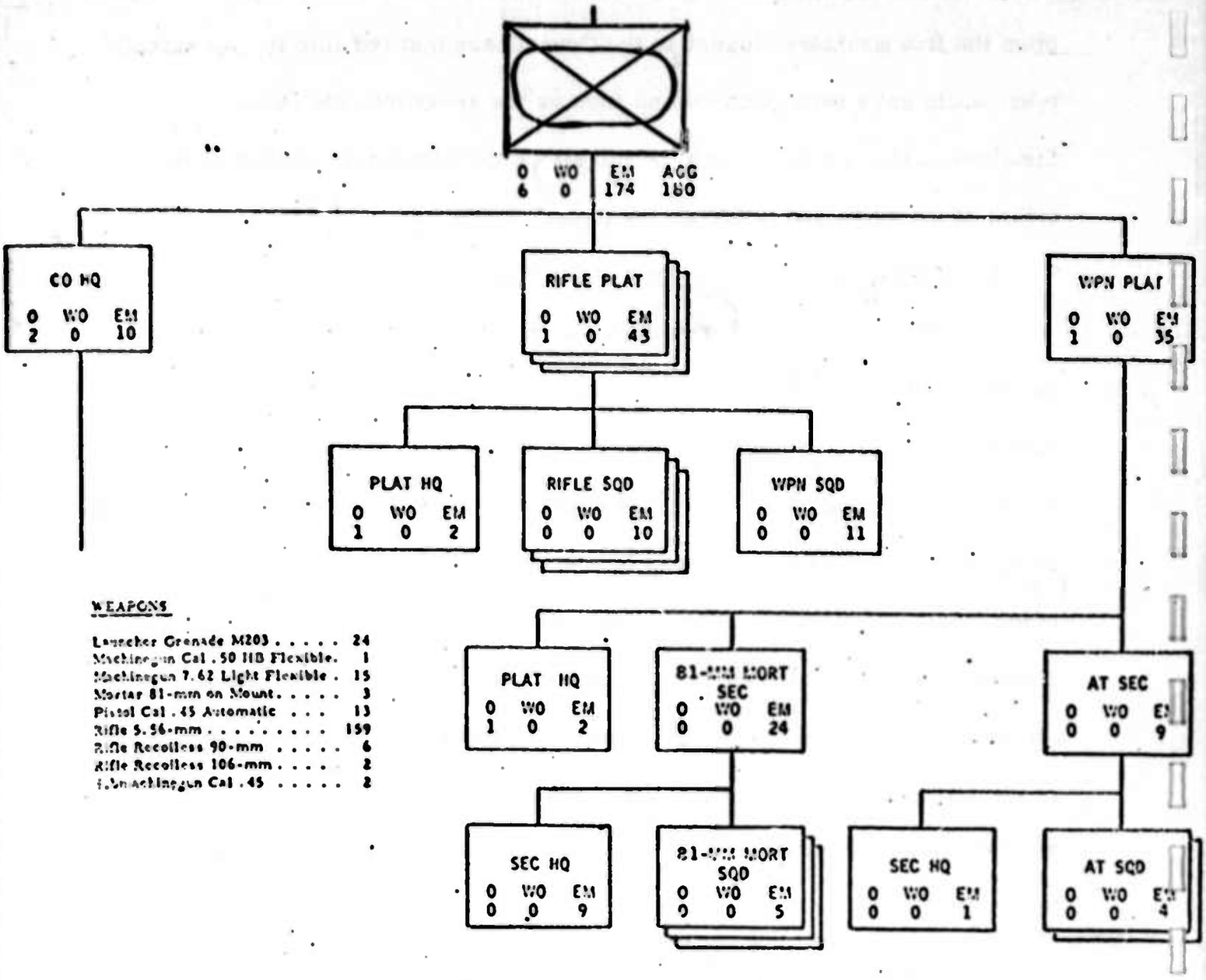
b. Characteristics of the Area of Operations

The City Government Building (Councilhaus) is a four story stone masonry building in the Old Town of Metropolis (Figure 1). It was built in 1652 in the center of an open square, so that it is surrounded on all sides by a plaza 80 meters wide. There is an open courtyard in the center of the building containing a fountain that it is fed by a spring, so that the defenders have an independent water supply. The building and plaza are drained by several sewers built in the past four hundred years. All are made of brick with circular arch roofs, but they vary greatly in dimensions. The other utilities in the area run in conduits along the sides of the sewers. The one sewer left open by the defenders (Figure 1) is the largest, measuring ten feet wide and six feet high.

c. Description of Own Forces

(1) One Burgundian infantry company (Figure 2). The company received supplies of barbed wire, lumber, mines, demolitions, and sensor devices to prepare the Councilhaus for defense.

(2) 120 Metropolis Municipal Police officers from the nearby Police Headquarters, armed with submachineguns or riot shotguns. Five are members of the Police Rescue Squad, trained and equipped for search and rescue operations in the city's utility tunnels.



WEAPONS

Launcher Grenade M203	24
Machinegun Cal .50 HB Flexible	1
Machinegun 7.62 Light Flexible	15
Mortar 81-mm on Mount	3
Pistol Cal .45 Automatic	13
Rifle 5.56-mm	159
Rifle Recoilless 90-mm	6
Rifle Recoilless 106-mm	2
Submachinegun Cal .45	2

Figure 2

d. Description of Enemy Forces

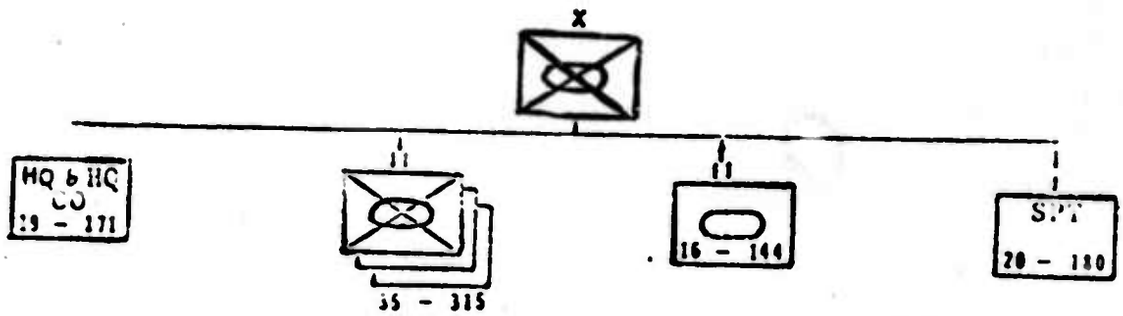
Lenonian 27th Motorized Rifle Regiment, minus one rifle battalion and the tank battalion (Figure 3).

5. PROBLEM ANALYSIS

The Burgundian defenders recognized that the term "all around defense" includes "up and down defense" when applied to city fighting. Their deliberate defense against underground attack was based on blocking the utility tunnels (sealed access doors, barbed wire), detecting enemy use of the tunnels (sensors, listening sentries), and positioning firepower in advance (Claymores, remotely fired machine guns). This was backed by additional barriers and firing positions in the cellars, where the final defensive battle would be fought for control of the tunnels.

The weak point in their defense underground was their sewer escape route. Left unblocked except for a blast wall, it was guarded only by a fixed outpost at its mouth and moving patrols along its length. Although the defenders had welded closed manholes leading into it from the street, the Lenonian plan for blasting into it was fast and effective. In this event the Lenonians discovered the escape sewer by interrogation of a prisoner. In other cases an avenue of attack like that sewer might easily be unknown to the defenders. The question of information on utility tunnels is an important one in city combat.

The first problem of the Lenonian attackers was their sketchy intelligence on Metropolis' underground systems. They could not find the fire, police and



LENONIAN MOTORIZED
RIFLE REGIMENT

Figure 3

utility company records on the city tunnels, nor could they find the personnel with knowledge of them. Prisoner interrogation gave them important information, but their reconnaissance patrolling was slow and costly.

The second problem of the attacker was the removal of obstacles. The blast effect of FAX and high explosive charges may have been effective against sealed access doors and walls built across tunnels, but blast walls can be built to attenuate this effect. Since blast is an effective antipersonnel effect also, troops emplacing charges must either remain outside of the tunnels (FAX provides for this) or move out of them before detonating their charges. (As in the bangalores and pole charges). In either case, there is a delay before they can exploit the detonation. Furthermore, blast is not effective against ventilated obstacles such as barbed wire. Even the fragmentation effect of bangalore torpedoes leaves a tangle of cut up wire in tunnels, which the attackers have to crawl over or dig out. Lastly, blast may destroy the tunnel itself and create a greater obstacle than it was intended to remove.

The Lenonian commander next had to plan the actual attack through the tunnel system. His movement was limited to a very few men abreast in the largest tunnel, so that in this event a few defenders in the cellar of the Councilhaus could have held up the attack for a long time. Furthermore, it is very difficult to give fire support to an underground attack. The Lenonian commander solved this in part by firing into the cellar windows from his positions across the plaza. Some of this fire may have been effective, but much of it would have been up at ceiling level and of little effect against defenders barricaded at floor level. High explosive fragmentation or flechette warheads on recoilless rifles would probably have been the most effective

munitions. Normal overhead and flanking fire cannot be used in the restricted space of tunnels.

6. RESULTS OF ANALYSIS

It is easier to deny use of tunnels or to defend in them than it is to attack through them. In either attack or defense special equipment, time consuming preparations, and good intelligence are important. This analysis concerns itself with equipment, and little needs to be said about the time factor. The general problem of intelligence, which is not exclusively in the field of study of any subcontractor, is brought out clearly in this event as an important factor. Systematic data gathering (and data denial) of critical information on cities must become normal in the military intelligence collection effort during both peace and war. An organized effort among allies, such as the NATO bridge classification system, could be developed for key types of city structures, above and below ground.

Blast weapons have greatly increased effects in tunnels. The blast weapons now available include Claymores, other prepared mines, a variety of high explosive demolitions charges, and FAX. The primary responsibility for storage and issue of this equipment is given to engineer units, who can issue them to infantry units with engineer assistance and advice when the need arises. Development work is needed in FAX technology, building on the experience gained in tunnel destruction in Vietnam. The application of advanced demolitions techniques can develop prepared charges that are small and easy to carry in tunnels for clearing obstacles, breaching walls, and

forcing access doors. Coordination with Federal agencies and industrial companies involved with use of explosives underground (construction, mining) may suggest new approaches for development.

Rapidly deployable obstacles to movement and vision are also needed. The ideal configuration for these would be a small high density container for storage, transport, and emplacement with rapid expansion capability into a high volume obstacle to fill a tunnel. Fast hardening foams might produce such a barrier; barbed wire packed under spring pressure might also expand on release to fill a tunnel. Plastic sealing compound, welding equipment, or explosive stapling devices might be useful for rapidly locking access doors.

Current small arms are generally satisfactory for tunnel fighting. A minor improvement may be a reduced charge cartridge (5.56 and 7.62 mm) giving all the range needed with much reduced blast effect on the firer. Concussion hand grenades are available, and should be used; a concussion round for the M203 grenade launcher would probably be less useful, due to limitation of high trajectory fire in tunnels, than the present 40 mm buckshot round. Remote sighting and firing devices for the M16 rifle and particularly for the M60 machine gun would allow protected personnel to dominate a tunnel. These munitions and devices could be stored and issued for tunnel use as are demolitions and fortification materials.

Problems relating to other contractors in this study include communications within tunnels and from tunnel to surface, and sensors for warning and reconnaissance. Vehicles for rapid movement in tunnels would increase tactical effectiveness as well as speed resupply and medical evacuation.

7. ALTERNATIVE RESPONSES

A type of attack not discussed in this event is the underground mine. This is simply a very large high explosive charge fired in a tunnel under the objective, usually followed by a surface attack. This ancient method pretty nearly destroys the objective itself, but its collateral effects on other buildings in a city have not been studied recently. The application of FAX or advanced demolitions techniques may increase the effectiveness of mining. When tunnels are already available, mining may provide a fast and accurate means of target attack. Government academic and industrial organizations involved in mining with explosives may have useful knowledge to assist in development in this field. Nuclear and earthquake effects data may also be applicable.

The use of flame weapons and foams to suffocate enemy personnel is a possibility, providing that friendly forces are equipped with an air supply. Military and civilian fire departments have experience in both of these fields. Protection means against smoke and suffocation are well developed, and the foams originally developed for aircraft fires are now being used to fill basements in order to extinguish fires. These foams, available with pumping equipment worldwide, are usually suffocating. With further development, they may be excellent for denying use of tunnels.

EASTERN EUROPE - SKODA

TECHNICAL PROBLEM RESUME

Problem: Firepower 9	Date:	Sheet 1 of 9
Operational Area: SKODA		
Title: Assault in City Suburbs		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 9	Date:	Sheet 2 of 9
Operational Area: SKODA		
Title: Assault in City Suburbs		

1. REFERENCES

a. GTE Sylvania Technicca1 Report No. 1, Military Operations in Built-Up Areas, July 1972, para. 4.4.c.(2).
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, U.S. Army Infantry School, Vol. 1 and Vol. 2.
d. Coates, Joseph, Nonlethal and Nondestructive Combat in Cities Overseas, IDA, p. 569.
e. Mombasse, Raymond, Urban Warfare.
f. FM 31-50, Combat in Fortified and Built-Up Areas, March 64, U.S. Army.

2. PROBLEM DESCRIPTION

The U.S. 71st Infantry Brigade, supported by helicopters and one engineer company, made rapid initial progress in the attack, but encountered resistance in the suburbs near the Skoda airfield. Rumelian forces have developed fortified defensive positions in low density area (20% roof coverage) which permits enemy defensive maneuvers behind the first line of fortifications. The civil population has been evacuated. U.S. forces have also encountered defended high-rise apartment buildings. Movement through the area has been hampered by rain and light fog.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

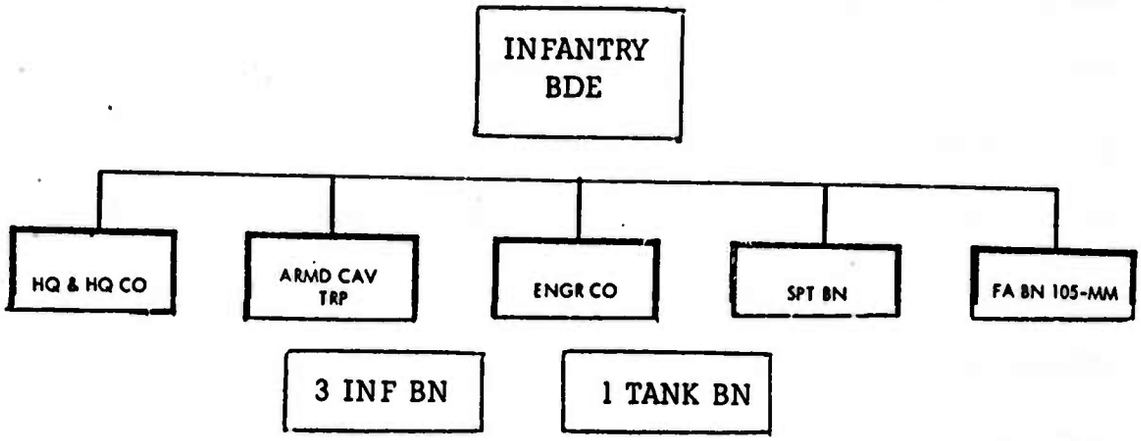
An analysis is needed of the employment of helicopters in city combat. In this event, helicopters are used for reconnaissance, for lifting direct fire weapons to rooftops, and for tactical troop movement. The tactics and techniques of these and other uses should be developed in detail.

4. SITUATIONS AND CONSIDERATIONS

The first combat operation of event 4.4.c.(2) is the encounter between the U.S. 71st Infantry Brigade (Figure 1) and the Rumelian 201st Motorized Rifle Regiment (Figure 2) in the suburbs of Skoda, between the electric generating plant and the city airport. This area has been evacuated and is not an objective of the 71st Brigade. Approximately 4 Km must be penetrated to reach the prime objective. The city suburbs do not have to be completely cleared but only passed through to reach the main objective. The basic defense is the "center of resistance" comprised of numerous "strong points". A strong point is a fortified building, protected by sand bags and probably by mines. Thus a set of strong points with a common firing network makes up a center of resistance. Along with the fortified buildings in the centers of resistance will be buildings containing only snipers and connected to strong points via underground tunnels or communication trenches. These buildings allow for harassing fire and defensive maneuver for counterattacks.

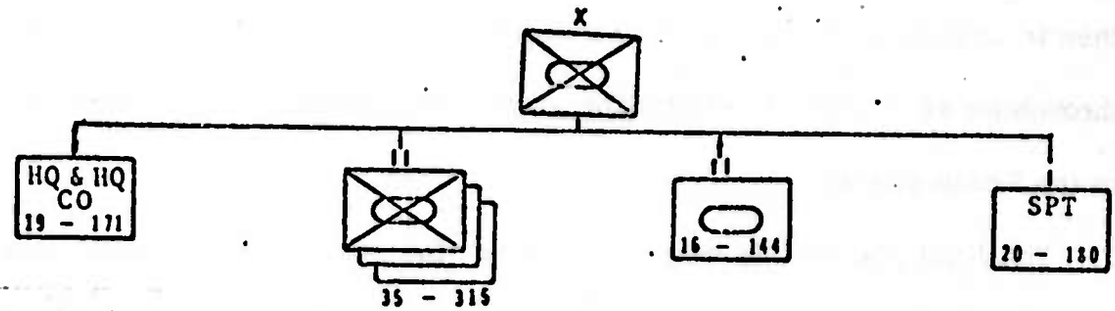
5. PROBLEM ANALYSIS

The 71st Brigade C.O. assigns one battalion to a street for each of 2 battalions and holds a third battalion in reserve. His plan is to clear a corridor through the suburbs. The reserve battalion will search out points firing onto this corridor and destroy these points. Observation helicopters will find and report enemy strongpoints and troops concentrations threatening to counterattack on the flanks of the corridor. Armored cavalry will precede each battalion's advance.



71st Infantry Brigade

Figure 1



Rumelian Motorized Rifle Regiment

Figure 2

The first battalion commences clearing operations by clearing occupied buildings along the route. The total linear distance cleared will be about 4 Km. Emphasis will be on speed of advance. Movement by infantryman on the street will be by means of APC and emphasis on using buildings for the advance. The second battalion will do likewise for a route three blocks east of first battalion.

The next part of this event consists of closing to the airport, with the environment now offering high rise apartment buildings among 3-4 story buildings. The situation is similar to the previous actions but now the enemy presents a greater threat in that he is capable of firing down into the corridor from high angles. The brigade C.O. employs infantry platoon assault teams to land by helicopter on the roofs of these 9-10 story apartment buildings and then to work down these structures from the inside. Artillery fire is avoided throughout as it tends to clutter the streets with rubble. This slows the advance to the Skoda airport.

The final part of this event consists in the seizure of the airport itself. At 0300 a foothold on the airport is seized and rapidly reinforced by a helicopter shuttle. Efforts are made to open communications with the commander of the Rumelian forces holding the field. Recon helicopters are sent at first light to detect enemy positions, and ground troops prepare to close with and destroy the enemy. Since most of the Rumelian 201st Regiment has been deployed to defend the suburban approaches to the airfield, little resistance is expected.

6. RESULTS OF ANALYSIS

Among the specific problems in this event are:

- sniper neutralization
- building clearance
- protection against counterattacks

Use is made of US countersniper teams to patrol the protected corridor leading through the city suburbs to the Skoda airport. A team is one rifle squad, with the men working in pairs, one spotter and one shooter. They are armed with M-16 rifles with telescopic sights. They are also equipped with night vision devices. Every squad has two M203 grenade launchers. The mission of these teams is to find snipers and destroy them with aimed rifle fire and rifle grenades.

The clearance of buildings on the three streets leading to the Skoda airport is to be accomplished using standard US doctrine as in Field Manual FM 31-50.

A short analysis using Lanchester equations was accomplished to determine the relative vulnerability to attacking soldiers as a function of sniper location. Figure 3 shows that hit probability decreases at the very short ranges due to the aspect angle. The target becomes smaller as height increases due to range and the angular size of the target. Covering fire should be concentrated against snipers on lower floors during a building assault.

The use of helicopters assisted the ground commander in many ways throughout these events. They were used to screen flanks to detect enemy strongpoints and troop concentrations, to lift assault teams and direct fire weapons onto rooftops, and to reinforce at critical times. Many other uses are possible in other urban

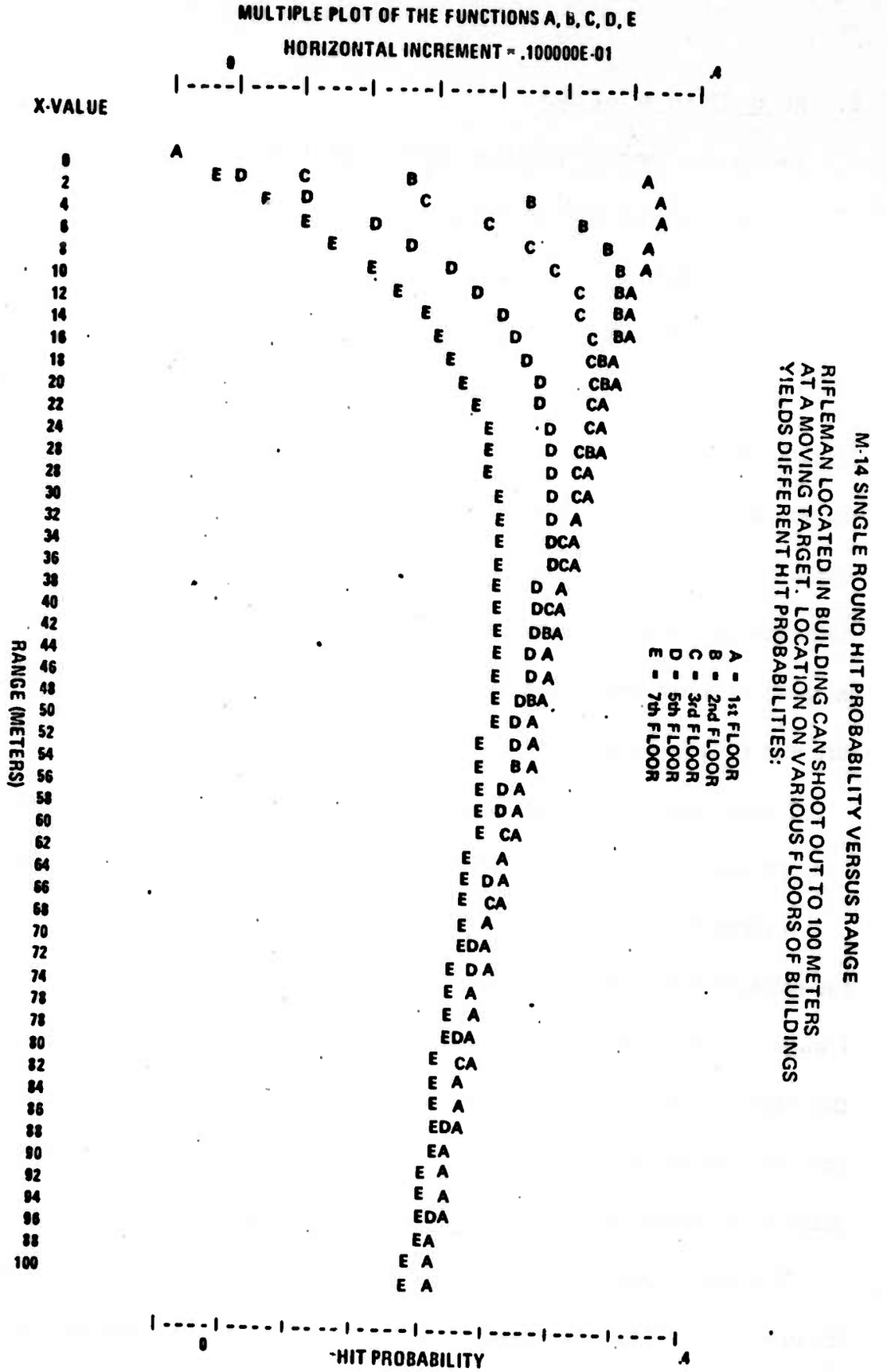

MULTIPLE PLOT OF THE FUNCTIONS A, B, C, D, E
HORIZONTAL INCREMENT = .100000E-01
X-VALUE
RANGE (METERS)
HIT PROBABILITY
M-14 SINGLE ROUND HIT PROBABILITY VERSUS RANGE
RIFLEMAN LOCATED IN BUILDING CAN SHOOT OUT TO 100 METERS
AT A MOVING TARGET. LOCATION ON VARIOUS FLOORS OF BUILDINGS
YIELDS DIFFERENT HIT PROBABILITIES:
A = 1st FLOOR
B = 2nd FLOOR
C = 3rd FLOOR
D = 5th FLOOR
E = 7th FLOOR

Figure 3

situations, and little doctrine has been found for such employment.

7. ALTERNATIVE RESPONSES

Infiltration of company-sized armor-infantry task forces on multiple routes is another approach to the problem of rapid penetration through a built-up area. Use of multiple routes, with each task force bypassing defenders rather than attacking them presents the defending commander with a mass of contact reports from his subordinates and consequent confusion as to what is happening.

Conversely, the attacking commander must have excellent communications and constant situation reports from his subordinates if he is to exploit their successes and prevent them from getting tangled with each other. See TPR-27, Ambush of a Relief Column Hung Shan, for a more detailed discussion.

A high firepower, blast-your-way-through tactic is another approach to movement through cities. Lead tanks reconnoiter by fire as they move at high speed, civilians are driven off the streets by machine gun fire, and every enemy fire is returned immediately with all available direct fire weapons. Obstacles and knocked out friendly vehicles are bulldozed out of the way and fresh units are pushed through when lead units are stalled. This approach may work against relatively light opposition, as it did for the Russian armor units in Budapest in 1956; it is likely to fail quickly if the enemy antitank defense is dug-in and well organized. While damage is high to combatants, neutrals, and buildings with this method, it could be limited to only one or two routes, leaving the rest of the city untouched. If successful, it is also fast and therefore limited in time.

TECHNICAL PROBLEM RESUME

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1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, par. 4.4.d.(1)
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Fort Benning, Ga. Vols. I and II.
d. WW II German Fire Document Translations, Stanford Research Institute AD 664 523.
e. Comparative Effectiveness of Four Riot Control Agents. Chemical Warfare Labs., AD 737 784
f. Unpublished manuscript on streetfighting doctrine, Ketron, Inc.
g. Interview: M/G Charles P. Stone

2. DESCRIPTION OF THE PROBLEM

Seize and clear the Old Town section of Skoda with minimal civilian casualties and building damage.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Investigate methods of blocking or otherwise denying the enemy the use of underground transportation and utility networks. The items to be investigated include a wire gun, mines, manhole sealers, and gaseous agents.

b. Determine the feasibility of using command detonated mines in cities and methods of disguising them (e.g. fireplugs, auto hub caps, manhole covers).

c. Investigate tactics, munitions, flight techniques for helicopter operations in cities. Operations include reconnaissance, direct-fire support, tactical troop movements, and logistic support.

d. Determine the feasibility of developing a "city suit" for addition to armored vehicles. This suit would add protection against short range weapons common to city fighting, such as high and low angle fire weapons, mines,

fire bombs, and shaped charge munitions. It could trade off the speed, range and cross-country mobility characteristics needed in open warfare.

4. SITUATIONS AND CONSIDERATIONS

a. Tactical Event for Analysis

This event centers around combat in the narrow streets and high building density of the Old Town of Skoda. The 301st Tank Battalion with a company of mechanized infantry attached is ordered to move northward to link up with other 301st Infantry Division elements entering Skoda from the north. Encountering strong resistance at the western shore of the Ruva River, the tank battalion and infantry company, assisted by U.S. helicopter gunships, attack through a town square and adjoining streets. Map, Figure 1.

b. Characteristics of the Area of Operations

The region is hilly and almost completely covered by 3 to 4 story wood and masonry homes, with the street level floor frequently occupied by small shops. There is a high population density in the area although there are no people in the streets. Steep roofs and the lack of open spaces for landing zones make helicopter use difficult. There is an extensive underground sewer network in which the enemy can move.

c. Description of Friendly Forces

One tank battalion and one infantry company, 301st Wallonian Infantry Division (Mechanized). Artillery of the 301st Division and helicopter gunships of the 7th U.S. Division in support. Figure 2 and 3.

d. Description of Enemy Forces

Two rifle battalions, 201st Rumelian Motorized Rifle Division. Figure 4.

5. PROBLEM ANALYSIS

The problem is to gain control of the old section of Skoda without having to level it. If the friendly forces approach the region with light weapons including mortars, the entrenched enemy will not be moved since he has the protection of the various urban structures within the area. Rounds with a

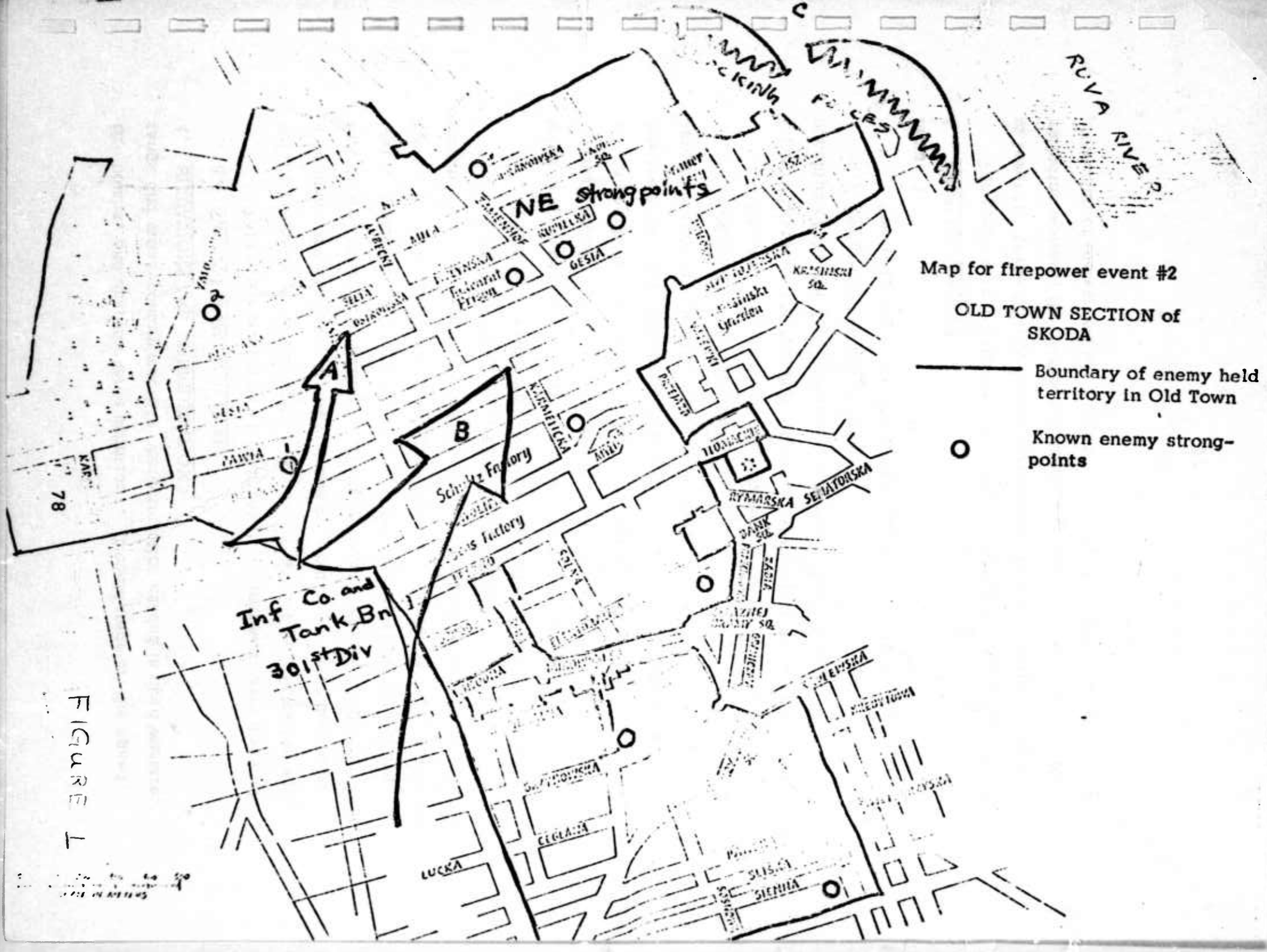
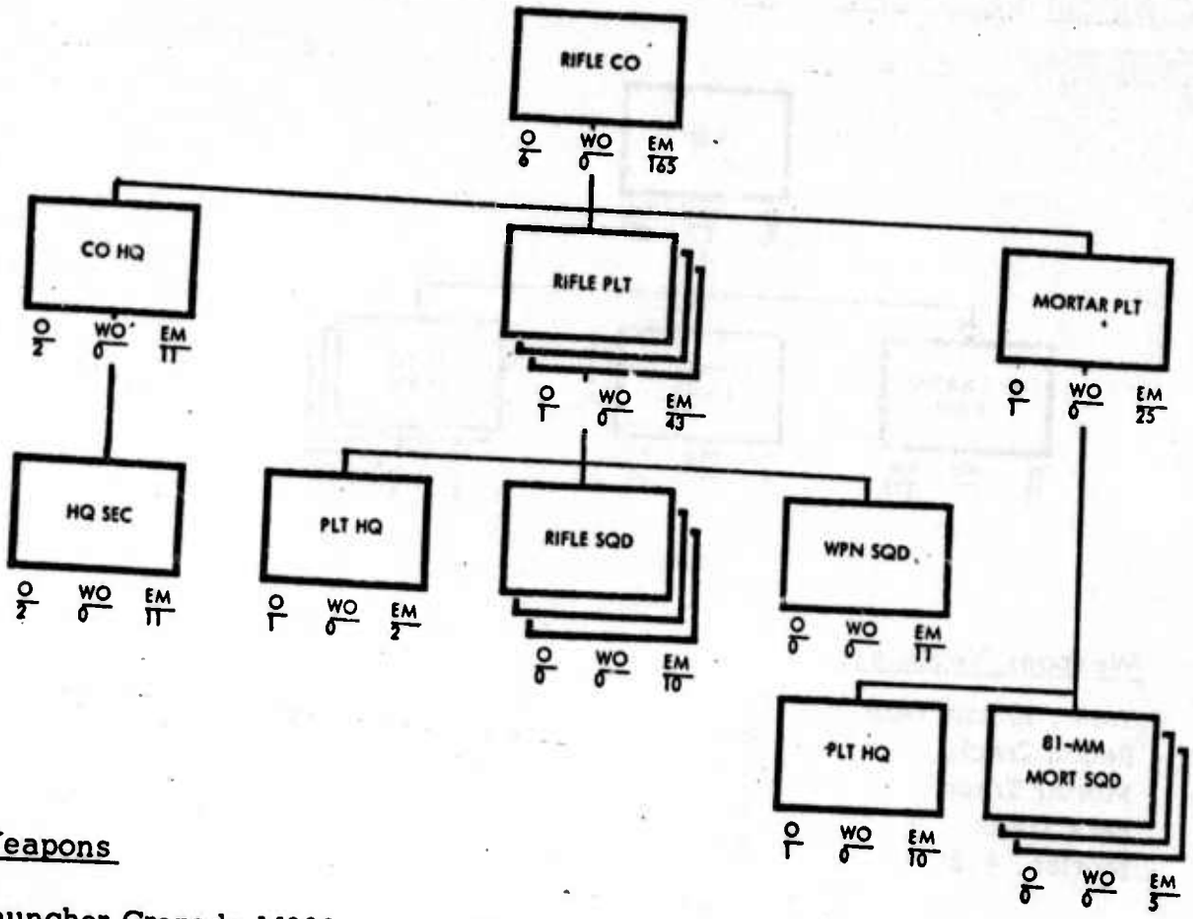

NE Strongpoints
A
B
Inf Co. and Tank Bn 301st Div
Schulz Factory
Map for firepower event #2
OLD TOWN SECTION of SKODA
Boundary of enemy held territory in Old Town
Known enemy strong-points

FIGURE 1

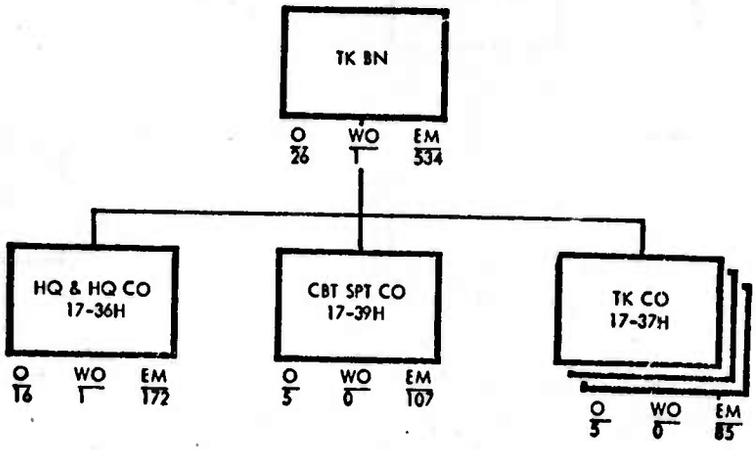


Weapons

Launcher Grenade M203	23
Machinegun 7.62-mm Light Flexible	6
Mortar 81-mm On Mount	3
Pistol Cal .45 Automatic	31
Rifle 5.56-mm	140
Rifle Recoilless 90-mm	6

Rifle Company, Wallonian Infantry Division (Mech)

Figure 2



Weapons/Vehicles:

Tank, 105mm Gun	54
Recon Track	9
Mortar Track	4
Pers Track	8
Mortar, 4.2"	4

Tank Battalion, Wallonian Infantry Division (Mech)

Figure 3

Motorized Rifle Battalion, 201st Rumelian Division

Figure 4

large radius of destruction will destroy large sections of buildings and streets, and also the historical landmarks. In addition to this, the use of tactical air support must be constrained due to the danger of fire and blast damage to the old buildings in this section.

The tank-infantry force attacks on two axes in column as shown on Map 1. Column A separates strongpoints 1 and 2 and neutralizes them, using recoilless rifles and tank fire only as needed. Column B advances rapidly towards the NE strongpoints emphasizing speed rather than flank protection. It attempts to cut the defenders in half and push them against blocking forces composed of the other units of the Wallonian 301st Division. All forces are ordered to exercise fire discipline to lessen damage to buildings.

The sewers are considered to be likely escape routes for the Rumelians so an engineer platoon places barbed wire nets at known strategic intersections. CS is also fired into the tunnels although the Rumelians are known to have gas masks. CS is not used above ground since it is felt to be a hindrance to offensive operations.

Enemy resistance quickly falls apart. The NE strongpoints were surprised to have the enemy on them in so short a time. Although there was extensive damage to 9 buildings in the Old Town section the overall damage to this region is minimal. The Wallonian/U.S. blocking force collects large numbers of prisoners.

Even though there were numerous Rumelian soldiers that escaped this "hammer - anvil" operation, they were separated in the confusion from their officers and units. Captured officers of the Rumelian army were taken back into the Old Town section and used to persuade the remaining bypassed defenders to surrender. This had a convincing effect and soon the entire area was deemed secure.

6. RESULTS OF ANALYSIS

This scenario suggests that the utility and technical feasibility of several items be analyzed: techniques and hardware for denial of tunnel systems; types of command mines; and methods of creating (and sealing) mouseholes.

Each of these items could contribute significantly to the commander's options.

1. Barbed wire barriers to enemy personnel in sewers and underground tunnels. These are expedient devices that do not depend on complete knowledge of the underground tunnel system beneath a city. Since this knowledge does not exist at present, even for New York City, it is unlikely to be found and stored in a quick access data bank within the next 15 years. Barbed wire, particularly in the form of a "wire gun" for rapid emplacement, will serve as a light, nonlethal method for interdicting sewer and tunnel traffic. Coupled with persistent CS it is a simple means of controlling the network of transit routes beneath a city without using lethal gas.

2. Command detonated mines - found to be quite useful in cities due to the limited ranges in city fighting. They are good for canalizing movement as well as for producing casualties.

3. Jet axe - for blasting holes into buildings and thus bypassing ambushes and boobytraps. (Hung Shan TPR 3 analyzes these in greater detail).

7. ALTERNATIVE RESPONSES

In this event a tear gas munition that is invisible might be very effective. Edgewood Arsenal has done some work in invisible tear gases and their use would give us little warning as possible to the enemy. An analysis of air delivery of chemicals that give no warning that they are being dispensed would aid city operations. Helicopters have been used in the past to dispense chemical agents.

An investigation of compact devices that rapidly produce barriers, such as a "barbed wire gun", is needed as a possible solution to the problem of blocking underground tunnels during an urban clearing operation.

TECHNICAL PROBLEM RESUME

Problem: Firepower II	Date: 1 Dec 72	Sheet 1 of 12
Operational Area: SKODA		
Title: Capture and Crossing of a Bridge		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 11	Date: 1 Dec 72	Sheet 2 of 12
Operational Area: SKODA		
Title: Capture and Crossing of a Bridge		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, par 4.4.d.(2).
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Fort Benning, Ga.
d. Ketron, Inc. unpublished manuscript on streetfighting tactics.

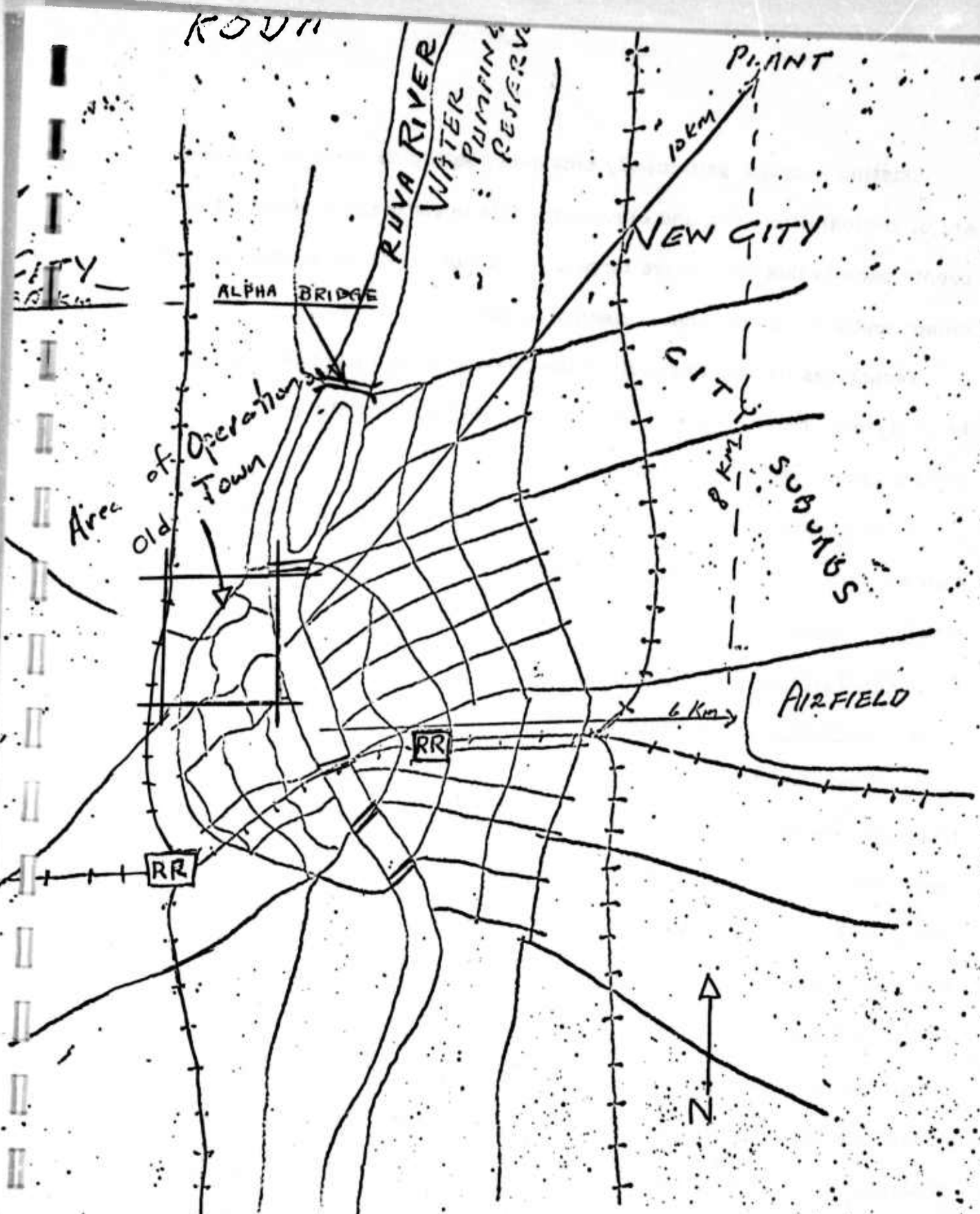
2. DESCRIPTION OF PROBLEM

At 0430 on 19 August, Rumelian forces completed their withdrawal to new positions on the east bank of the Ruva River and blew all except the Alpha Bridge (Figure 1). Infantry, tank, and engineer elements of the 301st Wallonian Infantry Division immediately attempted to capture and cross the bridge and clear it of any enemy demolitions. They were stopped by automatic weapons fire from four Rumelian river patrol boats and from high rise buildings on the east bank facing the Alpha Bridge.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

An analysis is needed of methods for delivery of a high volume of suppressive fire at medium range against the vertical faces of highrise buildings. Weapons dispersed vertically and horizontally across vertical faces can dominate critical bridges, intersections, plazas, and parks. Volume of fire, angle of elevation, vertical mobility of weapons, and terminal effects of munitions are among the factors for analysis.

The capability to cover such a vertical face with a smoke curtain is also worth further analysis. The curtain should be produced rapidly and last for a few minutes in still air to provide concealment for short movements across open areas.



Skoda City Map

Figure 1

(not to scale)

Existing weapons, particularly tank guns, should be examined for their arc of vertical depression and elevation. This is particularly important in events such as this one, where targets are in high buildings at short to medium ranges and down on the river at medium ranges.

Techniques for aerial assault of the rooftops of highrise buildings should be analyzed. These appear to be costly and difficult, but the profit to be gained makes them worth examining.

Finally, rapid methods of locating and defusing prepared demolitions charges need to be developed. Antitampering devices greatly complicate the problem. Police and military methods have hardly advanced since World War II.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

There are three threats in this event: The fire from the Rumelian river patrol boats, the high angle fire from apartment buildings on the east bank, and the possible late firing of Rumelian demolitions that are in place on the bridge. Five tanks driven out onto the bridge plus tanks along the east bank suppress the four river patrol boats, using 105mm gun and .50 caliber MG fire. After the patrol boats are sunk or driven off, the tanks shift their fire to the apartment houses to suppress snipers. Under the cover of the tank fire, engineer demolition teams remove the explosives from the underside of the Alpha Bridge. Infantry squads then cross the bridge in APC, dismount and break into the buildings to start house-to-house clearing, while tanks cover the west bank streets. Sentries posted on and under the bridge guard against any covert enemy attempt to destroy the structure. The clearance of the highrise buildings is similar to the actions described

in the assault on the city suburbs near the main Skoda airfield (FP1). The sequence of events is shown in figure 2.

b. Characteristics of the Area of Operations

The west (friendly) bank at the Alpha Bridge is typical of Old Town construction in Skoda: narrow streets paved with cobblestones, and 3 to 4 story buildings of timber and masonry with steep tiled roofs. The east (enemy), bank is lower, but there are several modern highrise (up to 12 stories) flat-topped buildings facing the river at the bridge site. The bridge itself is a stone masonry, two arched bridge with a roadway wide enough for two lanes of traffic. The roadway is 25 feet above the water.

c. Description of Own Forces

1 Tank Company, 301st Armor Battalion, 301st Wallonian Infantry Division (Mechanized). Figure 3.

1 Rifle Battalion (Mechanized), 31st Infantry Regiment, 301st Wallonian Infantry Division (Mechanized). Figure 4.

1 Combat Engineer Company, 301st Engineer Battalion, 301st Wallonian Infantry Division (Mechanized). Figure 5.

d. Description of Enemy Forces

1 Motorized Rifle Battalion (80% strength), 201st Rumelian Motorized Rifle Division. Figure 6.

5. PROBLEM ANALYSIS

The problem is to suppress enemy fires, clear the bridge of demolitions, and get forces across to seize the high buildings dominating the bridge. Because time is critical (enemy capability to fire the bridge demolitions is unknown) these actions should be done concurrently.

Smoke is desirable here, either a curtain to conceal the bridge and the Wallonian troops on it, or blinding smoke against Rumelian firing positions. Neither type of smoke is effective during the assault phase described in this event because of the time factor. Building up and maintaining a curtain to hide the bridge from enemy positions dispersed vertically in the buildings would take too much time. Similarly, blinding each of the many window firing positions across the vertical faces of the buildings requires considerable

THE ASSAULT ON THE ALPHA BRIDGE

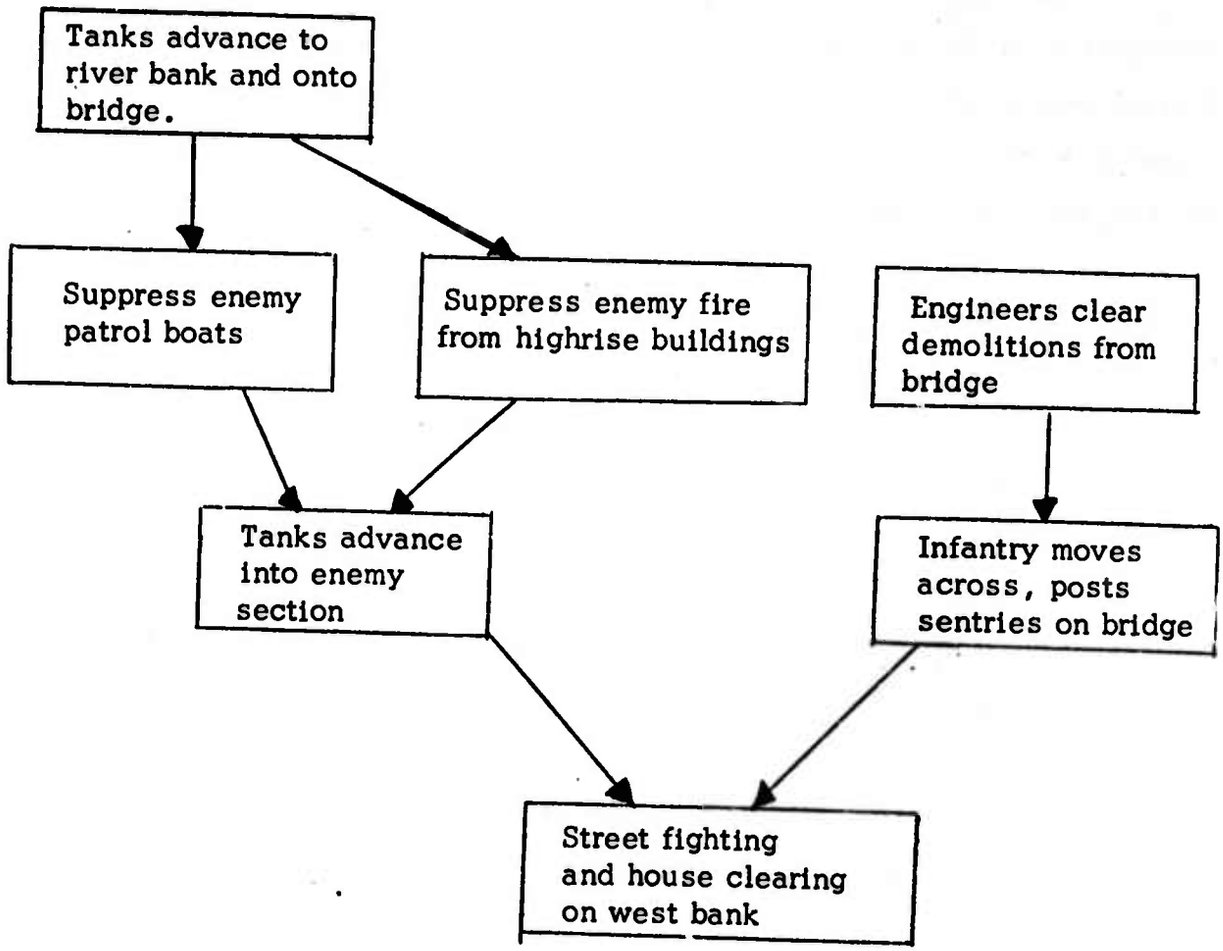
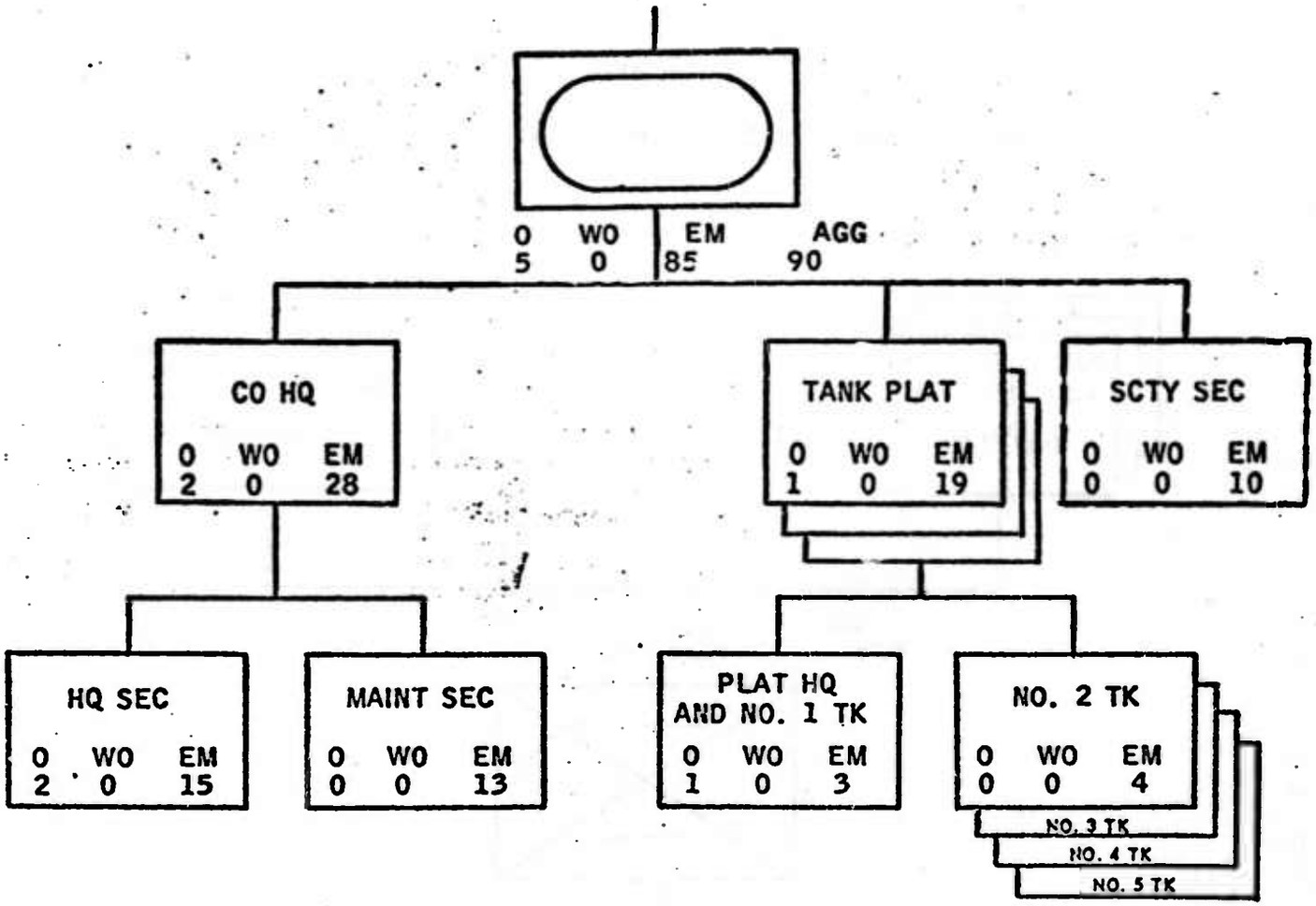
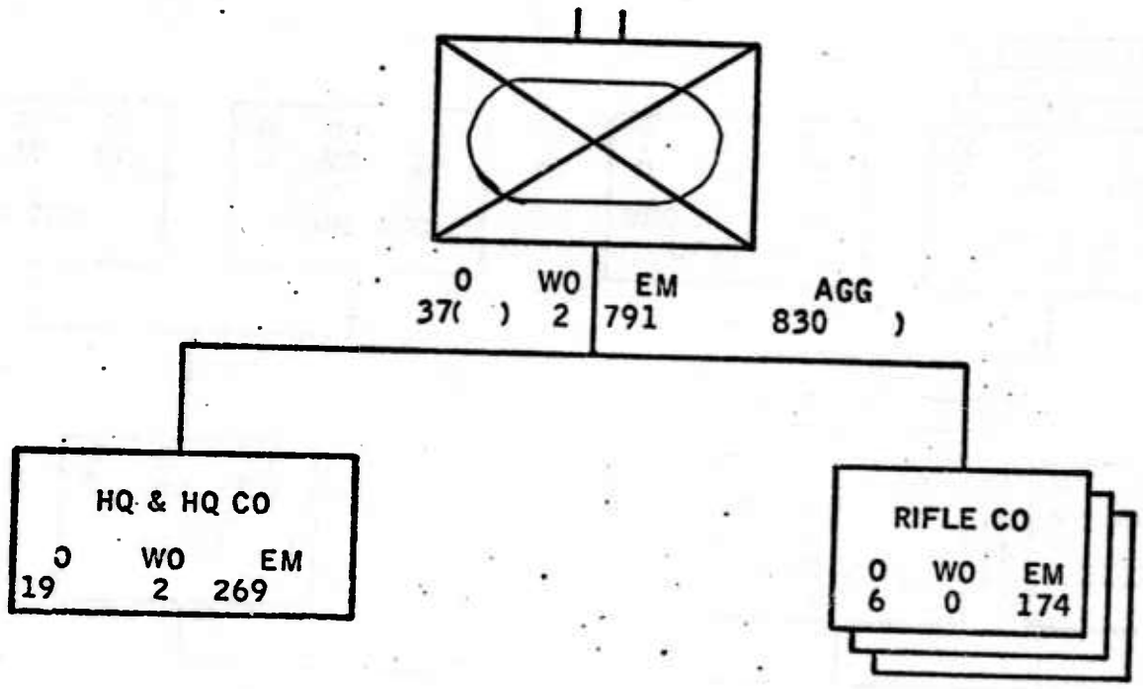


Figure 2



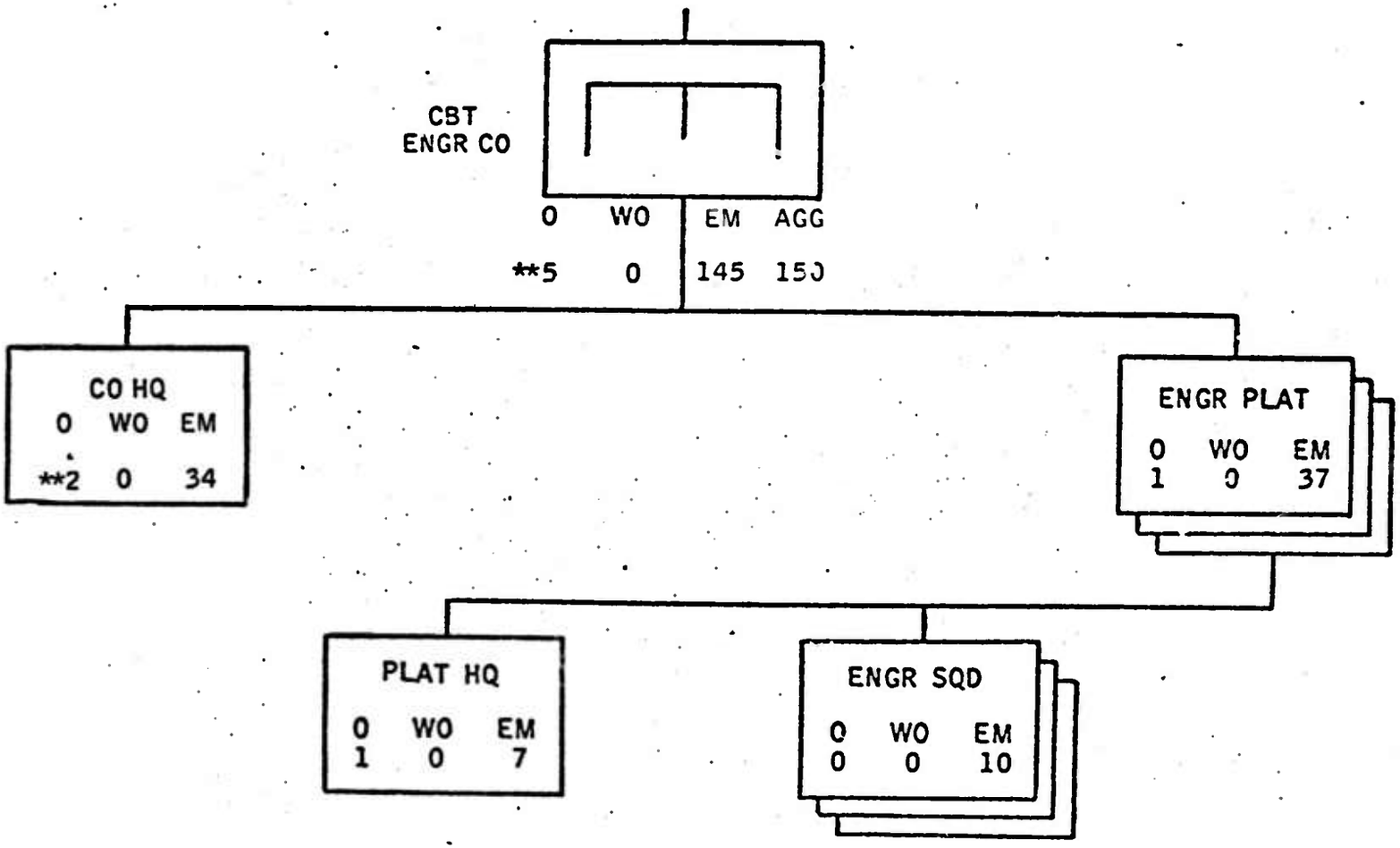
Tank Company, 301st Wallonian Infantry Division

Figure 3



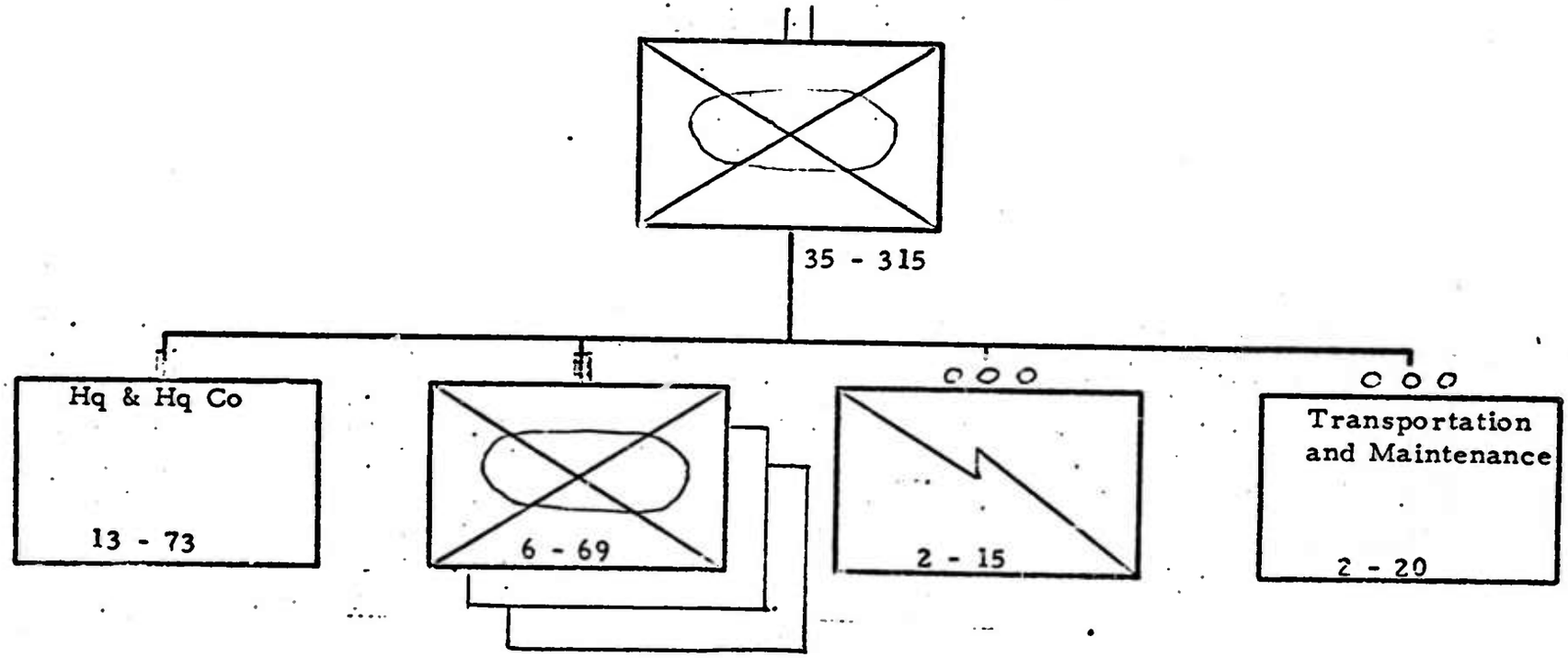
Rifle Battalion (Mechanized), 301st Wallonian Infantry Division

Figure 4



Combat Engineer Company, 301st Wallonian Infantry Division

Figure 5



Motorized Rifle Battalion, 201st Rumelian Division

Figure 6

time. Once the assault phase is over, a smoke cloud maintained directly on the bridge would conceal it from long range observation and fire by the Rumelians. In any case the logistical effort required for sustained smoke operations and the uncertainties of weather make it a difficult weapon to employ.

A fast method of suppressing fire from the many possible weapons positions on the vertical faces of highrise buildings is not available. While horizontal ground surfaces can be swept by a few automatic weapons, vertical surfaces cannot. High volumes of antipersonnel fire by many weapons is needed. Airburst artillery fire may be too dangerous to the assaulting forces in this event, but it is a possibility. Canister and flechette rounds for tank guns and for 90mm and 106 mm recoilless rifles could put down fairly good suppressive fires, but they are relatively slow rate of fire weapons. Effective suppressive fires appear to be the most positive and reliable means of restoring mobility to forces pinned down by fire.

The defeat of the Rumelian patrol boats is a simpler task, provided that the 105 mm tank guns can depress enough to fire at them. Even if only machine guns and recoilless rifles can be brought to bear on them, the boats would find it difficult to hold positions close to the bridge. Without cover, concealment, or room to maneuver, the patrol boats could be neutralized rapidly.

The removal of the bridge demolition charges is slow, hard work, and an error would result in detonation of the charges and destruction of the bridge. The engineer teams must locate all charges, check them for anti-tampering devices, and defuse them. All of this is done against time, on the assumption that charges are in place and the enemy has the ability to fire them.

The movement of forces across the bridge by armored carriers appears to be the fastest and safest method. Alternate methods (swimming, boats, wading, helicopters) depend on the characteristics of the particular situation and equipment available. In this event, the use of helicopters to land on the roofs of the buildings dominating the bridge is the most likely

alternative.

6. RESULTS OF ANALYSIS

The most important factor in this event is suppressive fire. If the assaulting forces can gain and keep fire superiority, they have a reasonable chance of a successful crossing. A less likely way to success is to conceal the movement of the forces by smoke.

Other problems are the angles of elevation and depression for tank guns, the use of helicopters to deliver assault teams and heavy weapons onto the rooftops of highrise buildings, and the location and defusing of demolition charges.

7. ALTERNATE RESPONSES

Suppressive fire into the vertical faces of tall buildings may be a mission for fixed and rotary wing gunships. The effectiveness and vulnerability of airborne weapons platforms in intensive urban firefights such as developed in this event is worth evaluating.

TECHNICAL PROBLEM RESUME

Problem: Firepower 12	Date: 30 Nov 72	Sheet 1 of 11
Operational Area: SKODA		
Title: Attack of Enemy Strongpoint and Reinforcement of Partisan Unit		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 12	Date: 30 Nov 72	Sheet 2 of 11
Operational Area: SKODA		
Title: Attack of Enemy Strongpoint and Reinforcement of Partisan Unit		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built-Up Areas, July 1972, par. 4.4.c.
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, U.S. Army Infantry School, Vol. 1 and Vol. 2.
d. The Application of Extended Lanchester Theory to Combat in Cities, MORS Working Group Paper

2. DESCRIPTION OF PROBLEM

The reinforcement of a Wallonian partisan unit located next to a Rumelian infantry strongpoint.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. From an analysis of the scenario and actual experience there are repeated events that are crucial to success in city combat. These events and their tactical variations should be modeled using Lanchester Theory. This problem indicates that building entry techniques are critical and should be analyzed in detail.

b. Smoke seems particularly appropriate to city combat. Its use should be studied in detail to yield an engineering design for future dispensing devices.

c. Command detonated mines and suitable barriers should be analyzed in city combat.

d. Wall breaching devices should be evaluated in terms of their utility in assisting in the horizontal and vertical mobility of troops maneuvering in a built up area.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

At 2245 18 August the CG, 301st Wallonian Infantry Division receives word from his G-2 that partisan bands have formed within Skoda to aid the US-Wallonian force in their attempt to enter and control the city. Although these partisan bands have met with some successes in harassing the Rumelian forces, their disorganized communications have meant that each band acts independently of other bands and of the Wallonian and U.S. armies.

In this particular event information is received that a partisan unit is located in the Kammler factory and that Rumelian infantry man a strongpoint next door in the tobacco factory.

b. Characteristics of the Area of Operations

This section of Old Town is densely built up. Three and four story structures are made of brick or masonry on a wooden frame. The physical layout of the region is on maps, Figures 1 and 2. Most of the factories are constructed of brick.

c. Description of Own Forces

(1) Partisan unit located in the Kammler Factory: 33 men armed with 15 semiautomatic rifles, hand grenades and petrol bombs.

(2) Wallonian forces: 1 infantry company is available to reinforce the partisans. Figure 3.

d. Description of Enemy Forces

In the tobacco factory there are 50 Rumelians from Company A, 201st Motorized Rifle Regiment. Around the factory there are 5 MG emplacements protected by sandbags. The enemy force is equipped with light antitank weapons.

5. PROBLEM ANALYSIS

The most dangerous approach to a prepared defensive position in city fighting is through the streets. Emplaced machineguns and antitank weapons dominate the streets and make movement costly. In this event, the Wallonian company moves and fights through the buildings as much as possible.

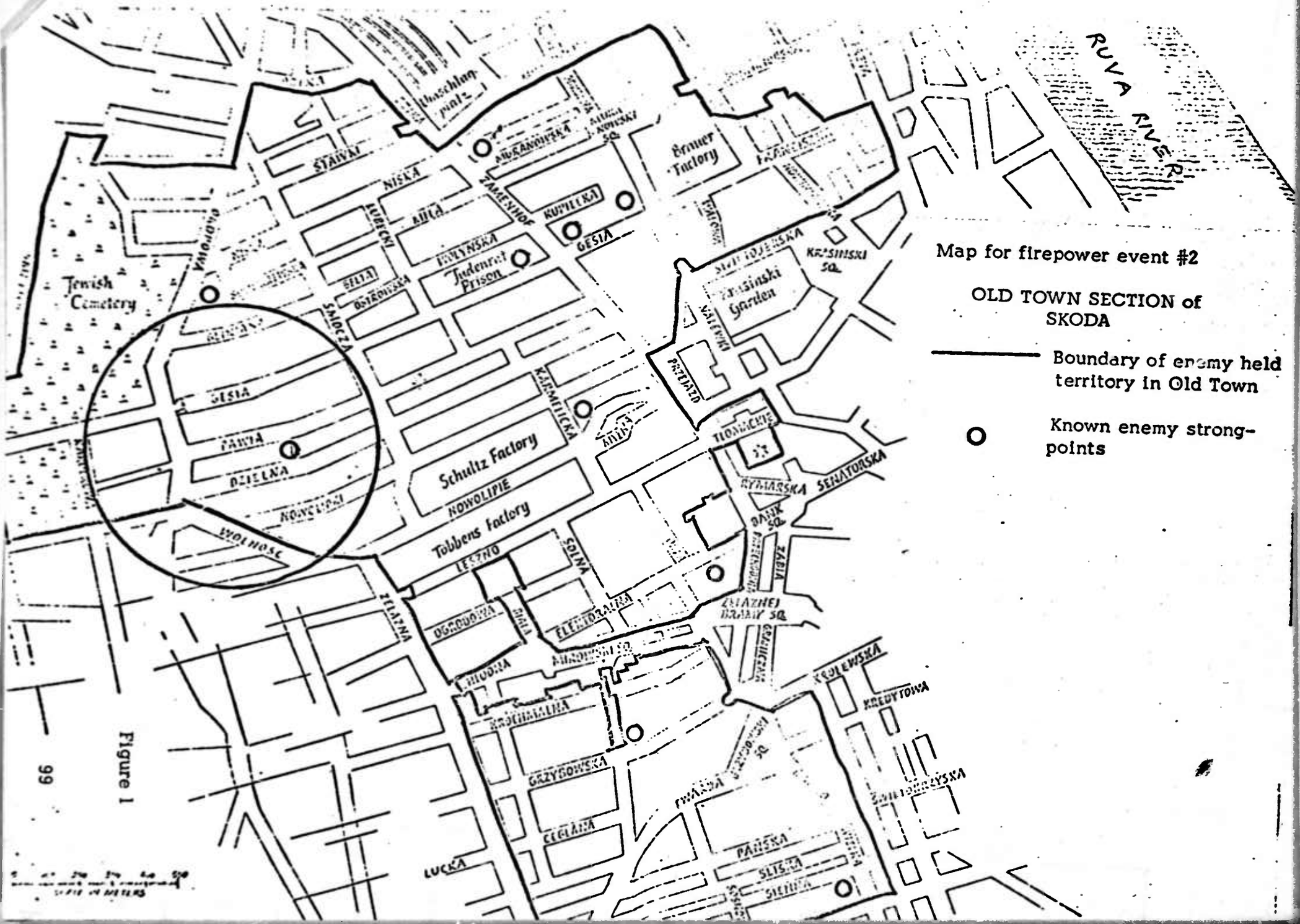

RUVA RIVER
Jewish Cemetery
Judenrat Prison
Bauer Factory
Krasinski Garden
Schultz Factory
Tobbens Factory
KRASINSKI SQ.
DANIK SQ.
ZELAZNEJ BRAMY SQ.
GESIA
PAWIA
DZIELNA
NOWOLIPIE
LESZNO
SOLNA
ZELAZNA
LUCKA
GRZYBOWSKA
KREDYTOWA
PANSKA
SLISKA
SIENNA
SENATORSKA
KRAKOWSKIE PRZEDMIESCIE
Map for firepower event #2
OLD TOWN SECTION of SKODA
Boundary of enemy held territory in Old Town
Known enemy strong-points

Figure 1

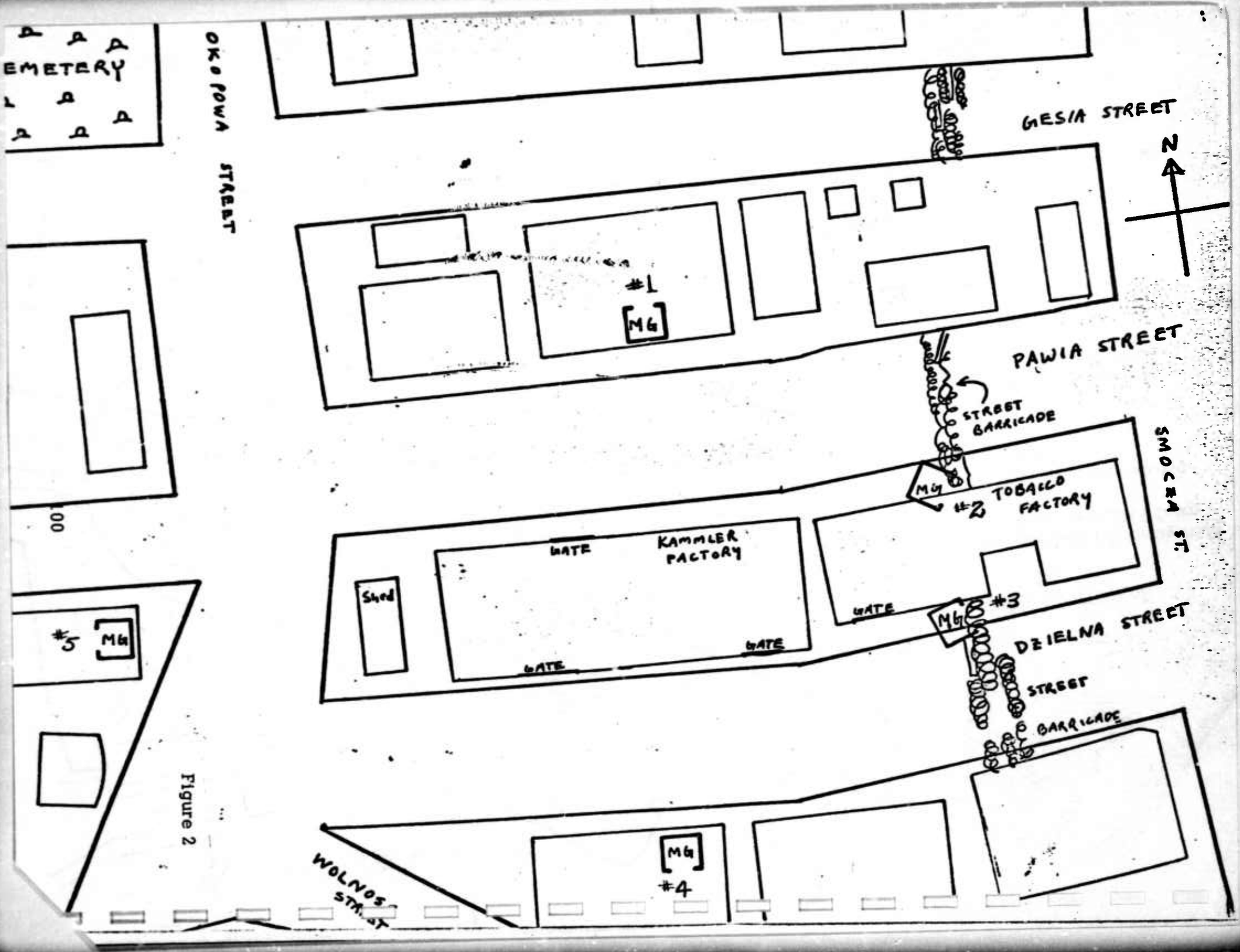
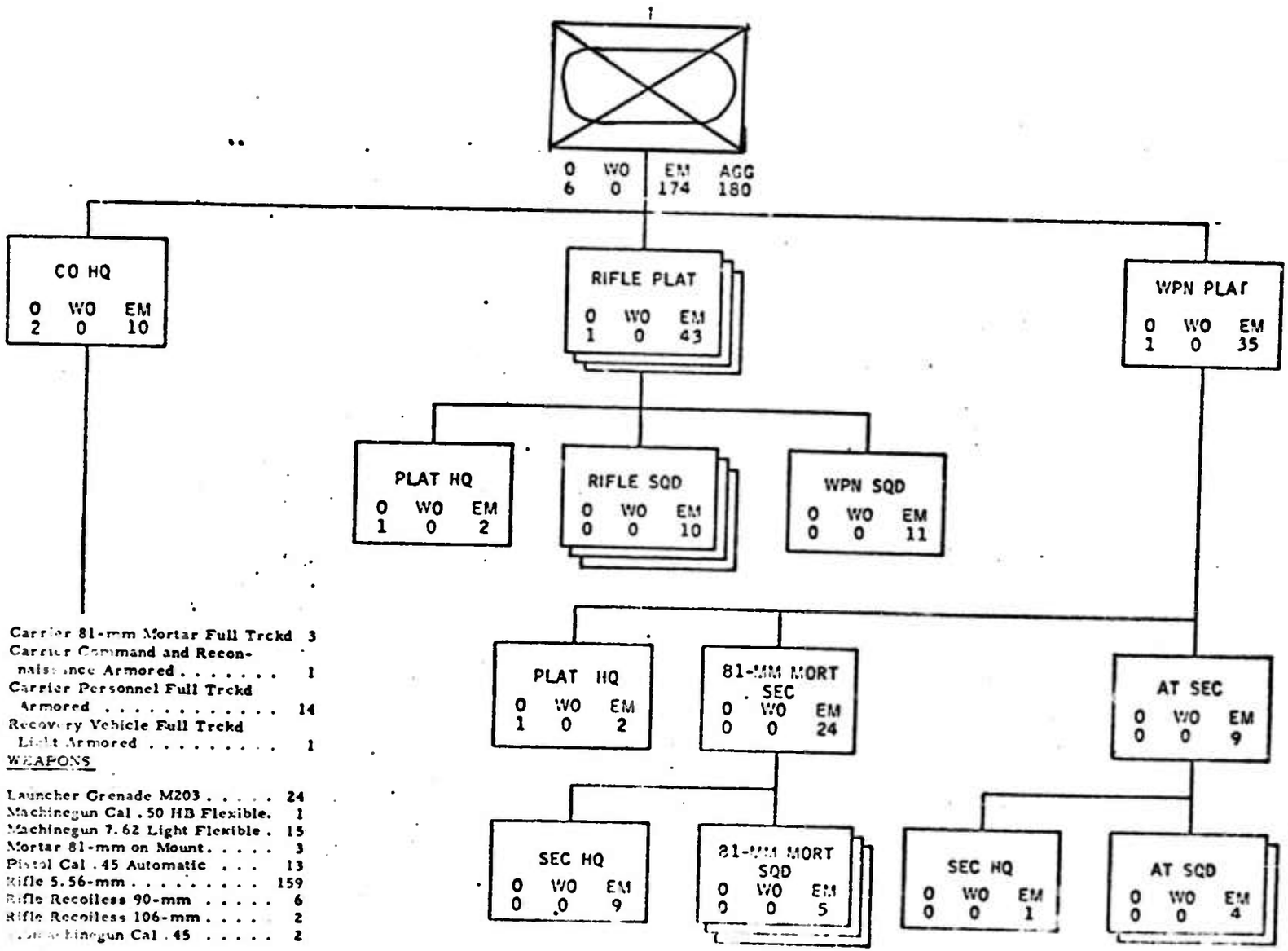

EMETERY
OKOPOWA STREET
GESIA STREET
N
#1
MG
PAWIA STREET
STREET BARRICADE
MG
#2 TOBACCO FACTORY
SMOCZA ST.
GATE
KAMMLER FACTORY
Shed
GATE
GATE
GATE
MG
#3
DZIELNA STREET
STREET
BARRICADE
#5
MG
MG
#4
WOLNOS
STREET

Figure 2



Carrier 81-mm Mortar Full Trckd	3
Carrier Command and Reconnaissance Armored	1
Carrier Personnel Full Trckd Armored	14
Recovery Vehicle Full Trckd Light Armored	1

WEAPONS

Launcher Grenade M203	24
Machinegun Cal .50 HB Flexible	1
Machinegun 7.62 Light Flexible	15
Mortar 81-mm on Mount	3
Pistol Cal .45 Automatic	13
Rifle 5.56-mm	159
Rifle Recoiless 90-mm	6
Rifle Recoiless 106-mm	2
Machinegun Cal .45	2

Figure 3
101

Rifle Company (Mechanized), 301st Wallonian Infantry Division

The leading platoon moves unopposed into the building on the northeast corner of Okopowa Street and Gesia Street. With one squad covering, the platoon rushes south across Gesia Street and enters the buildings on the south side. It then moves and fights eastward through the buildings, breaking through adjoining walls, until it knocks out MG #1 on Pawia Street. Again with one squad covering, the platoon rushes south across Pawia Street and joins the partisans in the Kammler factory. Before rushing, they throw smoke grenades to obscure the aim of MG #2 in the tobacco factory. Once inside the Kammler factory, the platoon leader reports by radio to his company commander. The movement of the remainder of the company is not considered in this event.

The crossing of Pawia Street is the key to this action. Assuming 10 enemy riflemen firing from the tobacco factory, the results of the rush across the street (50 feet) have been modeled using Lanchester Theory. The squads do not rush bunched together. Instead, individuals rush separated by a fixed distance. This technique prolongs the total rush, but reduces casualties. Those rushing are assumed not to be firing on the enemy.

6. RESULTS OF ANALYSIS

Lanchester Theory allows the variation of the important parameters. In the initial analysis, the size of the covering force was found to be the critical variable in reducing casualties in the force crossing the street (Figures 4 and 5). For the complete presentation of this approach and the sensitivity analysis, see reference d.

The use of smoke to conceal a street crossing is a useful technique. It was used in Hue in 1968, as well as in many city battles of World War II.

The analysis also shows that the Rumelian defenders must take positive action to avoid destruction by a methodical attack. Firing command detonated mines along the street during the attacker's rushes would increase his casualties. A barrier to the attacker's movement deployed across the street would slow his rush and increase his exposure to fire. There is a best distance at which to place a barrier from the defender's position. The printout in Figure 6 shows hit-probability as a function of horizontal range

ASSUALTING AN ENEMY HELD BUILDING

DEFENDER – 10 MEN

ATTACKER – 26 MEN RUSHING, 4 MEN COVERING

DISTANCE OF RUSH = 50 FEET

ATTACKER EMPLOYS CS SMOKE GRENADES TO COVER HIS ADVANCE TO THE BUILDING, THUS BOTH SIDES ENGAGE IN AREA FIRE. ONLY RIFLES INVOLVED AND ASSUME ATTACKER RUSHES THE ENEMY AT A RATE OF ABOUT 7 M.P.H.

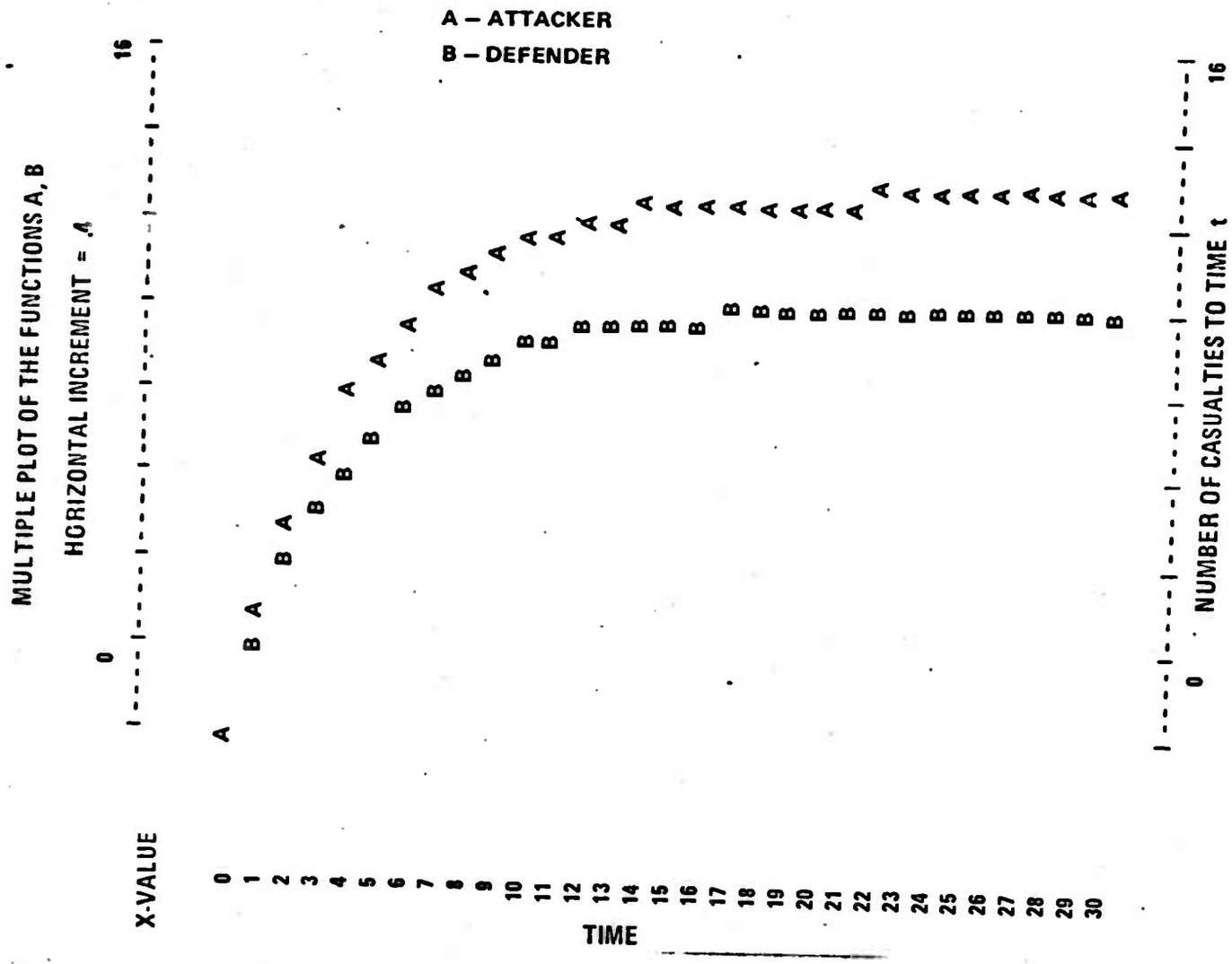


Figure 4

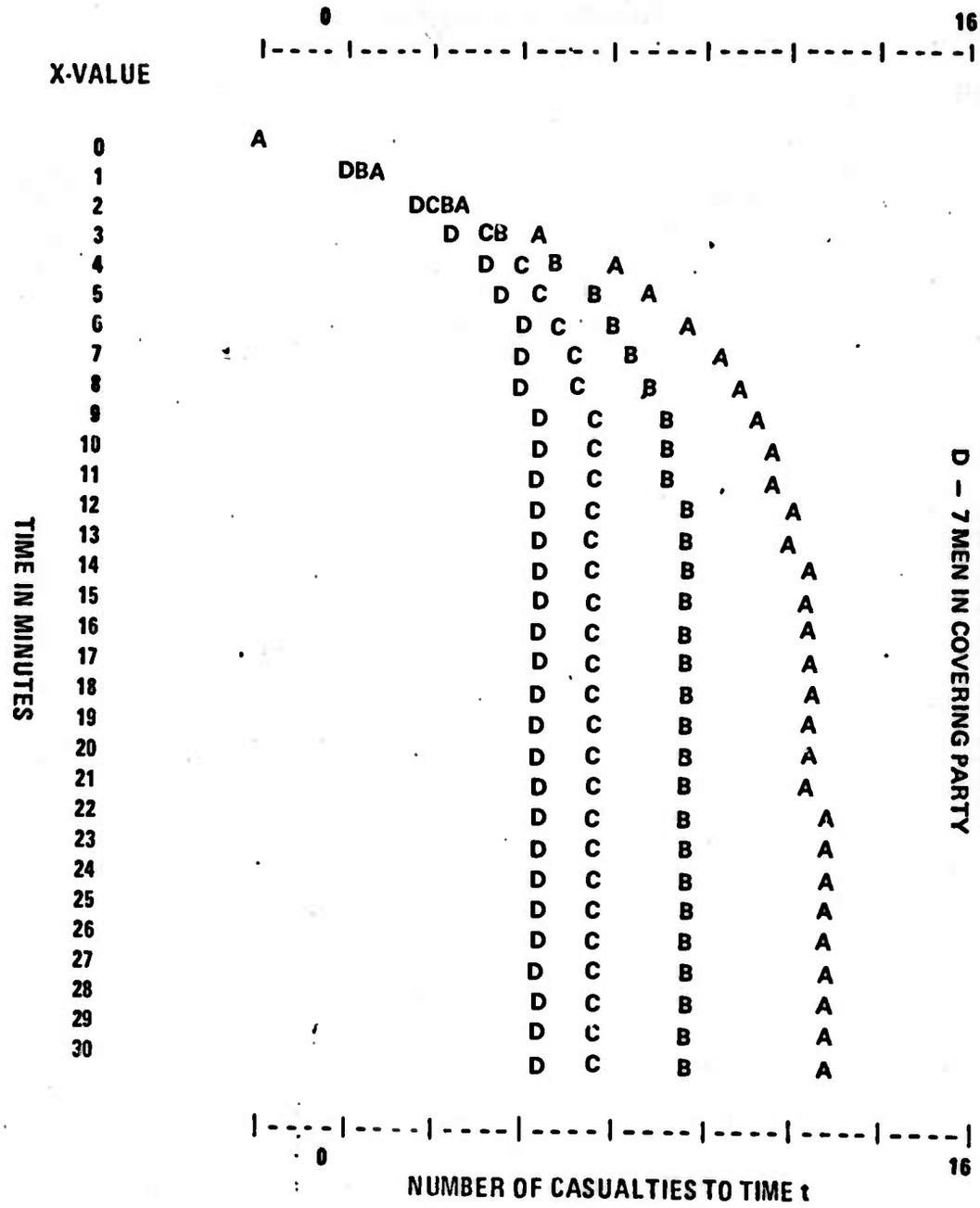

MULTIPLE PLOT OF THE FUNCTIONS A, B, C, D'
HORIZONTAL INCREMENT = .4
0
16
X-VALUE
TIME IN MINUTES
NUMBER OF CASUALTIES TO TIME t
ATTACKING BUILDING
SAME AS FIRST SITUATION EXCEPT THAT SIZE OF ATTACKERS COVERING TEAM IS VARIED. THIS PLOT DISPLAYS 4 LEVELS OF ATTACKERS CASUALTIES.
A – 4 MEN IN COVERING PARTY
B – 5 MEN IN COVERING PARTY
C – 6 MEN IN COVERING PARTY
D – 7 MEN IN COVERING PARTY

Figure 5

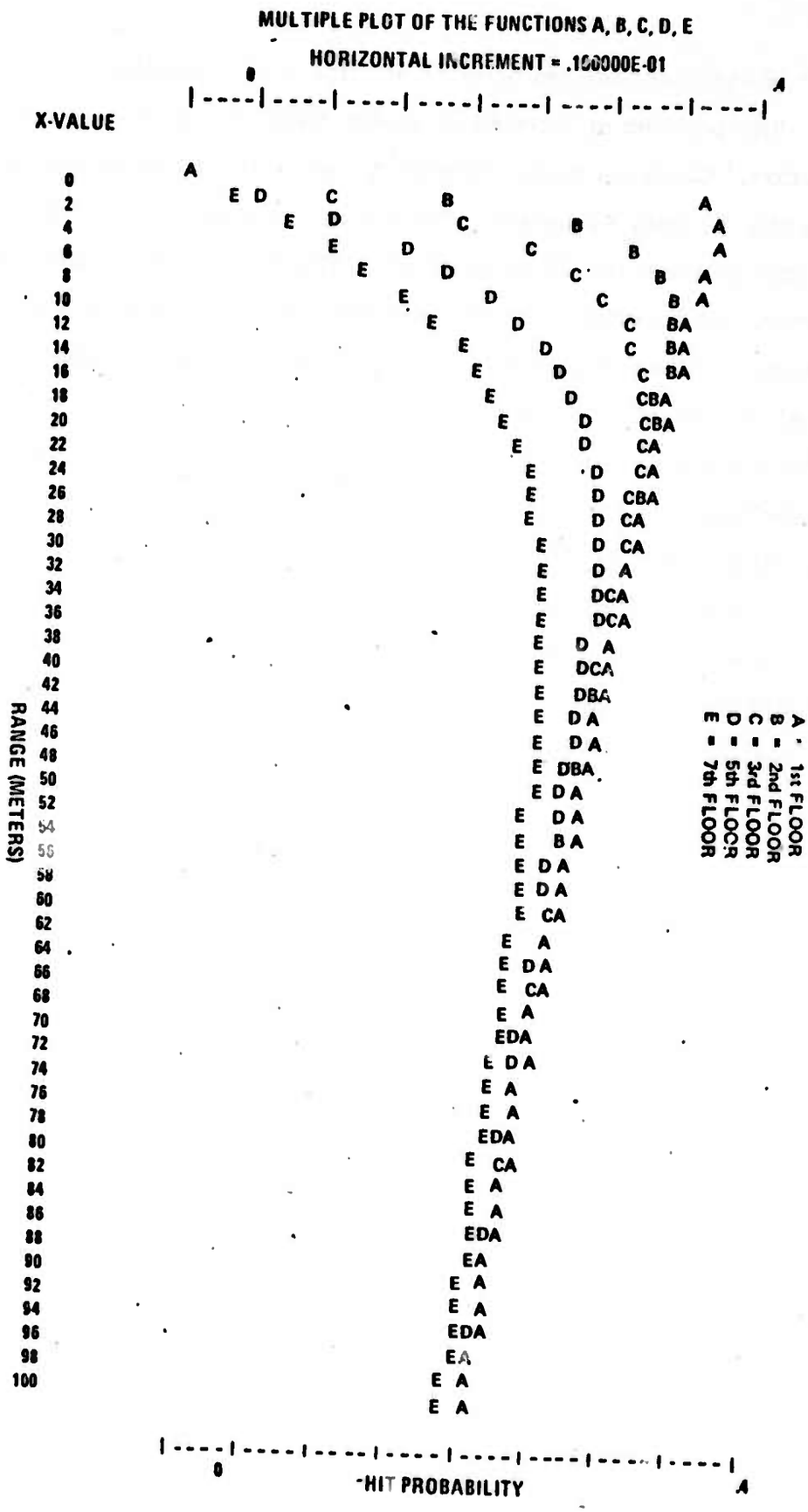

MULTIPLE PLOT OF THE FUNCTIONS A, B, C, D, E
HORIZONTAL INCREMENT = .100000E-01
X-VALUE
RANGE (METERS)
HIT PROBABILITY
M-14 SINGLE ROUND HIT PROBABILITY VERSUS RANGE
RIFLEMAN LOCATED IN BUILDING CAN SHOOT OUT TO 100 METERS
AT A MOVING TARGET. LOCATION ON VARIOUS FLOORS OF BUILDINGS
YIELDS DIFFERENT HIT PROBABILITIES:
A = 1st FLOOR
B = 2nd FLOOR
C = 3rd FLOOR
D = 5th FLOOR
E = 7th FLOOR

Figure 6

and of vertical position on different floors of a building.

The problem of entering an enemy held strong point is critical in city combat. Crossing areas covered by enemy fire is an action that continues to recur in many scenarios. The entire spectrum of tactical actions related to this problem should be analyzed. The parameters include the types and numbers of covering weapons, the spacing of crossing troops, the use of smoke or incendiary devices, and the use of larger weapons. Positioning is all important also, that is, from where should the rush begin and at what point should the rusher attempt to gain entry? The use of wall breachers for getting into position and gaining entry should also be examined.

7. ALTERNATE RESPONSES

The use of tactical helicopter support for both covering fire and for roof top mobility should be analyzed. The ability to gain and hold roof top control should reduce significantly the problems of building entry. The use of armor in conjunction with helicopters should be a part of this study.

TECHNICAL PROBLEM RESUME

Problem: Firepower 13	Date:	Sheet 1 of 8
Operational Area: SKODA		
Title: The Use of Artillery in City Combat		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 13	Date:	Sheet 2 of 8
Operational Area: SKODA		
Title: The Use of Artillery in City Combat		

1. REFERENCES

a. Ketron Interim Technical Report, Vol. III, 25 Aug, 1972, Extensive bibliography on Artillery Firepower in Built-Up Areas.
b. GTE Sylvania Special Technical Report No. I, Military Operations in Built Up Areas, July 1972

2. PROBLEM DESCRIPTION

The use of artillery in city operations.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

Self propelled artillery pieces should be analyzed by the relevant Army Agency or contractor in the role of direct fire weapons in cities. Questions of support and protection of these pieces should be analyzed. Warhead types to be considered should include HE, FAX and Chemical.

4. SITUATIONS AND CONSIDERATIONS

In the attack, it is customary for infantry commanders to call for preparatory artillery fires to soften up enemy positions. This practice has been carried over to city warfare with dubious results. Although indirect artillery fire has the ability to turn a large urban into rubble, it does not have the ability to destroy enemy forces located in prepared positions. This will be even more true for modern cities with the use of reinforced concrete as a building material. Indirect artillery fire is the single most important cause for noncombatant fatalities in a general war. The reason for this is that the general tendency for military forces is to secure the best and strongest positions for themselves, leaving the civilians to fend for themselves in structures that have been deemed less sturdy. A modern concrete city is not amenable to capture by artillery fire. This was true in WW II and is certainly the case now where the size, strength and number of potential strongpoints in a city has been growing faster than the trend in artillery shell diameter, and explosive power. If Aachen could not be secured

in 1944 with the enormous firepower used on it then Aachen of the 1970's will not be secured with an even greater increase in fire poured onto the city.

City targets are point targets. As such they do not present attractive targets to massed artillery weapons. Point targets must be defeated by point weapons. A recent advance in artillery for this tactic has been the CLGP (cannon launched guided projectile) which is discussed in another TPR.

A variant of getting the round to hit the target more accurately is to bring the tubes closer to the targets. This method has an advantage in terminal effectiveness over the CLGP in that the impact angle will be close to zero degrees. The CLGP will still have a high angle of fall. This could be a significant difference between the two systems granting that SPs in a city are vulnerable to enemy fire. The smaller the angle of fall the greater the probability of penetration and the smaller the probability of ricochet. If it takes several CLGP rounds to destroy a target, all of the cost-effectiveness arguments in favor of CLGP systems are destroyed.

5. PROBLEM ANALYSIS

In addition to conclusions in this section, results of the analysis of case studies are presented on the accompanying charts, Figures 1-3.

Consideration should be given to using SP weapons inside the city where they may engage targets at point-blank range. This will allow for the prompt destruction of strongpoints that are blocking the advance of infantry and tank units. It will thus add directly to the speed at which a city is secured and in this sense will reduce unnecessary destruction.

Tactics for SP use in cities must be developed that include protection of weapon and crew. Figure 4 shows a technique found successful by the Soviet Army. No one is on the street. The SP receives protection by jumping to pre-cleared safe zones. Scouts advance ahead of the clearing platoons and attempt to locate important targets. They are armed with tracer rounds and flares to communicate with their infantry. The tracer rounds allow the targets to be pinpointed.

6. RESULTS OF ANALYSIS

The use of indirect artillery fire in city combat tends to be inaccurate and destructive of neutral structures. A better role for artillery in the city is to serve as direct fire weapons. This role would greatly decrease the time needed to clear a path through a city and would produce far less collateral damage.

US	USSR
• PREPARATORY FIRES ONLY IF NEEDED	• QUICK, INTENSE PREPARATORY
• DISCOURAGES ARTILLERY ENTRY INTO CITY; MASSED FIRE WHEN NEEDED	• USES ARTILLERY DIRECT FIRE ON STRONGPOINTS
	• EMPHASIZES CHEMICAL WARHEADS
	• DEALS WITH ARTILLERY VULNERABILITY IN CLOSE COMBAT

Figure 1: Key Differences: US & Soviet Doctrines

U.S.

MISSION

- SUPPORT ATTACKING GROUND FORCES
- DESTROY HEAVY FORTIFICATIONS & BUILDINGS
- NEUTRALIZE ENEMY ON TOP FLOORS AND ROOFTOPS

SUGGESTED WEAPONS/ROLES

• 155 MM SP	DESTROY BUNKERS & CONCRETE BUILDINGS (36" CONCRETE @ 2700 M.)
• 8 IN HOW	DESTROY CONCRETE BUILDINGS & DEFENDING TROOPS (56" CONCRETE)

Figure 2: Artillery Doctrine* for City Combat

* FM 31-50

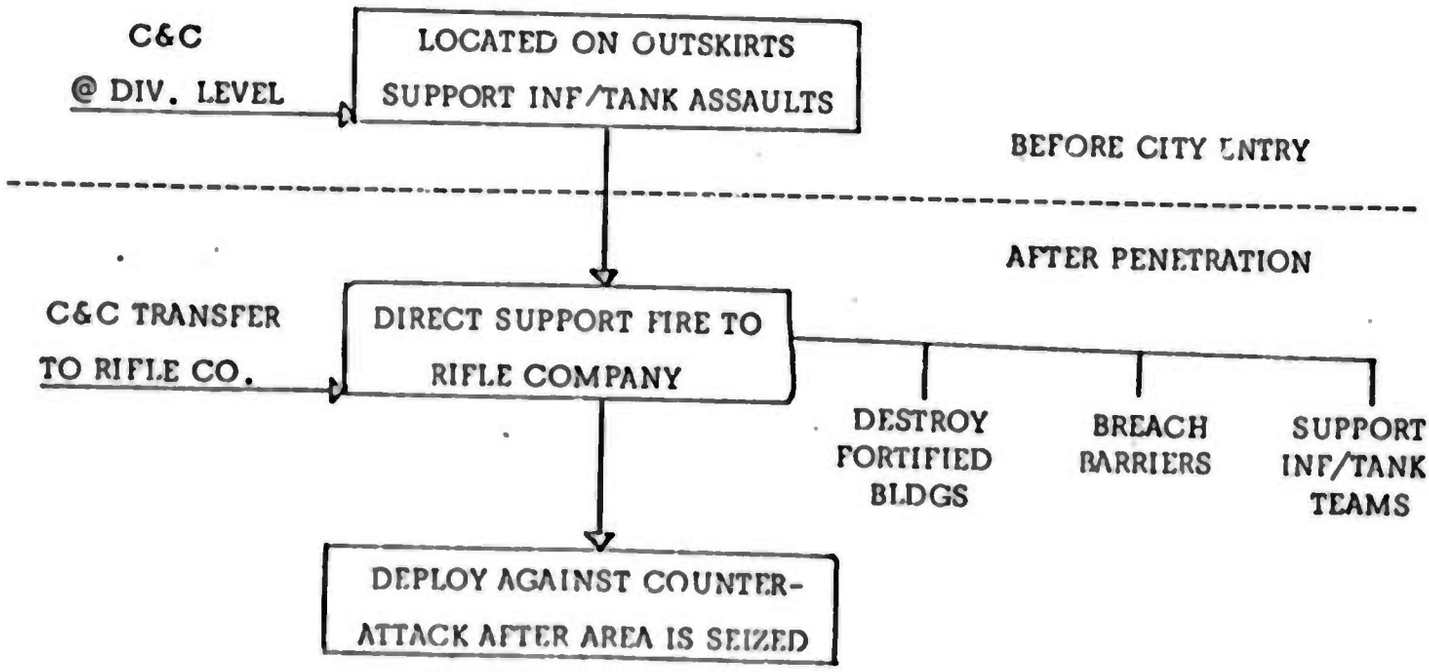
SOVIET

ARTILLERY DOCTRINE FOR CITY COMBAT

MISSION -

- DESTROY FORTIFIED BUILDINGS
- BREACH BARRICADES & OBSTACLES FOR VEHICLE & TROOP PASSAGE
- SUPPORT INFANTRY & TANK ADVANCE
- COUNTER COUNTERATTACKS

ROLES -



SOURCE: "MILITARY HERALD" DEC 1961
(A SOVIET DEFENSE PUBLICATION IN TRANSLATION)

Figure 3

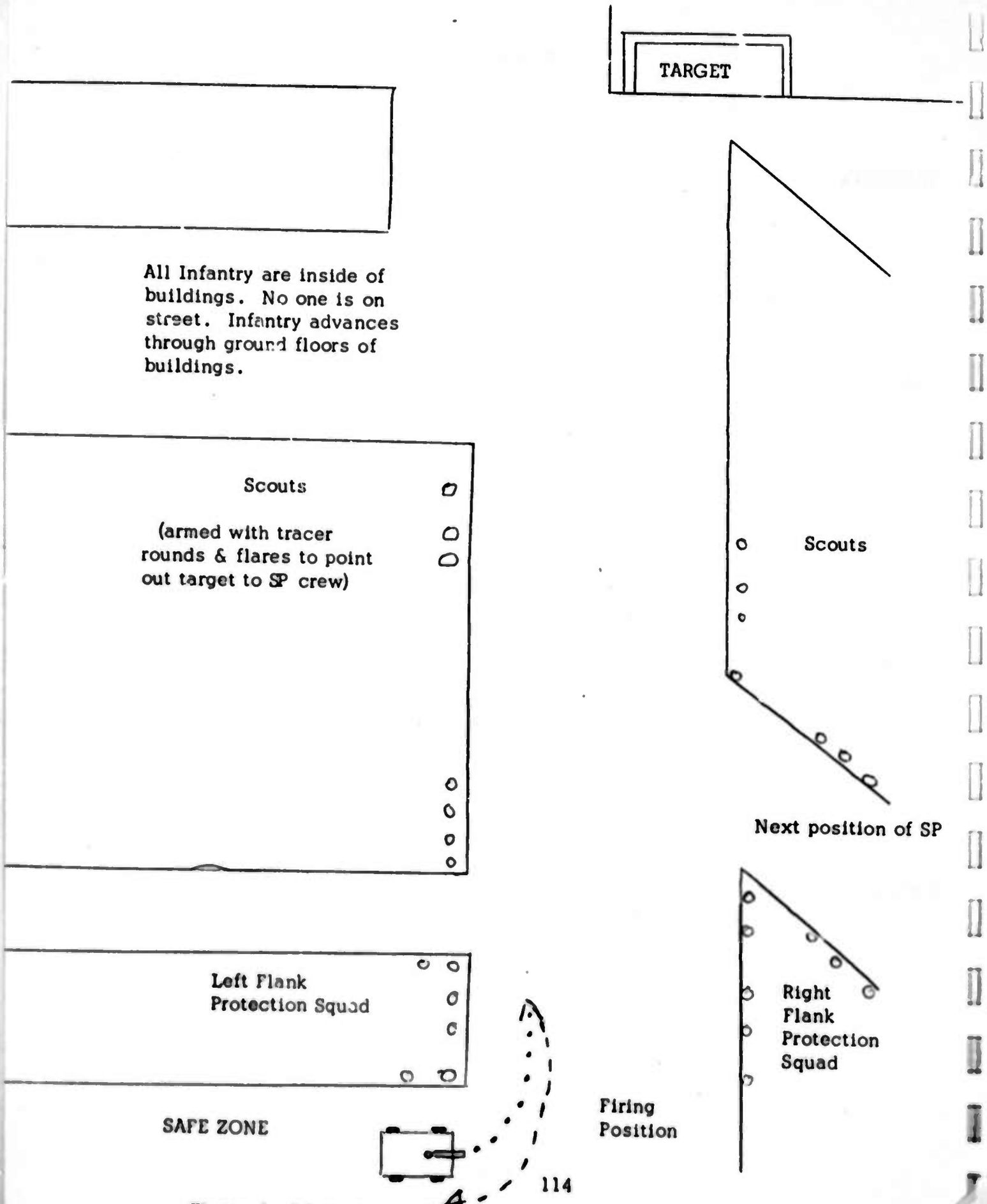


Figure 4: Advancing an SP HOW Through A City

CENTRAL AFRICA - MOMBOLA

TECHNICAL PROBLEM RESUME

Problem: Firepower 14	Date: 4 Oct 1972	Sheet 1 of 14
Operational Area: MOMBOLA		
Titie: DETECTION AND APPREHENSION OF INFILTRATORS		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 14 **Date:** 4 Oct 1972 **Sheet 2 of 14**

Operational Area: MOMBOLA

Title: DETECTION AND APPREHENSION OF INFILTRATORS

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para. 6.4.a(6).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Build-up Areas, Vol II, Annex 4.
c. U.S. Infantry Reference Data, ST-7-157, FY72, page 169.
d. U.S. Army Special Forces foreign Weapons Handbook, USAJFKCENSPWAR (Abn) 1 Jan 67.
e. U.S. Army FM31-50, Combat in Fortified and Built-up Areas, Mar 64.

2. DESCRIPTION OF PROBLEM

U.S. troops are assigned to search all Mombolans passing through a highway checkpoint. They are fired on by surprise at close range as a vehicle attempts to run through the checkpoint.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. In conjunction with surveillance contractor, study the feasibility of developing and employing vehicle and personnel scanning devices for locating firearms and munitions.

b. In conjunction with the civil interaction contractor, perform a comprehensive study of checkpoint procedures for different mixtures of police and military forces. Examine the best uses of different types of weapons for this type of operation.

c. Analyze possible firepower improvements to develop a close range infantry weapon for use in city combat (checkpoints, building searches) and determine the desirable operational characteristics of such a weapon. Examine the technical feasibility of likely or possible candidate systems.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

On 8 May 1975, two police officers checking the burlap bag carried by a farmer find two U.S. hand grenades among the yams. At noon on 8 May 1975 the Chief of Police of Mombola requests the assistance of the AID Public Safety Advisor in detecting the presence of weapons among the food being brought into the city. The Chief reports that an informer has stated that all of the guns and ammunition from the Constabulary Training School are to be smuggled into the city prior to the Mombo attack. Also, additional MLA personnel posing as farmers and individuals are reported to be entering the city without opposition. The 333rd Infantry Battalion of the 301st Infantry Brigade is ordered to establish checkpoints on all approaches to the city and recover any weapons that may be discovered and to arrest and detain all individuals detected carrying weapons or other contraband. Two infantry companies are assigned perimeter sectors for establishing checkpoints. One company is kept in reserve. At checkpoint Alfa a 1 1/2 ton stake truck carrying concealed weapons is stopped for search. At the first sight of American troops, the driver attempts to bolt through the checkpoint. The penetration attempt is obviously well planned since several of the farmers who were also passing through the checkpoint at that time draw firearms and begin shooting to cover the truck's advance. There are three men on the truck and seven infiltrators disguised as farmers on foot who participate in the pitched battle. There are approximately ten non-combatants in the

vicinity. It is approximately three blocks to adjacent checkpoints on either side of checkpoint Alfa. By the time reinforcements can get to the position, the fighting is over.

b. Characteristics of the Area of Operations

Mombola is located in central Africa on a navigable river and at a key rail intersection. The city, capital of Momboland, is laid out in a square pattern (Figure 1). The government center, completed in 1938 is bordered on the west by a western commercial area with multi-story apartments, offices and banks. To the north is the old quarter with one story, high density, hut-type housing; to the east the native commercial area of one story native craft "cottage industry" buildings and shops borders the government center. To the south, army barracks built by the British during their occupation line the center.

The center itself consists of the capital and four story buildings for police, army and interior departments set in a large parkland and grass area. A detailed map (Figure 2) shows the situation at checkpoint Alfa at the time the shooting begins. The area is flat and relatively open with a few scattered trees. The streets at the intersection are about 30 feet wide. The buildings are one story single room stores made of wood and are lightly built.

c. Description of Own Force

The U.S. 333rd Infantry Battalion, 301st Infantry Brigade, is deployed as follows:

- o A Company, south and west perimeter.
- o B Company, north and east perimeter.

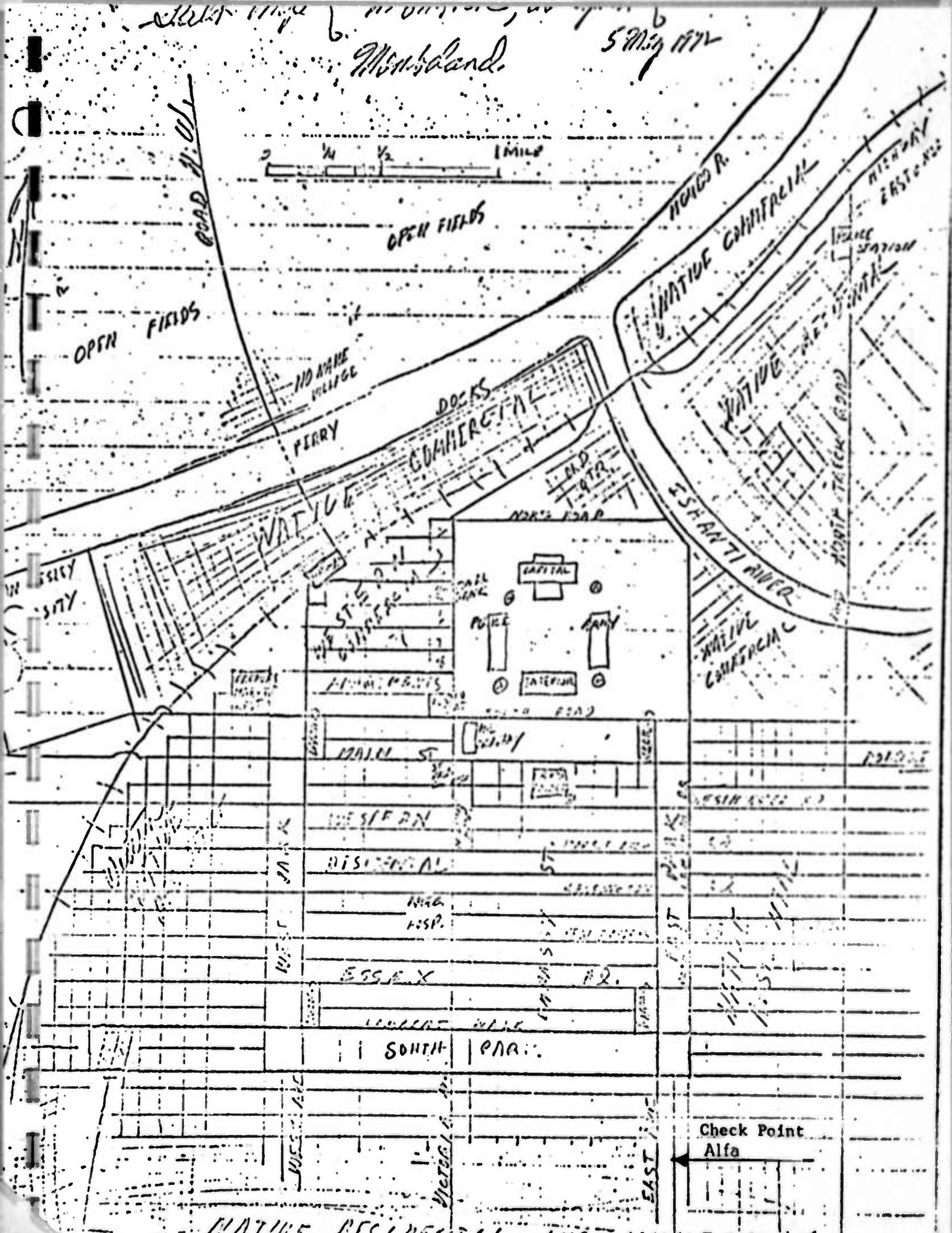
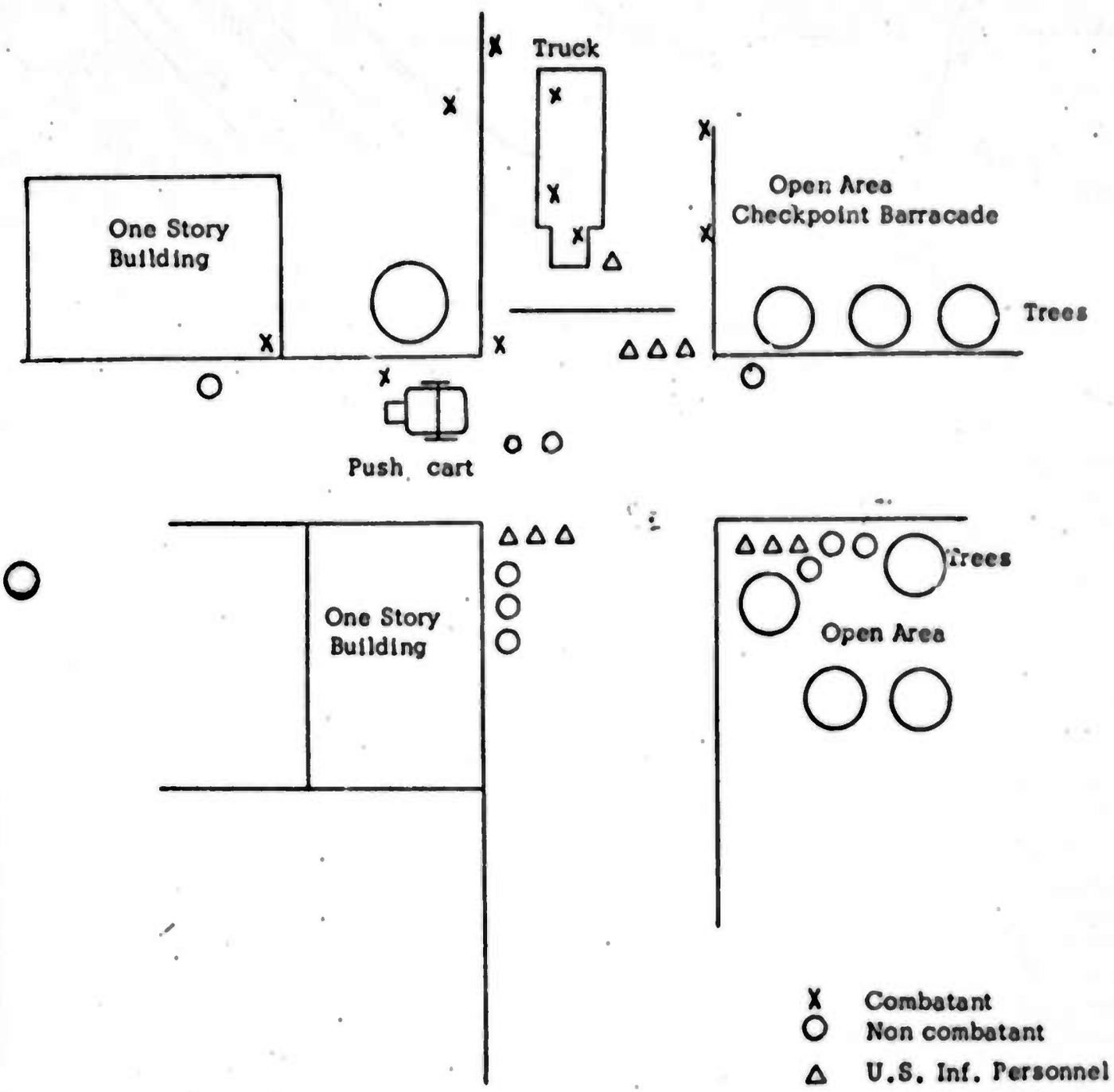

OPEN FIELDS
OPEN FIELDS
NO NAME VILLAGE
FERRY
DOCKS
COMMERCIAL
NATIVE COMMERCIAL
NATIVE
ESHANTI RIVER
CAPITAL
POLICE
ARMY
INTERIOR
MAIN ST
ESSEX
SOUTH PARK
Check Point Alfa
NATIVE RESIDENTIAL AND COMMERCIAL

Figure 1



CHECKPOINT ALFA

Figure 2

The Battalion CP is located at the FRM army barracks at the corner of West Avenue and Lambert Walk, adjacent to West Park. A prisoner holding area has been established within the barracks compound. Company C is located at the army barracks to provide for prisoner pick-up, holding and detention. Additionally one platoon of Company C is being held as a reserve in case additional support is required at any of the checkpoints.

d. Description of Enemy Forces

(1) MIA personnel disguised as farmers and armed with individual weapons and grenades have the mission of infiltrating the city to attack U.S. and allied military personnel and equipment, and to seize and hold major government buildings.

(2) The MIA organization and major equipment lists are shown in Figure 3.

5. PROBLEM ANALYSIS

The checkpoint was manned by a squad of the 1st platoon, Company A. All personnel and vehicles entering the city were to be stopped and searched for weapons and other contraband. The squad leader and three riflemen were positioned at the checkpoint (Figure 2). Two of the three riflemen were involved in the stopping and searching of the personnel and vehicles. The squad leader and the other rifleman were there to cover the searchers and to assist in removing weapons and other contraband obtained during the search. The balance of the squad was deployed in two teams some 25 meters behind the checkpoint, one team (leader, grenadier, and rifleman) in the street and

MLA Unit	No of Men	Equipment
A Reg 1st Bn	500	5 Machine Guns - Cal 303 Bren (UK) 500 Rifles - Cal 303 Enfield (UK) 3 Company Radios (VHF FM)
A Reg, IIIC & 2nd Bn	600	500 Rifles, 5 Machine Guns Reg Hq Radio (VHF FM)
B Reg	1500	15 Machine Guns, 1500 Rifles, 3 Jeeps 1 Reg Hq Radio, 12 Co. Radios

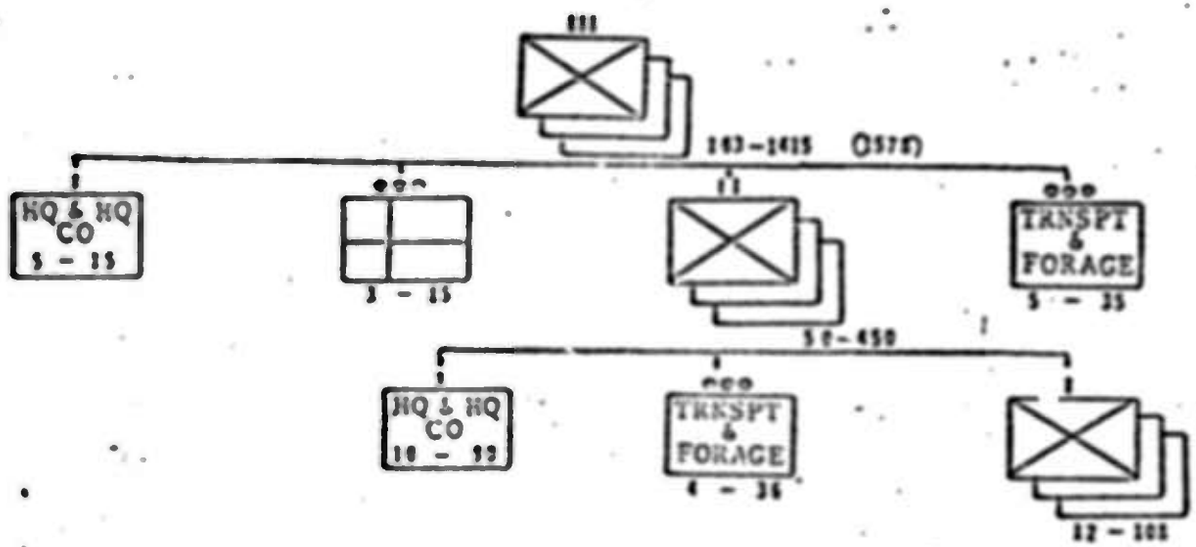


Figure 3

'Enemy Organization
Mombola Liberation Army, Regiments A, B and C

the other team (same composition) in an open area on the other side of the street (see Figure 2). Their orders were to remain in position and provide covering fire to the checkpoint if necessary. Because of the numerous civilians in the area, squad personnel were briefed that in the event of trouble they were to fire only at people carrying or firing weapons. All men in the squad wore steel helmets and armored vests and carried protective masks.

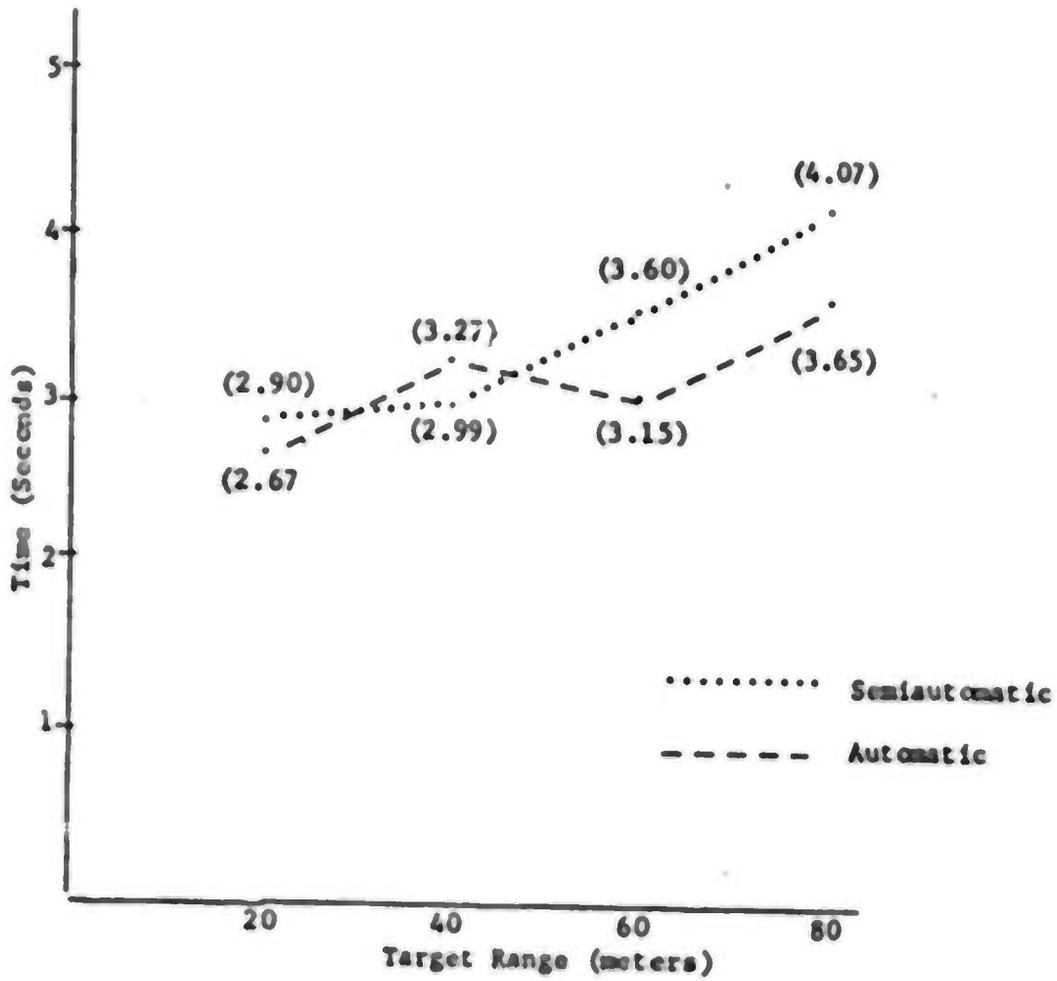
The penetration attempt was initiated when the driver of the 1 1/2 ton stake truck drove through the barricade. Almost instantaneously, firing broke out. The two men on the truck gunned down the two riflemen searching the vehicle. The squad leader attempted to come to the aid of his men but he too, along with the other riflemen were shot by infiltrators posing as farmers before they could fire their weapons. The remainder of the squad immediately opened fire. The truck driver and the two men on the truck were shot, stopping the truck. A pitched battle was carried on between the remainder of the infiltrators and the squad. Since the infiltrators were disguised as farmers, it was difficult for the squad personnel to identify which were non-combatants and which were the infiltrators. They fired at anyone firing on them. Most of the civilian population in the area scurried to side streets or into shops. One infiltrator climbed up on a roof and began to fire down on the troops. He was killed before he hit anybody.

The remainder of the infiltrators retreated out of the city. Because the action was short and intense, the assistant squad leader did not call for reinforcements until the action was almost over. Reinforcements from the

3rd platoon finally arrived along with medical aidmen, but too late to become involved in the action. The infiltrators suffered 3 killed and 2 wounded; U.S. casualties were 1 dead and 6 wounded. Additionally, five civilian non-combatants were wounded during the firefight. Damage to buildings was minor. A squad from the 3rd platoon took over checkpoint Alfa and the remainder of the original squad of the 1st platoon was withdrawn.

Vehicles attempting to run the checkpoint could be stopped by the AT rockets (LAW) or recoilless rifles (90mm) but at the short ranges involved in this situation, these would probably inflict casualties on both non-combatants and U.S. personnel. A well-built obstacle in the road is a better solution to the problem.

If the checkpoint personnel were armed with a shotgun or salvo fire weapon that could be brought into action with a very short reaction time, they might have very rapidly inflicted more casualties on the infiltrators and so reduced their own casualties. A short range (100 meters) multiple projectile weapon could give friendly troops a distinct advantage in a close range firefight where extra aiming time to insure hits on targets at 10-40 meters might be just enough to tip the outcome in favor of the infiltrators. Studies at the Infantry Board show the time to first round fired to be 2.5 seconds for targets as close as 20 meters, and almost 3 seconds for time to first hit. Figure 4 shows the combined times for large samples of test soldiers using both the M14 and M16. The figure shows that there is a slight saving in time on the automatic mode. Also, the study showed



AVERAGE TIME TO FIRST HIT (BOTH MODES)

FIGURE 4

that hit probability was lower in the automatic mode. Figure 5 shows individual round hit probabilities for the M14 rifle at close range targets as a function of burst size. Both single round and cumulative burst hit probabilities decrease as burst size increases. The use of salvo type weapons would reduce the number of civilian casualties by terminating the fighting quickly before it spread to larger areas and increased in intensity.

If the checkpoint personnel had been armed with the salvo weapons described above and also provided with identification/search surveillance equipment that could automatically carry out the screening of vehicles and personnel, they would have been able to respond much more effectively. Since the infiltrators would have been detected (they were carrying concealed weapons), the fire of the checkpoint force including the covering and reinforcing force could have been directed at specific targets thereby reducing both U.S. casualties and non-combatant civilian casualties.

6. RESULTS OF THE ANALYSIS

The basic problem in manning a checkpoint is overcoming surprise and reacting quickly and decisively. Possible improvements in surveillance equipment, with scanners, sniffers, etc., could reduce surprise significantly. The value of a forewarning, even a few seconds, could have significant impact on this situation.

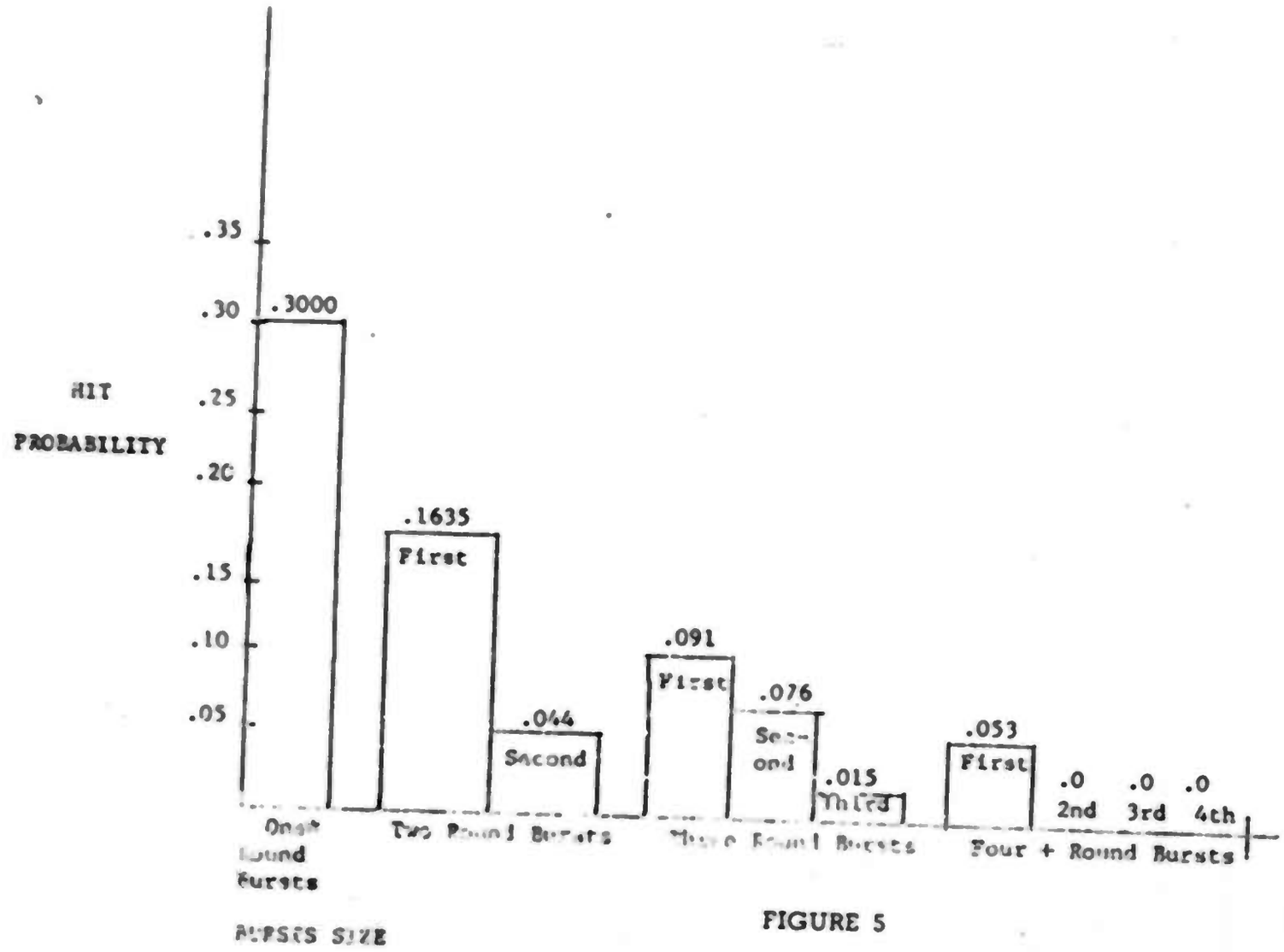


FIGURE 5

INDIVIDUAL ROUND HIT PROBABILITIES FOR RIFLE A

Standard tactics and procedures for troops on this type of duty are necessary. The exact techniques employed vary with situation and terrain. Rather than prescribe a specific MO for checkpoint control, a checklist of matters that should be considered by the unit commander might be developed.

The analysis shows that a close range, multiple projectile weapon would be useful in this situation. Several weapon concepts should be analyzed. These include shotguns, squeeze bore salvo rifles, submachineguns, and others.

7. ALTERNATE RESPONSES

Examine the possible use of the 40mm automatic grenade launcher as a vehicle threat in checkpoint situations.

This problem is also involved with civil interaction. Local police should be used to conduct searches. U.S. troops are useful as a show of strength and to cover the police, but foreign infantrymen are less efficient than local police in searching. When U.S. troops must do the job, they require an interpreter to assist them. Battelle should look into this.

TECHNICAL PROBLEM RESUME

Problem: Firepower 15	Date: 28 Dec 72	Sheet 1 of 13
Operational Area: MOMBOLA		
Title: Movement in Attack Position		

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TECHNICAL PROBLEM RESUME

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1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, July 72, Para. 6.7.d.(1).
b. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, Mar. 64.
c. U.S. Army Special Forces, Foreign Weapons Handbook, Jan. 67.
d. U.S. Army Small Arms Requirements Study (ASARS I), USACDC, Vol. IV, Annex L, Jun 70 (Conf)
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g. Study of Grenade Launching Systems, OR-68-5, U.S. Army Weapons Command, Sep 68 (Conf)
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i. Individual Man As a Weapon System, TR 72/001, Annex II, Litton Systems, Inc., Apr 72 (Secret)
j. Parametric Analysis of Man Portable Weapon Systems, RAC-TP-282, Jan 68 (Secret)
k. Threat Considerations for the Army Small Arms Weapons Systems Study (SAWS), USACDC, Sept 66 (Secret)

2. DESCRIPTION OF PROBLEM

The protection of troops exposed to enemy small arms fire in a city requires improved weapons and detection equipment. The use of improved employment techniques and weapons systems should be explored.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. A project should be initiated to produce sets of operational requirements for new weapons for use in urban antisniper situations.

b. A review of TECOM test requirements should be undertaken to determine if present test procedures include consideration of the unique demands placed on weapons systems in urban combat.

c. Should b. above show a requirement, a study should be initiated to define the unique operational test and evaluation requirements and to design recommended procedures and the test facilities.

d. New weapons systems concepts under consideration by WECOM, ILC, AMCA and similar agencies should be explored for utility in urban combat.

e. Coordination with agencies in par. d. above should be made to insure that the requirements of urban combat are included in their criteria.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

The 332nd Infantry Battalion of the 301st Infantry Brigade is located at the airport some seven miles south of the city of Mombola. The Battalion is ordered to move out and is assigned the mission of the defense of the Government Center and to defend against the immediate threat of occupation of the buildings by the MLA. According to Battalion S-2 all buildings and open areas in the Government Center are exposed to fire from buildings occupied by the MLA adjacent to the Government Center. Since attack of the Government Center by the MLA is considered likely at anytime the Battalion is ordered to enter the Government Center and occupy the buildings without delay.

The 332nd Infantry Battalion exits the airport and travels on Highway 1 to the city of Mombola, entering the city from the south on Patrice Lomumba Road. When they reach the intersection of Patrice Lomumba Road and South Road they find the intersection blocked by the large piles of debris and trees from the recent FRM army attack on the MLA forces occupying the barracks located at the corner of South Road and East Avenue. The Battalion is forced to halt and almost immediately begins receiving light fire from the barracks. Additionally, the Battalion begins receiving inaccurate sniper fire from the native commercial area east of the Government Center. In order for the Battalion to reach its objective, the Government Center, it will be necessary to clear the route of approach and to move the debris and barriers.

b. Characteristics of the Area of Operations

Mombola is located in central Africa on a navigable river and at a key rail intersection. The city, capital of Momboland, is laid out in a square pattern (Figure 1). The Government Center, completed in 1938 is bordered on the west by a western commercial area with multi-story apartments, offices and banks. To the north is the old quarter with one story, high density, hut-type housing; to the east, the native commercial area of one story native craft "cottage industry" buildings and shops borders the Government Center. To the south, army barracks built by the British during their occupation line the center.

The center itself consists of the capital and four story buildings for police, army and interior departments set in a large parkland and grass area.

The buildings to the south and west are occupied by the insurgent MLA forces and while a number of dissidents are in the native areas, the main threat is estimated to be from the barracks and the 12 story apartment areas.

c. Description of Own Force

The U.S. 332nd Infantry Battalion, 301st Infantry Brigade is moving up Patrice Lomumba Road with an advance guard consisting of Alpha Company and the engineer detachment from the Brigade. The Battalion organization is shown in Figure 2.

d. Description of Enemy Forces

(1) The MLA organization is shown in Figure 3. The MLS force deployment and major equipment is listed below:

Location	MLS Unit	No. of Men	Equipment
Apartment & Radio Station	A Reg 1st Bn	500	5 Machine Guns - Cal.303 Bren (UK) 500 Rifles - Cal.303 Enfield (UK) 3 Company Radios (VHF FM)
Bank & Market	A Reg, HHC & 2nd Bn	600	500 Rifles, 5 Machine Guns Req. Hq. Radio (VHF FM)
Military Academy & Barracks	B Reg	1500	15 Machine Guns, 1500 Rifles, 3 Jeeps, 1 Reg Hq Radio, 12 Co. Radios

(2) Native dissidents armed with individual weapons occupy some of the shops in the native commercial area east of the Government Center and in some of the houses in the old quarter north of the Government Center.

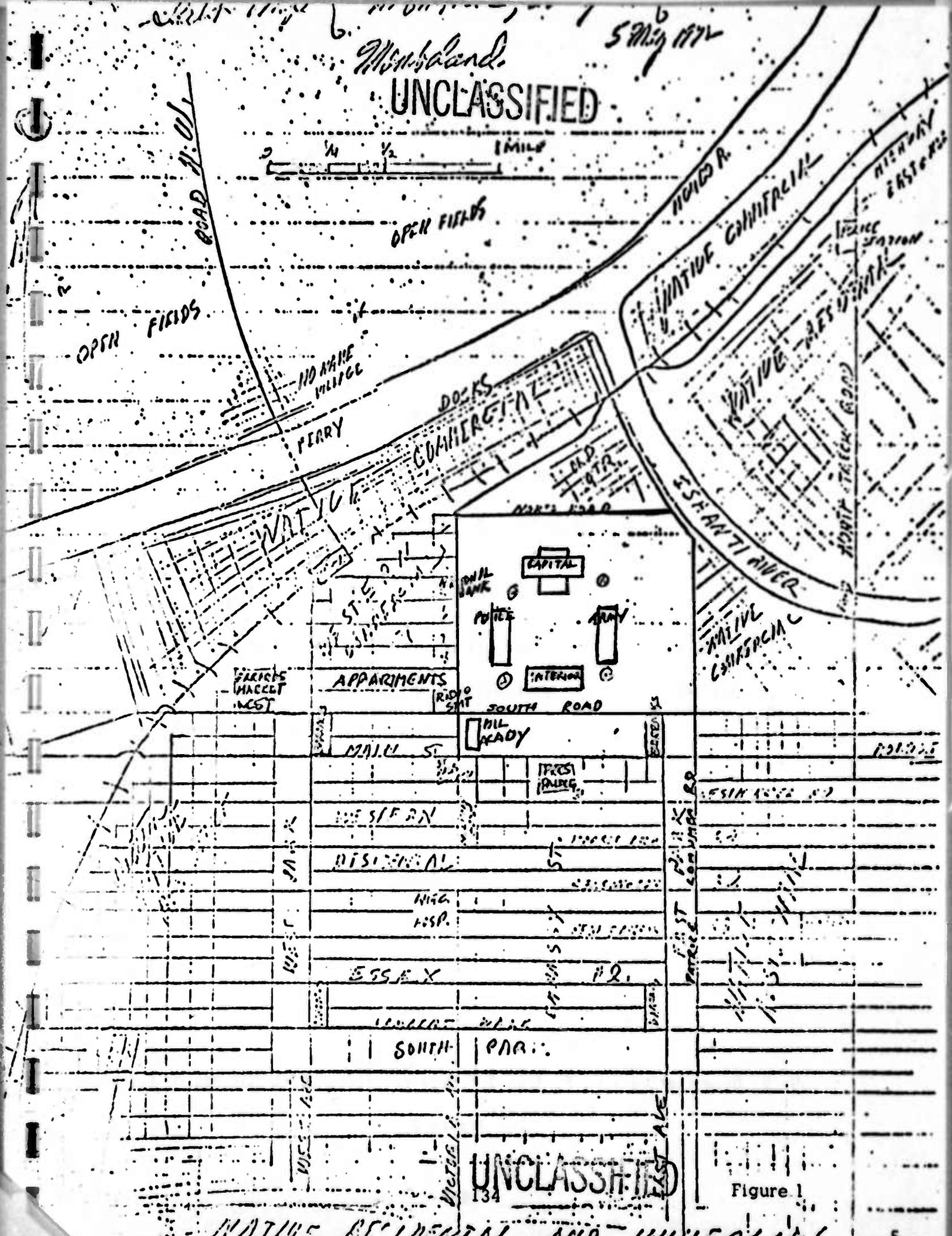
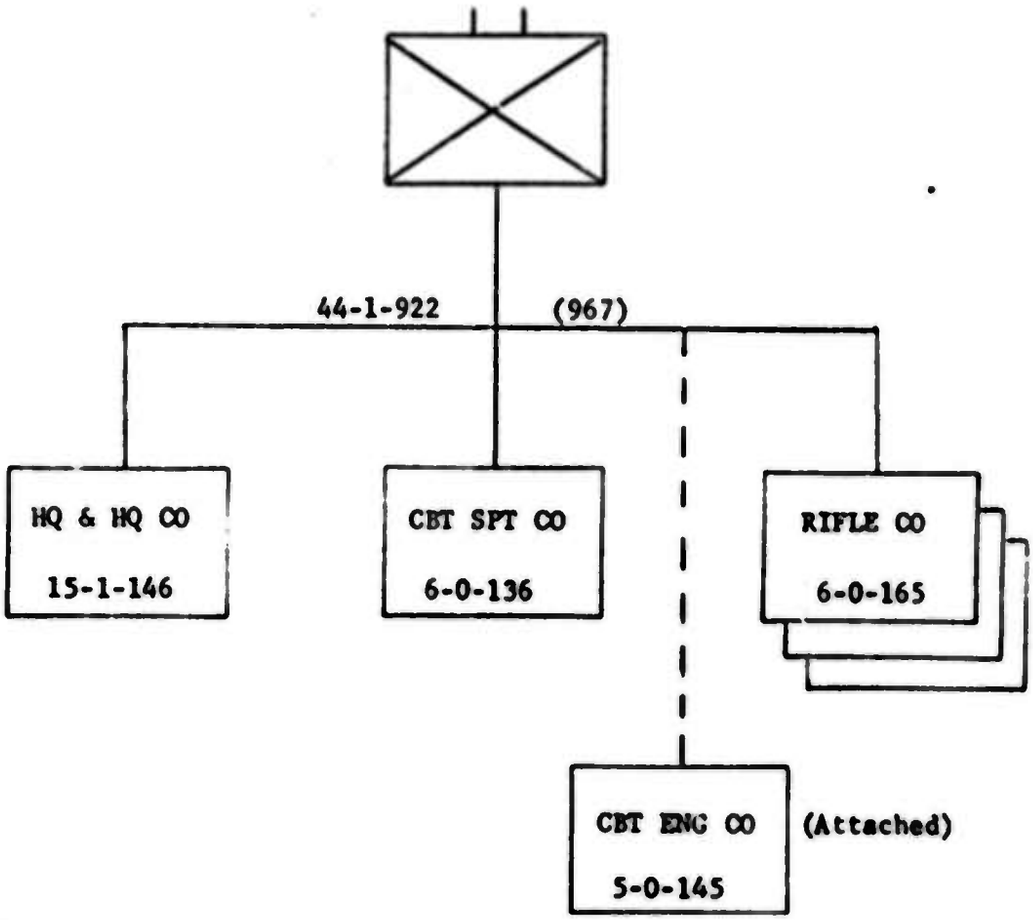
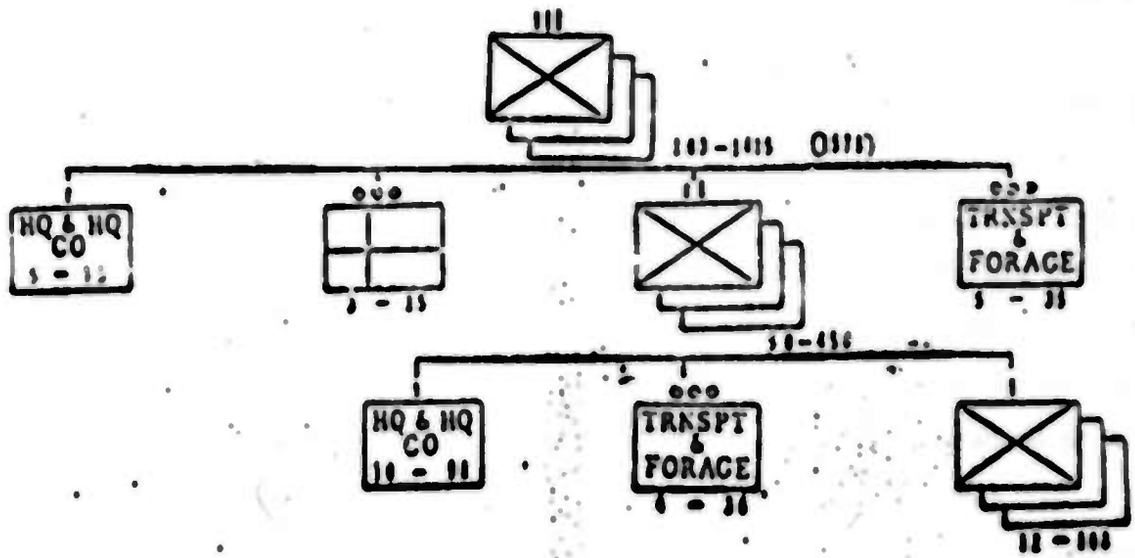

UNCLASSIFIED
1 MILE
OPEN FIELDS
OPEN FIELDS
ROAD
FERRY
DOCKS
COMMERCIAL
NATIVE COMMERCIAL
ESKANTI RIVER
CAPITAL
POLICE
ARMY
INTERIOR
APPARIMENTS
SOUTH ROAD
MAIN ST
SOUTH PARK
UNCLASSIFIED
NATIVE RESIDENTIAL AND COMMERCIAL

Figure 1



U. S. Organization - U. S. Army Infantry Battalion (With CBT ENG CO Attached)

Figure 2



ENEMY ORGANIZATION - MOMBOLA LIBERATION ARMY, REGIMENTS A, B, AND C

Figure 3

5. PROBLEM ANALYSIS

a. General

In this event, a U.S. Infantry Battalion, with a Combat Engineer Company attached, is employed in a Central African Environment. The battalion has been ordered to move out from their present location at the airport south of the city onto Highway 1, entering the city from the south. They will then proceed into the city and occupy the buildings in the Government Center.

Conducting infantry combat operations in built-up presents a number of serious problems. Buildings within built-up areas become battle areas because their locations control routes of movement or because they are key government or industrial installations. When an enemy chooses to defend a building in force, it may be preferable to destroy the building by artillery fire or air support rather than become engaged in the tedious and time consuming task of seizing it from him. However, if there are also civilian noncombatants in the building and/or in the general area and it is desirable to keep civilian casualties and collateral damage to a minimum, then there is no alternative but to launch an infantry attack against the building.

The standard Infantry tactics for attack combat actions must be modified to conform to the restrictions peculiar to urban warfare. Warfare in cities compresses the battle area in comparison to normal operations. Because of the restrictions on communications and observation, control is difficult and is normally decentralized. The decisions and initiative of small unit leaders assume added importance. Built-up areas offer excellent concealment and cover for both the attacker and defender. However, the defender has an important advantage in that the attacker must expose himself to move through the area. The defender can increase his advantage by selecting defensive positions which offer good fields of fire.

In this situation, the advance of the battalion through the city is halted as a result of large piles of debris and uprooted trees in the street blocking their way. The trees and debris must be removed before the battalion can proceed into the Government Center. The Combat Engineer Company is brought forward to remove the obstacle. While they are in the process of clearing the debris and uprooted trees, the engineers and the battalion come

under fire. They are receiving sniper fire from the native commercial district, and moderate small arms fire from the FRM forces occupying the Army barracks on the corner of South Road and East Avenue. Since it is imperative that they get to the Government Center as soon as possible, the snipers and the fire from the barracks must be suppressed. However, care must be exercised to keep both civilian non-combatant casualties and collateral damage to a minimum.

b. Description of Enemy Weapons

The enemy forces involved in this event are members of the B Regiment MLA which occupy the Army barracks and native dissidents who are firing from the native commercial center. The MLA forces in the barracks are armed with Enfield rifles and Bren light machine guns. The native dissidents are armed with Enfield rifles only. Characteristics of these weapons are in Appendix A, pages A-7, A-8.

c. Description and Comparison of U.S. Weapons

A detailed consideration of several aspects of U.S. weapon effects and operational characteristics are contained in Appendices A through D. An evaluated scoring of the principal U.S. weapons with respect to operational characteristics and weapons effects against various classes and conditions of targets appears in Appendix D. A summary evaluation of the weapons, based on Appendix D, follows.

M16A1 Rifle. The rifle is the primary individual infantry weapon and must be considered the most likely available weapon for employment against a wide range of targets. Operational probabilities of hit are relatively high for enduring, exposed personnel targets between the ranges of approximately 10M and 300M. Probability of incapacitation in these ranges is acceptable. At very near ranges (particularly in confined spaces), hit probabilities will be low due to the requirements of rapid firer reaction and large angular traverse of the weapon sight line to lay on randomly appearing targets. Rifle effectiveness is quite sensitive to target exposure time (See Appendix B); as a result, the rifle must be considered to have limited effectiveness against protected, fleeting targets such as snipers in buildings. The kinetic energies required to damage most vehicular targets exclude

the rifle as an effective weapon. The rifle does have limited potential to damage critical systems (fuel tanks, ignition, tires, etc.) of trucks and light wheeled vehicles. However, the driver of such vehicles generally offers a far better target.

M16A1(A) Rifle. In the automatic mode, the characteristics of the rifle are essentially identical to its characteristics in the semi-automatic mode. The higher density of projectiles per unit time in the target vicinity increases probability of hit; however, increased aim error due to recoil moderates the increase. Increase in effectiveness is limited to employment against enduring, exposed personnel targets. The increase against fleeting, protected targets is minimal.

M-60 Machine Gun. The M-60 machine gun is a highly effective weapon for delivery of aimed and area fire against personnel targets when reasonable fields of fire exist for the weapon. However, in the urban environment, considerable limitation of weapon employment may be expected. The weapon is bipod mounted weapon, not suitable for hand-held firing. This characteristic can be expected to restrict the effective use at short ranges due to the relatively limited traverse on the mount and the increased aim error induced by rapid, wide-angle traverse. Further, the weapon has a maximum angle of elevation of approximately 30°. For short ranges (the rear sight lowered) physical restrictions on the gunner are likely to reduce the maximum elevation (for purposes of aimed fire) to about 15°. Penetrability of the M-60 round is good for light material targets including light structures, trucks and light wheeled vehicles.

M-203 Grenade Launcher. The M-203 grenade launcher is a 40mm grenade launching attachment for the M16A1 rifle. It is a single shot, breech loading mechanism that attaches to the fore-end of the rifle; it has separate trigger and sighting mechanisms. The round has a relatively high trajectory angle and considerable inaccuracy can be induced by range estimation error; however, the weapon is relatively

effective in placing rounds through aperatures (windows, etc.) at ranges below 50M. The standard round is the 40mm fragmenting grenade round; smoke and CS rounds are also available. Lethal effectiveness characteristics for the fragmenting round are given in Appendix C.

M67 90mm Recoilless Rifle. The 90mm Recoilless Rifle is a light-weight portable weapon designed to be fired from either the ground or the shoulder against armored vehicles and tanks. The weapon is designed for direct firing only. The weapon has excellent penetrability against light and moderately strong structures and may be employed for wall breeching against these targets. The basic characteristics of the weapon -- tube length, round size (lethality) and backblast -- preclude its use in enclosed spaces. Weapon characteristics are included in Appendix A; accuracy is considered in Appendix B.

M29 81mm Mortar. The 81mm Mortar is a smooth-bore, muzzle-loading weapon with a high angle of fire. Basic weapon characteristics are given in Appendix A. The weapon is essentially an area fire weapon with a minimum range of 100M.

d. Analysis of Weapon System/Trade-offs

Protection of the Engineer unit requires rapid reaction to suppress snipers; since speed of barrier removal and passage through the area -- rather than building clearing -- is the essential requirement, temporary, effective suppression of the snipers is sufficient. Further, the two distinct positions of location of snipers sets different constraints on the available techniques of suppression.

In the native commercial area it must be assumed that civilian native personnel may be located in the same room or building area as snipers. A normal method of suppressing snipers would be the application of high volume, unaimed small arms fire on the local building face areas where snipers are suspected. However, it is assumed that the buildings are of relatively light structure which can be penetrated by small arms rounds. Native noncombatant personnel within the buildings would suffer casualties from high volume (relatively) indiscriminate fire.

Conversely, suppression of the snipers in the Army Barracks imposes no problems with respect to civilian casualties. High volume small arms fire across the face of the building should prove effective.

The restraints imposed by the presence of civilian personnel in the native commercial area effectively preclude the use of fragmenting rounds placed through windows. CS rounds are available for the M203 Grenade Launcher; however, it is doubtful that such rounds would be immediately included in the Battalion issue, or available for rapid reaction against snipers. If such rounds were available they could be highly effective. Their effectiveness would depend upon local conditions of wind and their potential to seriously impede the Engineer unit. Despite disadvantages, CS rounds represent the only present weapon capable of suppressing a sniper located in a confined space while limiting its effect on bystanders to temporary discomfort.

The disadvantages of CS rounds can be minimized by accurate placement of CS grenades through windows. The M203 grenade launcher will be relatively ineffective in placement of rounds through windows at ranges beyond 50M to 60M. However, below this range probability of placement of a round through a window is relatively high (see Appendix B).

If CS grenades are not available, the only real alternative against snipers in the native commercial area is accurate counter-sniper fire to keep civilian casualties to a minimum. This cannot be expected to be particularly effective. The only weapon applicable to this type of fire is the M16A1. It has excellent accuracy characteristics at the expected ranges, however, the difficulty of target acquisition will seriously degrade the effectiveness of the weapon. In Appendix B, Figures B-3, B-4, and B-5 show the probability of target acquisition. As soon as any amount of counter-sniper fire is delivered, average fraction of time in view and average up-time of a sniper will be low. The sniper needs only 3-5 seconds aim time to achieve accurate fire on the Engineer unit. With this up-time and an average in-view time of 0.5 seconds, the probability of target availability is only 0.25. If the sniper becomes cautious and reduces his average in-view time to 0.25 seconds, the probability of target acquisition (U.S. Force countersniper) becomes about 0.12.

It is clear that, if the snipers are aggressive, they can maintain fire on the Engineer unit with a relatively low probability of being hit; i.e. against an aggressive sniper, counter-sniper fire will be ineffective.

The combined elements of target acquisition difficulty and weapon restrictions to avoid civilian casualties poses difficult problems for which no immediately available concept of operations or weapon system offers an improvement (other than assuring availability of CS rounds).

This particular firepower event is a primary example of a unique urban combat situation for which current weapons are wholly inadequate. The problem requires the investigation and potential development of entirely new weapons concepts which embody the antagonistic features of highly selective lethality under stringent aiming requirements or general nonlethal suppression of a portion of a building. This latter requirement might engender such concepts as a sealing foam over a window area or a highly porous expanding foam within a room.

6. RESULTS OF ANALYSIS

This event has been constructed to reflect what may be considered a unique and difficult problem associated with combat in an urban environment. Based on analysis of the event, it appears that (1) temporary, effective suppression of snipers when there is no concern for collateral civilian casualties is well with present firepower capabilities; but, (2) restrictions imposed because of care for civilian casualties negate the effectiveness of all present weapons (except CS).

The near-term weapons systems or revised operational techniques portend no improvement for this type of situation; it is an area which requires heavy innovation in new equipment or weapon concepts.

7. ALTERNATIVE RESPONSES

a. Undertake an investigation and review of all current research in nonlethal weaponry to identify potentially useful techniques which could be applied to this problem.

b. Sponsor a study to specify the operational parameters of this type of urban combat event and derive from those parameters a specification of operational requirements to induce creative weapon/equipment research.

ANNEX

A

SUMMARY OF WEAPONS CHARACTERISTICS

WEAPON/AMMUNITION CHARACTERISTICS

U.S. RIFLES AND AUTOMATIC RIFLES (A)

Weapon Characteristics	M16A1	M16A1
Weight, empty (lb.)	6.9	6.9
Weight, loaded (lb.)	7.6	7.6
Mode of fire	Semi	Auto
Caliber (mm.)	5.56	5.56
Fire Rate, Aimed (rd/sec)	0.5	1.0
Fire Rate, Unaimed (rd/sec)	1.0	2.0
Max. Effective Range (m)	460	460
Minimum Range (m)	0	0
Ammunition Characteristics		
Projectile Weight (gr)	55	55
Round Weight (gr)	176	176
Magazine Capacity (rd)	20	20
Weight Loaded (lb)	0.7	0.7
Muzzle Velocity (fps)	3250	3250
Impulse (lb-sec)	1.25	1.25

WEAPON/AMMUNITION CHARACTERISTICS

M203 GRENADE LAUNCHER

Weapon Characteristics	
Weight, empty (lb)	2.4
Weight, loaded (lb)	2.9
Mode of fire	Single
Caliber (mm)	40
Fire Rate, Aimed (rd/sec)	0.047
Fire Rate, Unaimed (rd/sec)	0.083
Max. Effective Range	400
Minimum Range (m)	30
Ammunition Characteristics	
Basic Load (rds)	6
Types	HE, CS
Projectile Weight (gr)	2625
Round Weight	--
Magazine Capacity	--
Muzzle Velocity (fps)	250
Impulse (lb-sec)	3.5

WEAPON/AMMUNITION CHARACTERISTICS
M60 MACHINE GUN

Weapon Characteristics	
Weight, Empty (lb)	24.1
Weight, Loaded (lb)	32.3
Mode of Fire	Auto
Caliber (mm)	7.62
Fire Rate, Aimed (rd/sec)	2.0
Fire Rate, Unaimed (rd/sec)	4.0
Max. Effective Range (m)	1100
Minimum Range (m)	0
Ammunition Characteristics	
Projectile Weight (gr)	149
Round Weight (gr)	379
Belt Capacity (rd)	100
Weight, Loaded (lb)	7.8
Muzzle Velocity (fps)	2800
Impulse (lb-sec)	2.6

WEAPON/AMMUNITION CHARACTERISTICS

90mm RECOILLESS RIFLE M67

Weapon Characteristics	
Weight, Unloaded (lb)	35
Mode of Fire	Single
Caliber (mm)	90
Fire Rate (rds/min)	
Maximum	6
Practical	1
Maximum Effective Range (m)	
Armor	450
Other Targets	800
Minimum Effective Range (m)	50

Ammunition Characteristics	
Round Weight (lb)	9.25
Round types	HEAT
Muzzle Velocity (fps)	700
Basic Load (rds)	5

WEAPON/AMMUNITION CHARACTERISTICS

81mm MORTAR M29

Weapon Characteristics	
Weight, Firing Position (lb)	107
Mode of Fire	Single (drop fire)
Caliber (mm)	81
Fire Rate (rds/min)	
Maximum	12
Practical	3
Max. Effective Range (m)	3600
Minimum Effective Range (m)	100
Ammunition Characteristics	
Basic Load (rds)	80
Round Weight (lb)	9
Round Types	HE, illum, smoke
Muzzle Velocity (fps)	235

WEAPON/AMMUNITION CHARACTERISTICS

M1917 ENFIELD RIFLE

Weapon Characteristics

Weight Empty (lb)	9.5
Weight Loaded (lb)	10.1
Mode of Fire	Bolt Action
Caliber (in)	.303
Fire Rate, Aimed (rds/sec)	0.25
Fire Rate, Unaimed (rds/sec)	0.75
Max. Effective Range (m)	400
Minimum Range (m)	0

Ammunition Characteristics

Projectile Weight (gr)	174
Round Weight (gr)	398
Magazine Capacity (rds)	5
Weight Loaded (lb)	.51
Muzzle Velocity (fps)	2440

WEAPON/AMMUNITION CHARACTERISTICS

BREN LIGHT MACHINE GUN MARK II

Weapon Characteristics

Weight, Empty (lb)	23
Weight, Loaded (lb)	25.5
Mode of Fire	Semi Auto/Auto
Caliber (in)	.303
Fire Rate, Aimed (rds/sec)	1
Fire Rate, Unaimed (rds/sec)	3
Max. Effective Range (m)	1000
Minimum Range (m)	0

Ammunition Characteristics

Projectile Weight (gr)	174
Round Weight (gr)	398
Magazine Capacity (rds)	30
Weight Loaded (lb)	2.5
Muzzle Velocity (fps)	2440

ANNEX

B

AIMING ACCURACY AND TARGET ACQUISITION

Annex B

AIMING ACCURACY AND TARGET ACQUSITION

This appendix contains information pertaining to several aspects of aiming and accuracy of current U.S. weapons when employed in the urban environment. For rifles, aim error as a function of target exposure time is essentially the controlling factor in accuracy. Figures B-1 and B-2 give experimental data results (SAWS) on aim error vs. range and target exposure time. In general, it can be estimated that the ranges of primary interest in the urban environment are less than 100M. However, no known data exists on likely target exposure time in the urban environment. It was suspected that such exposure times might be quite low; therefore, an analytical (parametric) investigation of the problem of a personnel target in a covered position (e.g., the sniper) was conducted. The results appear in Figures B-3 through B-5.

In Figures B-3 through B-5, the "Average Time Between Pop-ups" is the cycle time of the target. A cycle is composed of some mean up (visible/-exposed) time with exponential distribution plus some mean down (covered) time with exponential distribution. The term F_v expresses the fraction of mean up time compared with average cycle time. The resulting curves express the probability of a firer finding a target visible when he looks and having the target available for x-seconds if visible.

Comparing the conditions of Figures B-3 through B-5 with those of Figures B-1 and B-2, it can be seen that the expected accuracy of rifle fire against sniper-like targets is quite low.

Additional investigation (reference f) compared accuracy of the 40mm grenade launcher and 90mm recoilless rifle in firing fragmentation rounds into a window. The grenade launcher was effective within 50 meters and the recoilless rifle within 150 meters.

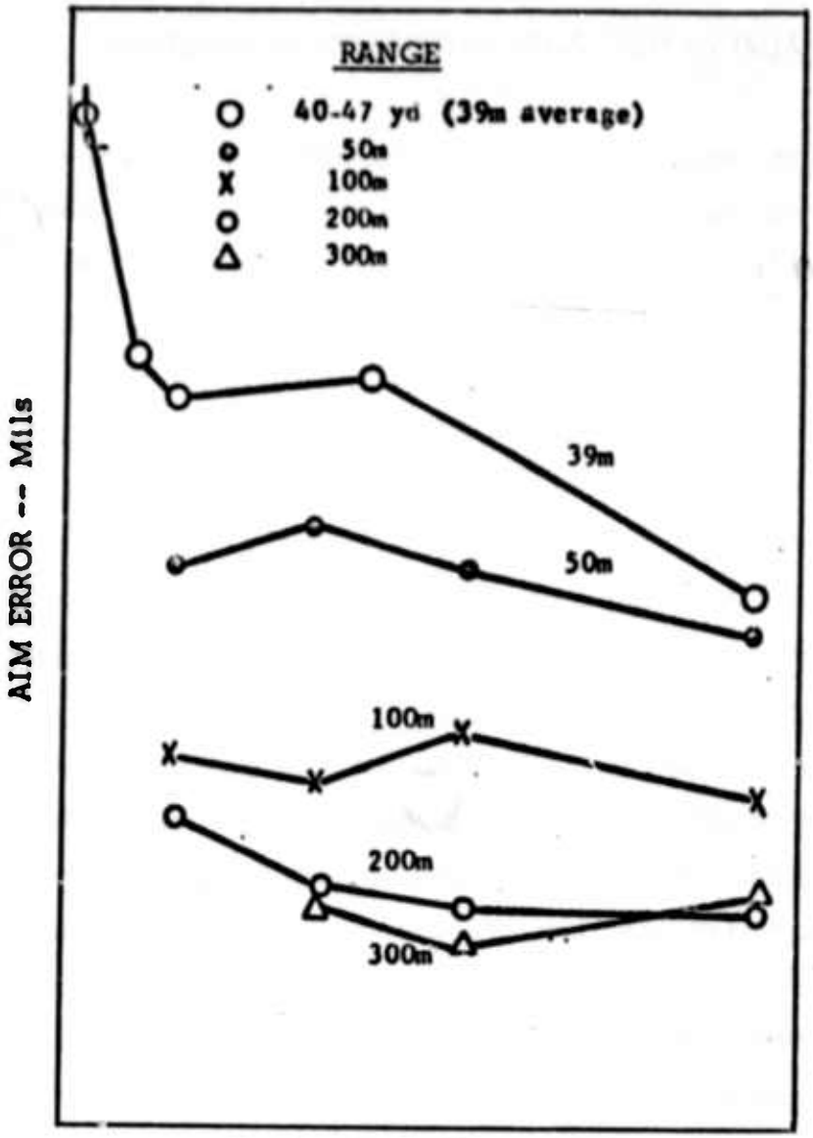


Figure B-1

ACCURACY AS A FUNCTION OF RANGE AND EXPOSURE TIME

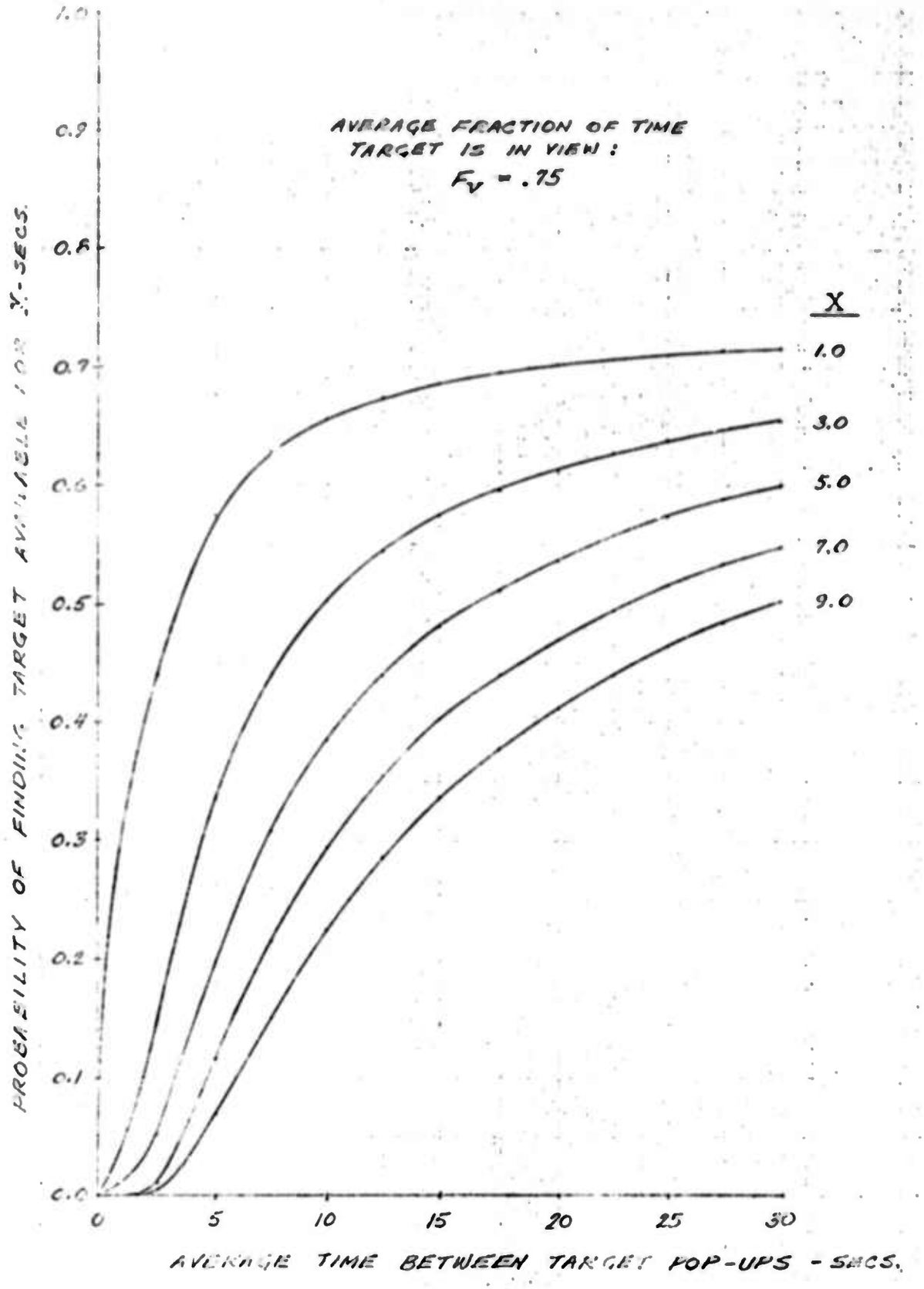


Figure B-3

PROBABILITY OF TARGET AVAILABILITY

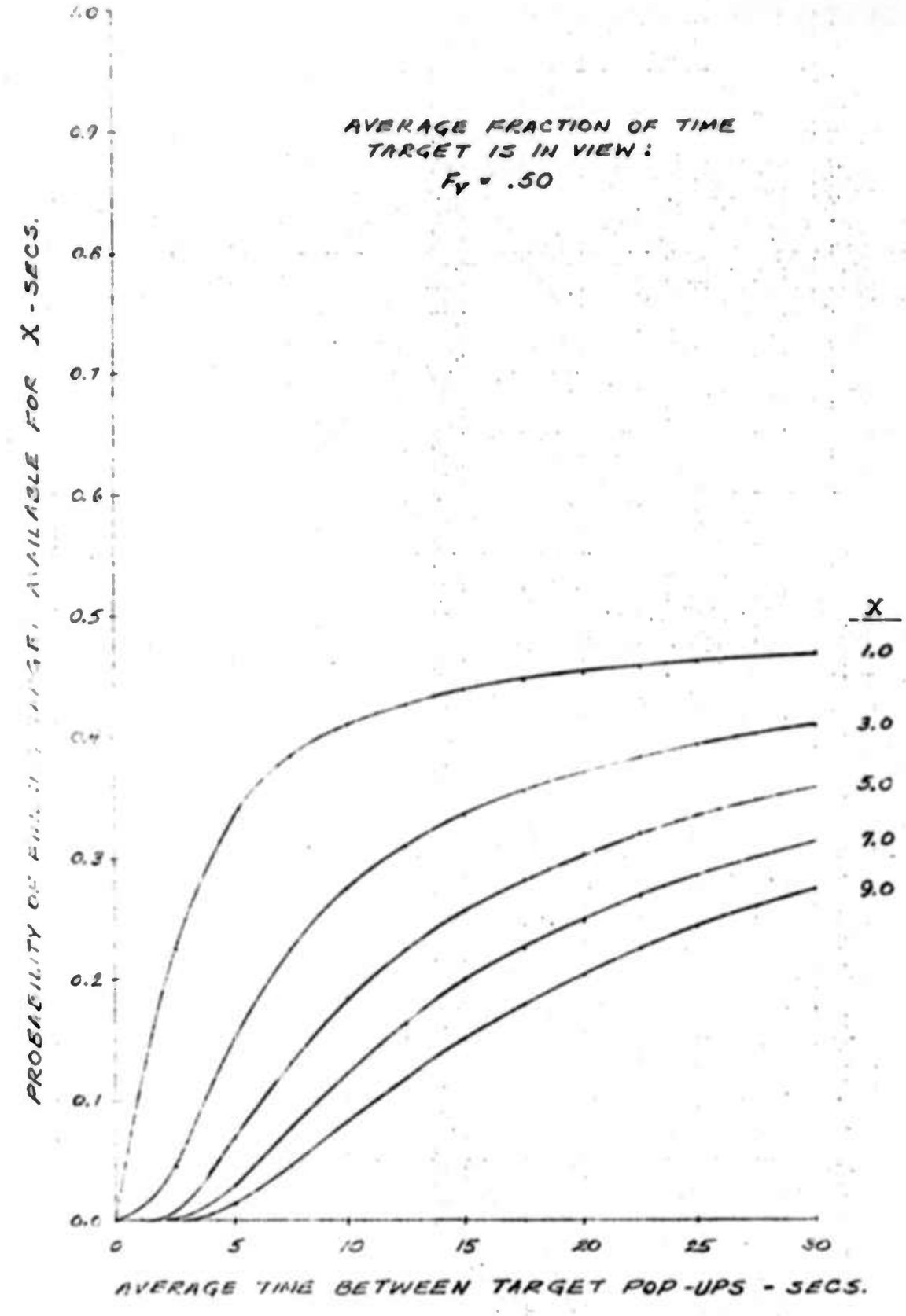


Figure B-4

PROBABILITY OF TARGET AVAILABILITY

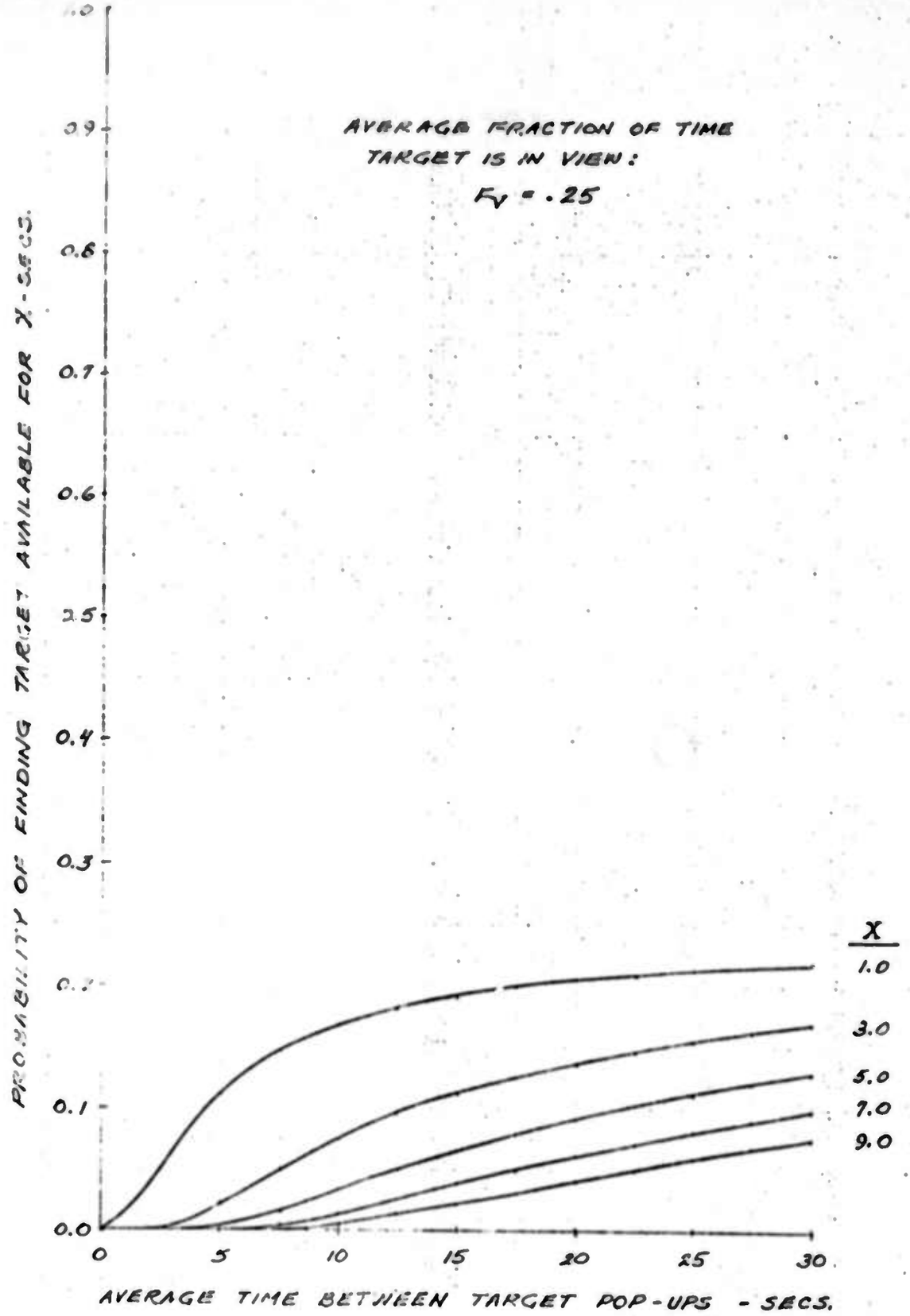


Figure B-5

PROBABILITY OF TARGET AVAILABILITY

ANNEX

C

GRENADE LETHALITY

Annex C

GRENADE LETHALITY

A means of increasing the effectiveness of grenade systems is the use of a VT fuse which produces a standoff or air burst. One source estimates that the lethality (lethal area) increases by a factor of three relative to the present ground burst 40mm grenade having a PD fuse. However, this magnitude of increase appears to be obtainable only under the most favorable circumstances.

The magnitude of increase is greatest against prone troops with a lesser factor obtained against standing troops. One source has estimated that a 40mm grenade burst at optimum height would increase lethal area by a factor of 2.25 for prone troops and by a factor of 1.50 for standing troops. This result was inferred by analogy with experimental results of larger caliber fragmenting munitions.

A more definitive comparison of ground burst versus air burst for grenade lethality is in reference f.

ANNEX

D

EVALUATION RATING OF U.S. WEAPONS

Annex D

EVALUATION RATING OF U.S. WEAPONS

The ratings presented in Figure D-1 represent a numerical scaling of the analysts' evaluation of available data, and on the analysts' knowledge of the analytical sensitivities of the weapons to aim error, target exposure, lethal effects, etc. Key elements of information leading to the rankings are contained in Appendices A through C.

In the figure, Unprotected Personnel Targets are generally equivalent to soldiers in the open. Protected Personnel Targets are those within the indicated structure. The terms Interior and Exterior refer to the firer location. For example: Protected -- Masonry/Adobe Structure, Interior refers to a personnel target and firer (with the designated weapons) both located within a masonry, adobe structure affording excellent cover for the target. Similarly, Protected -- Masonry/Adobe Structure, Exterior refers to a personnel target utilizing the masonry/adobe cover near an apperture with the firer located outside the structure.

The ranges selected were indicated by (1) the generally short range expected in urban combat and (2) the minimum safe ranges of the M203 grenade (30M) and the 81mm Mortar (100M).

The definitions for the evaluation ratings used are:

Operational Characteristics

0 - Operationally proscribed - conditions are outside prescribed range or safety limits

1 - Severely limited - conditions severely limit physical manipulation, weapon maneuver/set-up, or traverse (field of fire)

2 - Limited - basic weapon capability limited by aiming/laying/reaction time, low ammo supply

3 - Marginal - inherent difficulties in target acquisition, range estimation

4 - Adequate - generally effective in all characteristics; no particular degrading characteristics

5 - Highly effective - one or more outstanding characteristics; no siginificant degrading characteristics

Weapons Effects

0 - Ineffective	- no significant target effects; below kill/-damage threshold
1 - Excessive	- excessive warhead for target; "overkill"; or, unwarranted collateral damage
2 - Limited	- low probability of kill/damage on only selected areas of target
3 - Marginal	- low kill/damage effects; or, acceptable kill/damage with undesirable target discrimination
4 - Adequate	- generally effective kill/damage function and reasonable discrimination; no particular degrading effects
5 - Highly effective	- one or more outstanding effects with no significant degrading effects

Range

Close	-	less than 30M
Near	-	between 30M and 100M
Mid-Long	-	greater than 100M

Tgt.	Target Condition		Range	M16A1		M16A1 (A)		M-60		M203		90mm RR		H.Gr.		81mm Mort.	
				OC	WE	OC	WE	OC	WE	OC	WE	OC	WE	OC	WE	OC	WE
Personnel Targets	Unprotected		Close	3	4	3	4	1	4	0	0	0	0	4	4	0	0
			Near	4	4	4	4	4	5	3	4	5	1	3	4	0	0
			Mid-Long	4	4	4	4	4	5	3	4	5	1	0	0	4	5
	Protected -- light wood structure	Interior	Close	2	4	3	4	1	4	0	0	0	0	4	4	0	0
		Exterior	Close	3	3	3	4	1	4	0	0	0	0	4	4	0	0
			Near	4	3	4	3	4	5	4	4	5	1	3	4	0	0
			Mid-Long	4	3	4	3	4	5	4	4	5	1	0	0	0	0
	Protected -- masonry/adobe structure	Interior	Close	2	4	3	4	1	4	0	0	0	0	4	4	0	0
		Exterior	Close	3	2	3	2	1	3	0	0	0	0	4	4	0	0
			Near	3	2	3	2	4	3	4	4	5	1	3	4	0	0
			Mid-Long	3	2	3	2	4	3	3	4	5	1	0	0	0	0
	Protected -- reinforced concrete structure	Interior	Close	2	4	3	4	1	4	0	0	0	0	4	4	0	0
		Exterior	Close	3	2	3	2	1	3	0	0	0	0	4	4	0	0
			Near	3	2	3	2	4	3	4	4	5	1	3	4	0	0
			Mid-Long	3	2	3	2	4	3	3	4	5	1	0	0	0	0
Vehicular Targets	Tanks		Close	0	0	0	0	0	0	0	0	1	4	0	0	0	0
			Near	0	0	0	0	0	0	0	0	4	4	0	0	0	0
			Mid-Long	0	0	0	0	0	0	0	0	4	4	0	0	0	0
	APC		Close	0	0	0	0	4	2	0	0	1	5	0	0	0	0
			Near	0	0	0	0	4	2	0	0	4	5	0	0	0	0
			Mid-Long	0	0	0	0	4	2	0	0	4	5	0	0	0	0
	Trucks		Close	3	2	4	2	4	3	3	2	1	5	0	0	0	0
			Near	3	2	4	2	4	3	3	2	4	5	1	2	0	0
			Mid-Long	3	2	4	2	4	3	3	2	4	5	0	0	4	5

TECHNICAL PROBLEM RESUME

Problem: Firepower 16	Date: 16 Oct 72	Sheet 2 of 10
Operational Area: MOMBOLA		
Title: Engage and Repel Attackers		

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para. 6.4.d.(6).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, Vol. II, Appendix C, Annex IV.
c. U.S. Infantry Reference Data, ST-7-157, FY 72, Page 169.
d. U.S. Army Special Forces Foreign Weapons Handbook, USAJFKCENSWAR (Abn) 1 Jan 67.
e. U.S. Army FM 31-50 Combat in Fortified and Built-Up Areas, Mar 64.

2. DESCRIPTION OF PROBLEM

Repelling assaults on government buildings by an armed enemy requires improved weapons and detection systems.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

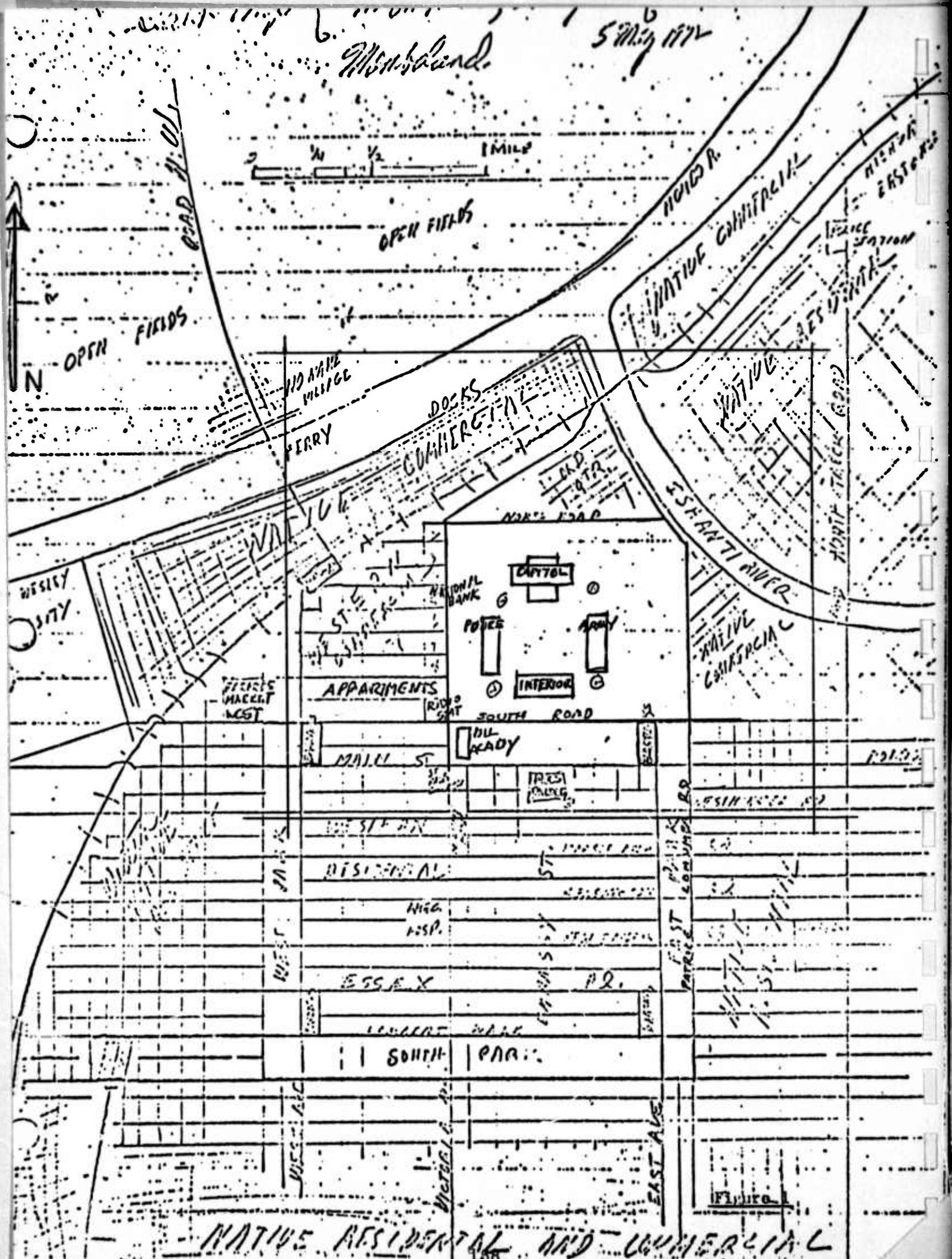
Analyze the operational effectiveness and technological feasibility of a short-medium range, high volume of fire shotgun or salvo type infantry weapon for city combat and other uses.

Analyze the coordination of illumination munitions for infantry weapons with night firing devices of the same weapons to prevent interference. This should be coordinated with the surveillance contractor.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

At 1900 hours, 17 May 1975, the 332nd Infantry Battalion of the 301st Infantry Brigade moves into the Government Center. The battalion occupies the army building in the center and provides for intensified external surveillance along the streets bordering the center: South Road, Victoria Avenue, North Road, and Patrice Lomumba Road.


Mainland
5 Mile Rd
1 MILE
OPEN FIELDS
OPEN FIELDS
N
NATIVE COMMERCIAL
NATIVE RESIDENTIAL
NATIVE COMMERCIAL
DOCKS
COMMERCIAL
FERRY
WESLEY CITY
CAPITOL
NATIONAL BANK
POTTER
APPARTMENTS
INTERIOR
SOUTH ROAD
MAIN ST
ESSEX
SOUTH PARK
RESIDENTIAL
HIGH
HOSP.
POLICE STATION
SHANTI RIVER
EAST AVE
WEST AVE
Figure 1
NATIVE RESIDENTIAL AND COMMERCIAL

The buildings are made of stone and reinforced concrete. The upper windows afford good coverage of the grounds but are deeply recessed, making it difficult to fire straight down without exposing the upper half of the body. Trees and shrubs restrict the view from the first floor.

The buildings to the south and west are occupied by the insurgent MLA forces and while a number of dissidents are in the native areas, the main threat is estimated to be from the barracks and the 12 story apartment areas.

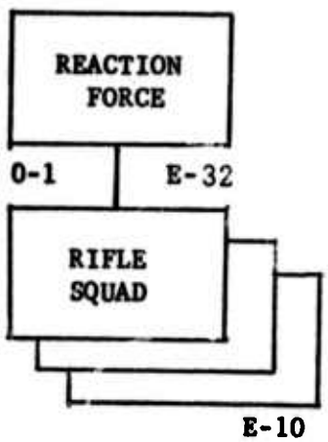
c. Description of Own Forces

(1) The U.S. 332nd Infantry Battalion, 301st Infantry Brigade occupies the Government Center and is deployed as follows:

- o A Company, along South Road.
- o B Company, along Victoria Avenue.
- o C Company, 1st Platoon along North Road, 2nd Platoon along Patrice Lomumba Road, and the 3rd Platoon is held in reserve.

The Battalion CP is located in the Army Building.

(2) The organization and weapons of the Reaction Force are listed below.



WEAPONS

27 Rifles (M-16)
6 Grenadiers (M203 GL)

d. Description of Enemy Forces

(1) The 50 man MLA force consists of a reinforced platoon armed with machine guns and rifles. This force has been hand picked by the commander of the A Regiment, MLA Army. The force has been thoroughly briefed on their mission. Their orders are to seize and occupy the Capitol Building and to establish positions on the first two floors. When this had been accomplished, the A Regiment MLA will then initiate an attack on the Center from the National Bank. The MLA force in the Capitol Building will support the attack by

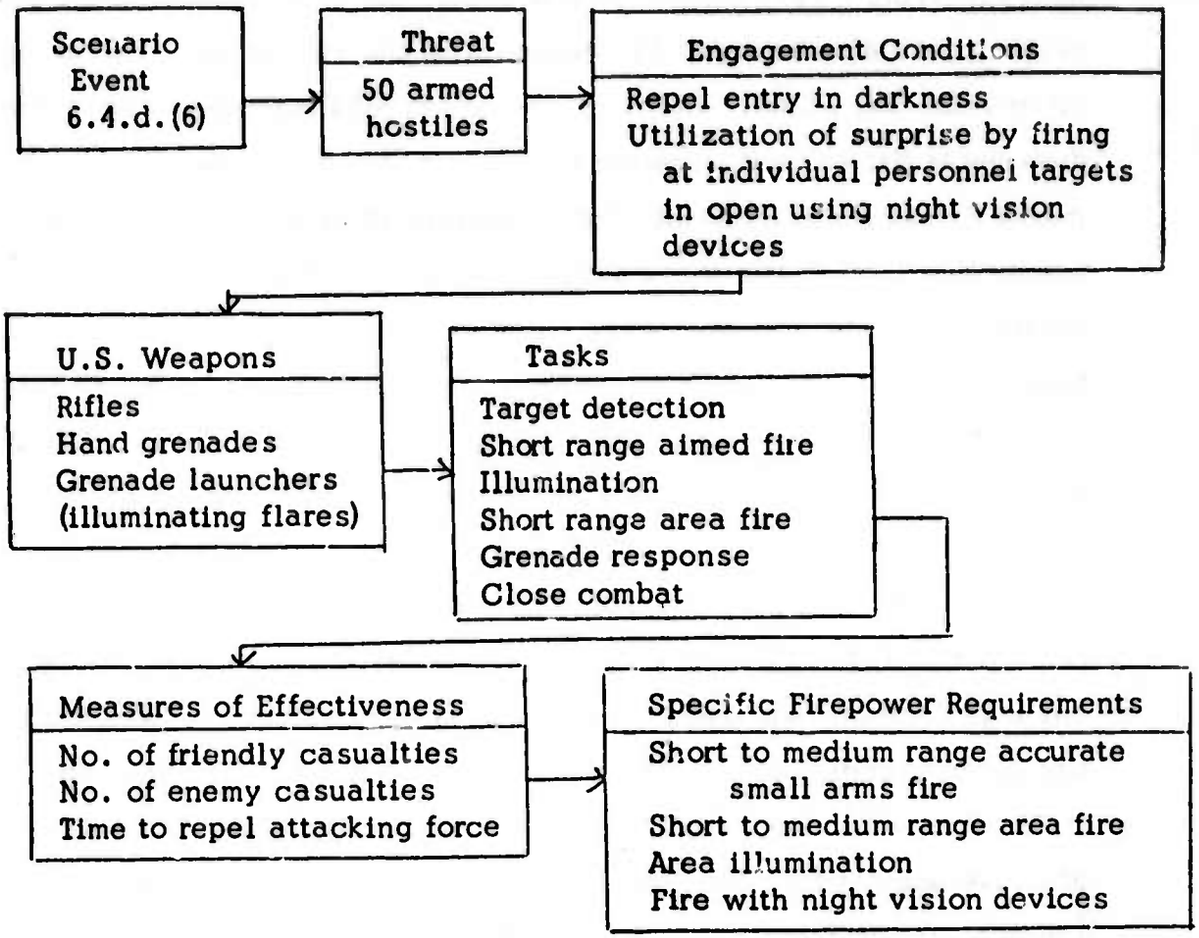
bringing fire to bear on the U.S. forces (Company B) defending the center along Victoria Avenue.

5. PROBLEM ANALYSIS

The three squad reaction force, under the command of a lieutenant, moved quickly to the Capitol Building. Upon arrival at the Capitol Building, the lieutenant deployed his force. Two grenadiers from the 1st squad armed with white star parachute rounds were placed under the command of the assistant squad leader, 1st squad. They were ordered to take up positions on the northeast corner of the Police Building and provide illumination of the area immediately west of the Capitol Building, on order of the reaction force commander. The remainder of the 1st squad and the 2nd squad were ordered to divide the first floor in half, with the 1st squad having responsibility for the main entrance. Two riflemen were ordered to cover the main entrance. The 3rd squad was ordered to occupy the 2nd floor. Each rifleman positioned himself at a window and remained silent and motionless. They were instructed to use the night vision devices provided to them and to open fire as soon as they saw the enemy. The reaction force commander further ordered that they were not to allow the enemy to close within hand grenade range before firing at him.

The situation is summarized in Figure 2 which shows the tasks that must be accomplished by the individual soldiers.

At approximately 100 meters from the main entrance, the MLA Maneuver force was detected by the 3rd squad on the 2nd floor and taken under fire. The MLA force suffered 5 casualties from this initial fire. The MLA unit acting as the covering force immediately opened fire - concentrating most of their fire on the 2nd floor. At the same time, the U.S. reaction force commander ordered the grenadiers to fire flares to provide illumination of the area where the MLA force was located. As the area became illuminated, the 1st and 2nd squad on the 1st floor opened fire. The MLA force continued to move forward under heavy fire. A force of 10 MLA soldiers ran into the main entrance of the building. They were immediately taken under fire by the two riflemen covering the main entrance and 4 were hit. The remainder of the MLA maneuver force was pinned down by



Firepower Event
Engage and Repel Attackers

Figure 2

the U.S. fire. They tried to assault the entrance, but were driven back after receiving 3 casualties. At this point, the MLA remnant in the main entrance was also engaged by riflemen from the 2nd squad. 3 more were hit and the last 3 fled. The remainder of the MLA maneuver force withdrew under fire to their covering force position. The entire force then moved across North Road into the old quarter of Mombola. While moving across North Road, the withdrawing MLA force suffered 2 more casualties. During the action, the MLA force suffered 25 casualties while the U.S. force received 11 casualties, while the 1st and 2nd squads on the 1st floor received 3 casualties each. The U.S. force was in an advantageous position in the building, but the men were required to expose themselves in order to fire at the attacking MLA force.

Although company and battalion mortars could also have been employed to support the reaction force, this action developed very quickly and it is doubtful that they could have been very effective. The mortars had not been registered in order to prevent civilian casualties. However, if the mortars had been registered in the area, they would have been effective against the MLA force, providing both illumination and firepower. The difficulty in registration in low-level city insurgency recurs in this study.

Rifle and hand grenades were effective as short to medium range area fire weapons. The MLA maneuver force took several casualties from hand grenade fragments, and the covering force suffered from the rifle grenades more than any other weapon. A small arms weapon system with good rapid fire capability and a shotgun or slavo round would complement the relatively slow firing M203 grenade launcher.

Another factor to be considered with the use of an improved small arms weapons system is the requirement for the development of compatible area illumination techniques. With an improvement in area illumination, and night sighting devices, the full benefits of the weapons system can be realized in night combat in built-up areas. Since there is sometimes a conflict between

illuminating technology and passive night vision surveillance technology, a study of both and their mutual interactions in the city environment might be warranted in conjunction with the surveillance contractor.

6. RESULTS OF ANALYSIS

The current doctrine applied in this situation accomplished the task with available weapons. Because of the conditions under which this action took place, night and at relatively close ranges, light casualties to the reaction force in the Capitol Building were to be expected. The defenders used area illumination and night aiming devices to locate targets. The high volume of covering fire from the MLA force was effective in partly suppressing defensive fire and caused casualties.

The development and use of small portable shields could reduce the defender's susceptibility to suppressing fire, allowing a greater volume of fire from the friendly dorces.

Infantry mortars (81 mm and 4.2") are especially valuable for illumination and for fire into open streets, parks, and plazas. They are difficult to register in a low intensity situation without alarming or actually hitting civilians and damaging buildings. Simple techniques for accurate fire without registration should be developed and practiced.

The compatibility between illuminating rounds and night vision devices to determine optimum user techniques could be fruitful. Optimum employment doctrine for these devices is heavily dependent on the numbers and types of items that are available. Use of special devices to aid one or two men at the expense of the balance of the squad can lead to a lower squad performance. The entire problem should be studied to develop sound user doctrine for various urban situations.

7. ALTERNATIVE RESPONSES

a. Develop small portable fire shields for quickly improving hasty defenses in buildings against fragments and small arms.

b. Develop simple techniques for registering mortars without firing. These should be adapted to city situations. They would allow quick and accurate mortar fire, illuminating or high explosive, without potentially dangerous registration fire.

TECHNICAL PROBLEM RESUME

Problem: Firepower 17	Date: 17 Oct 1972	Sheet 1 of 13
Operational Area: MOMBOLA		
Title: Conduct the Attack/Provide Security-Holding Force/Provide Transportation		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 17	Date: 17 Oct 1972	Sheet 2 of 13
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Title: Conduct the Attack/Provide Security -Holding Force/Provide Transportation		

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para. 6.4.e.(3).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, Vol. II, Appendix C, Annex IV.
c. U.S. Infantry References Data, ST-7-157, FY 72, Page 169
d. U.S. Army Special Forces Foreign Weapons Handbook, USAJFKCENSWAR (Abn) 1 Jan 67.
e. U.S. Army FM 31-50 Combat in Fortified and Built-Up Areas, Mar 64.
f. U.S. Army Infantry Center briefing for Ketron, Ft. Benning, Ga., Dec 72.

2. DESCRIPTION OF PROBLEM

An airmobile raid onto the roof of a highrise building is successful in freeing civilian prisoners, but comes under sniper fire from adjacent highrises during withdrawal.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

The armed helicopter should be evaluated specifically as a complete weapons system for use in city fighting. The study should compare armed helicopters quantitatively with fighter-bombers, tanks, and self-propelled artillery for this employment. It should be separate from studies of other roles for helicopters. The armed helicopter is no more related to the transport helicopter than the tank is to the 2 1/2 ton truck.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

During the fighting in Mombola, the B Regiment, Mombola Liberation Army (MLA) seized and occupied the National Bank and apartment buildings adjacent to the Western Commercial District. The apartment buildings were occupied by American and European families who are now being held prisoners of the MLA. The prisoners (approximately 120 men, women, and children), are being held on the upper floors of one of the apartment buildings. It is believed that the MLA will

kill the prisoners if they are not freed quickly. A conference with MAAG officials, whose families are among the prisoners, reveals that surprise cannot be achieved at the apartment buildings by a ground attack.

A helicopter flew along the western edge of the Government Center to attempt to find which building held the prisoners. The crew found that it was the tallest building in the area, a 16 story building midway between West Avenue and Victoria Avenue, between 8th Street and 9th Street. The helicopter crew could not tell how many of the upper floors were occupied by the prisoners, but did determine the following:

- The reinforced concrete roof is large enough to support two UH-1 helicopters landing simultaneously.
- There are no major obstacles to landing on the roof.
- There is an entrance to the stairwell from the roof to the floors below.
- There were no MLA forces observed on the roof.

Based on this information it was decided to land a rescue force on top of the building and remove the civilian prisoners by helicopter.

The plan for the rescue and evacuation of the families being held prisoner by the MLA is as follows:

The 334th Infantry Battalion, 301st Infantry Brigade provides the rescue force to evacuate the U.S. and European families.

The battalion is to advance from the Police Building and launch a ground attack against the MLA forces in the National Bank. The purpose of this attack is to draw the attention of the MLA forces away from the tops of the buildings.

If only light resistance is encountered, the battalion will seize and occupy the National Bank building. Additionally, one platoon (3 rifle squads only) of the battalion is assigned as the rescue force. The rescue force lands by helicopter on the roof of the apartment building housing the prisoners, evacuates the prisoners by helicopter, and then withdraws by helicopter.

The 334th Infantry Battalion attacks against the National Bank, and fifteen minutes later, the helicopters carrying the rescue force plus 4 escorting gunships, are airborne and headed towards the apartment building. The helicopters land on the roof of the apartment house, disembark the 3 squads and fly out of the area apparently unnoticed by the MLA forces in the adjacent area.

b. Characteristics of the Area of Operations

Mombola is located in central Africa on a navigable river and at a key rail intersection. The city, capital of Momboland, is laid out in a square pattern (Figure 1). The Government Center, completed in 1938 is bordered on the west by a western commercial area with multi-story apartments, offices and banks. To the north, is the old quarter with one story, high density, hut-type housing, to the east the native commercial area of one story native craft "cottage industry" buildings and shops border the Government Center. To the south, army barracks built by the British during their occupatcn line the Center.

The Center itself consists of the Capitol and four story buildings for police, army and interior departments set in a large parkland and grass area.

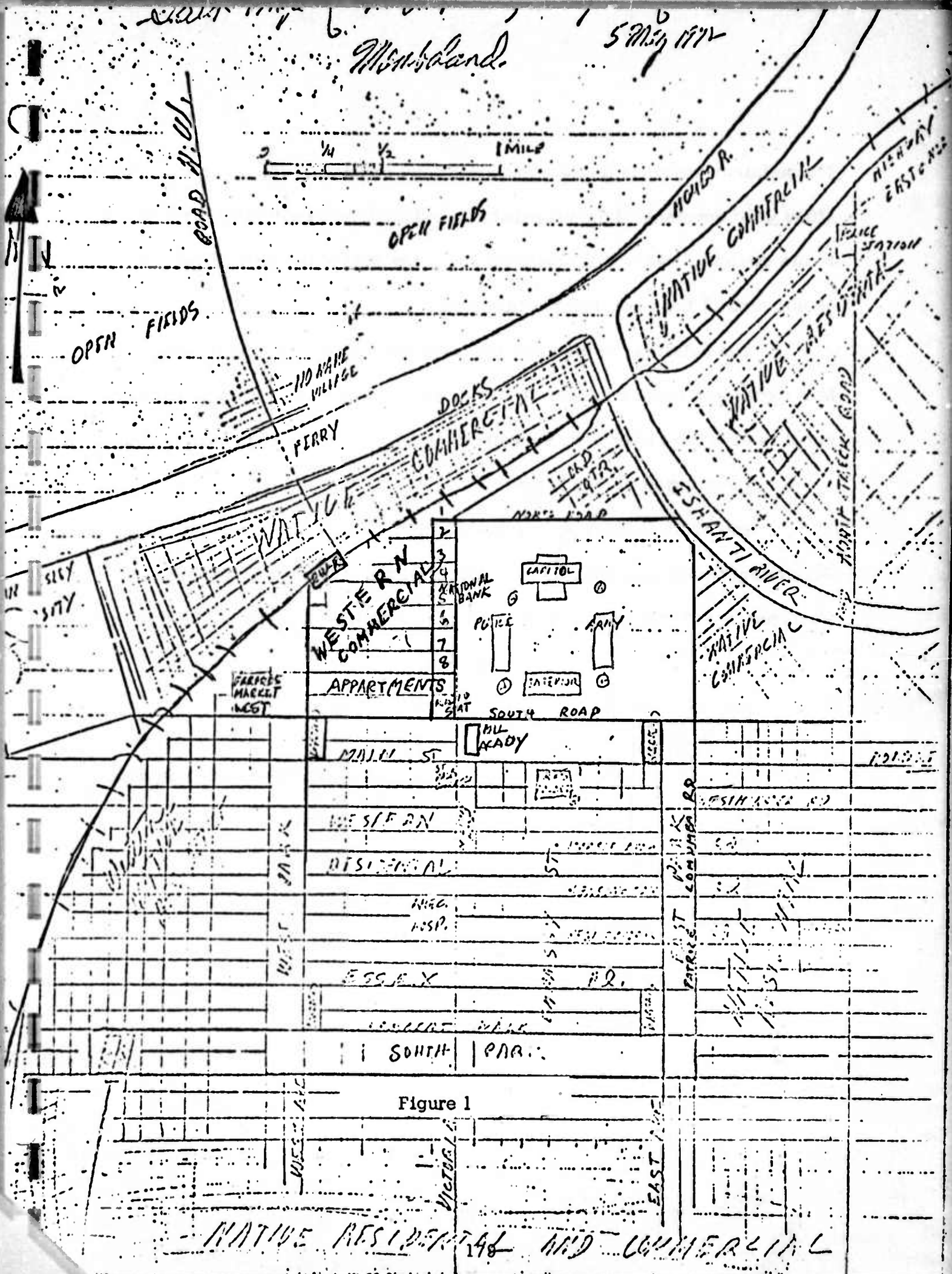

Woodland
1/4
1/2
1 MILE
OPEN FIELDS
NEW HAVEN R.
NATIVE COMMERCIAL
POLICE STATION
NATIVE RESIDENTIAL
OPEN FIELDS
NEW HAVEN VILLAGE
FERRY
DOCKS
COMMERCIAL
WATER
WESTERN COMMERCIAL
CAPITOL
NATIONAL BANK
POLICE
ARMY
EXCHANGE
APPARTMENTS
FARMERS MARKET WEST
SOUTH ROAD
HILL ACADY
MILL ST
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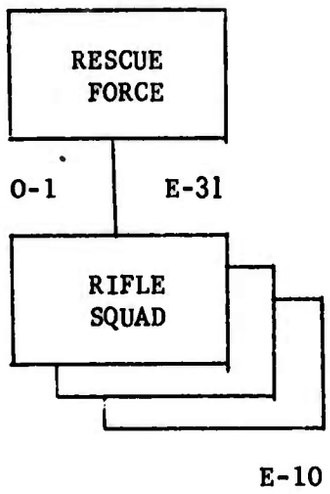
Figure 1

The buildings are made of stone and reinforced concrete. The upper windows afford good coverage of the grounds but are deeply recessed making it difficult to fire straight down without exposing the upper half of the body. Trees and shrubs restrict the view from the first floor.

The buildings to the south and west are occupied by the insurgent MLA forces and while a number of dissidents are in the native areas, the main threat is estimated to be from the barracks and the 12 story apartment areas.

c. Description of Own Forces

The 334th Infantry Battalion, 301st Infantry Brigade moved into the Government Center and established their CP at the Police Building. The organization and weapons of the rescue force from the battalion is listed below.



WEAPONS

26 Rifles (M-16)
6 Grenadiers (M-16/M203 grenade launcher)
Handgrenades

d. Description of Enemy Force

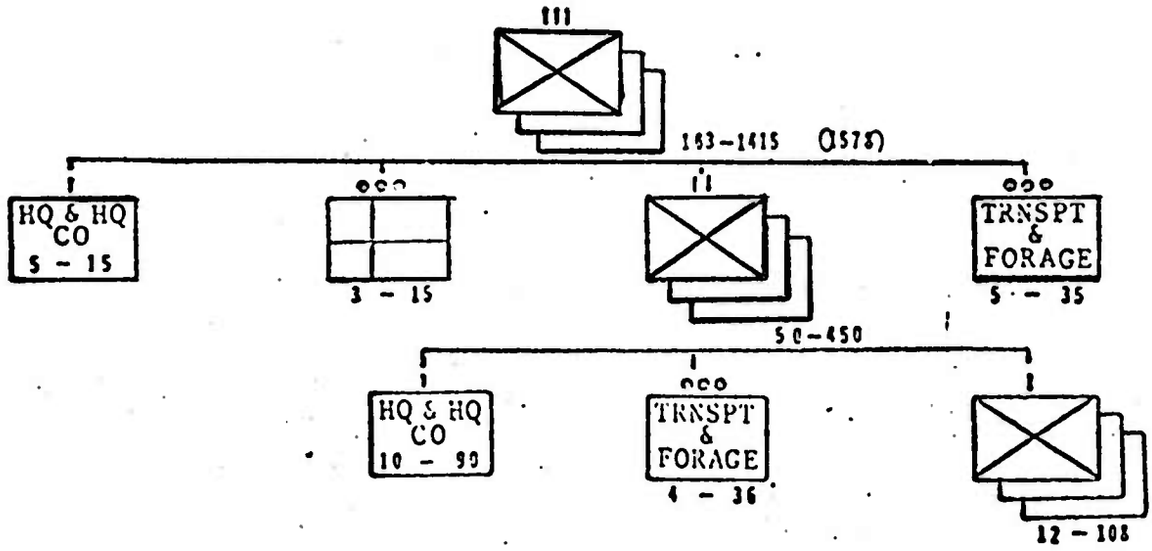
(1) The MLA force deployment in the area around the Government Center and their major equipment is listed below.

Location	MLA Unit	No. of Men	Equipment
Apartment & Radio Station	A Reg 1st Bn	500	5 Machine Guns - Cal 303 Bren (UK) 500 Rifles - Cal 303 Enfield (UK) 3 Company Radios (VHF FM)
Bank & Market	A Reg, HHC	600	500 Rifles, 5 Machine Guns Req Hq Radio (VHF FM)
Military	B Reg	1500	15 Machine Guns, 1500 Rifles, 3 Jeeps, 1 Reg Hq Radio, 12 Co. Radios

The organization of a typical Mombola Liberation Army (MLA) Regiment is shown in Figure 2.

(2) Native dissidents armed with individual weapons occupy some of the shops in the native commercial area east of the Government Center and in some of the houses in the old quarter north of the Government Center.

(3) The MLA force occupying the apartment building consists of the 1st Platoon, Alpha Company, 1st Battalion, A Regiment MLA. The force totals 30 men. The top 3 floors of the building, where the prisoners are being held, is being guarded by the 1st squad. There are two riflemen per floor. The squad leader and assistant squad leader are positioned on the 4th floor from the top. The 2nd squad and the platoon headquarters are located on the first floor of the building and have established positions from which to repel a ground attack on the building. The 3rd squad is kept in reserve and rotates periodically with

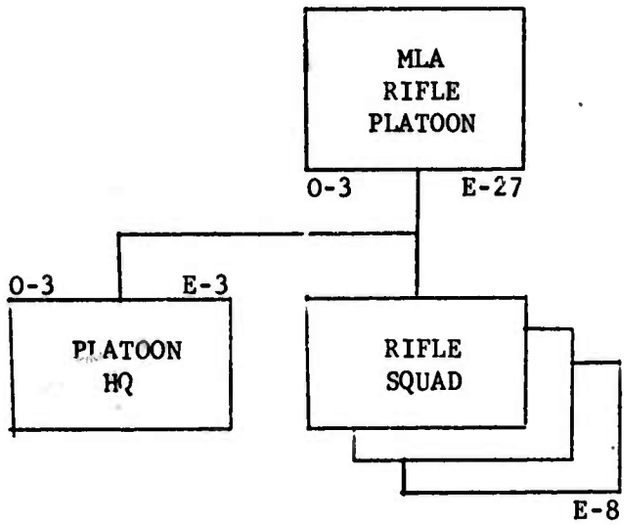


Enemy Organization

Mombola Liberation Army, Regiments A, B, and C

Figure 2

the 1st squad in guarding the prisoners. The organization and weapons of the MLA force are shown below:



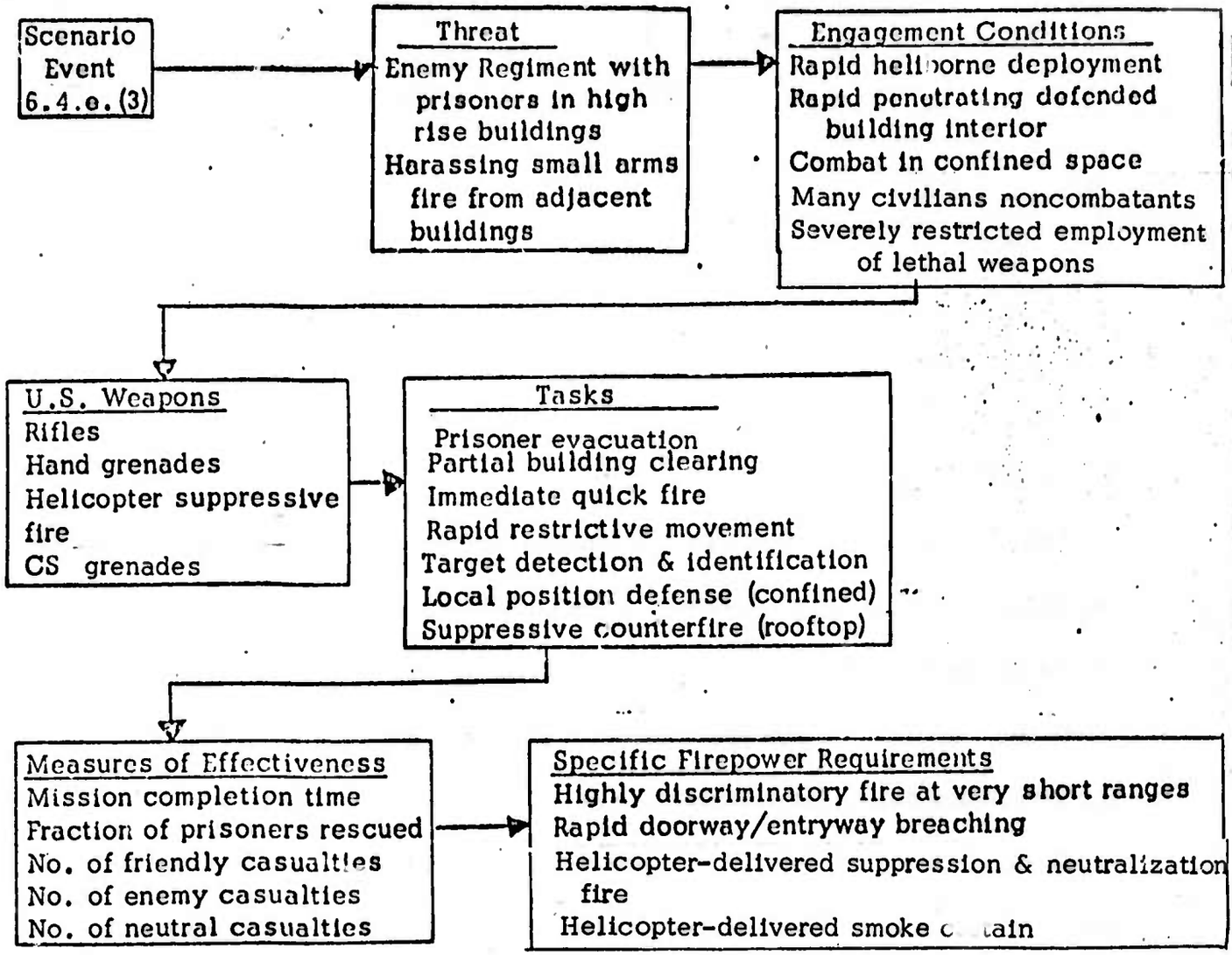
WEAPONS

27 Rifles - Cal.303 Lee Enfield (UK)
3 Pistols - Cal. 455 Webley SL (UK)

5. PROBLEM ANALYSIS

The situation and tasks are summarized in Figure 3. The 1st and 2nd squads disembark from the helicopters and move quickly towards the doorway leading to the stairwell. Although the door is locked, they force the lock and proceed down the stairwell. When they reach the door to the top floor, a fire team from the 2nd squad enters the corridor and immediately engages the two MLA soldiers. Although the two MLA soldiers manage to wound one U.S. soldier, they are both wounded and captured. Meanwhile, the other fire team of the 2nd squad moves down to the next floor and enters the corridor. There is a brief firefight with the MLA guards; both guards are killed without neutral or friendly casualties.

The 1st squad moves down to the next floor and engages the MLA guards and also the MLA squad leader and assistant squad leader who are moving up the stairwell. Again there is a brief firefight with a heavy concentration of



FIREPOWER EVENT

Conduct the Attack/Provide Security

Figure 3

fire, all at extremely short ranges. One U.S. soldier is killed and one wounded; all the remaining MLA soldiers are killed. The 1st squad then reorganizes, moves their casualties up to the roof, and establishes a defensive position on the next floor down (4th from the roof) where they cover the stairwell with grenades and rifle fire against attack by the MLA forces on the floors below. The 2nd squad moves the prisoners out of the top three floors to the roof. While the action was going on between the MLA guards and the 1st and 2nd squads, the 3rd squad had landed and is now in position on the roof. The rescue force Commander calls in the prisoner evacuation helicopters.

Now MLA snipers start firing at the friendly forces on the roof and on the approaching evacuation helicopters. Lightly armored helicopters (Cobras) are called in to eliminate the snipers. The gunships make steep divebomber-like passes at the snipers while firing their electric miniguns and 40 mm grenade launchers (standard equipment on the current Cobra). To minimize their exposure they make passes at buildings at an angle of 50 degrees from the horizontal. This confuses the snipers, as they are unable to see the gunships from their windows until they are being fired on directly. Some fire into a building by flying behind it and then rapidly turning the corners to the front at 100 m.p.h. This tactic gives the snipers only a fleeting glimpse of the gunship as it fires at them.

Four gunships operated in these ways to fire onto sniper positions while communicating with the U.S. rescue force. This lasts 15 minutes, and then

a thick layer of smoke is laid to curtain the landing and takeoff of the evacuation helicopters. This smoke gives concealment from the snipers. (A variant of this tactic is to drop napalm onto the faces of buildings from which fire is coming). The evacuation of the prisoners and the withdrawal of the rescue force is completed without casualties under the suppressive fire and smoke delivered by the gunships.

6. RESULTS OF ANALYSIS

Helicopter gunships are the best and fastest fire support available to the infantry in the rooftop battle described here. By using the flight techniques described, which were used during the battle of An Loc in 1972, they are able to deliver a high volume of fire with their electric miniguns at snipers in buildings. The snipers, on the other hand, are given only a very quick glimpse of the helicopter. With their slower firing weapons, they have relatively little chance of knocking the helicopters down. Furthermore, when the helicopters fire down into an upper story window, all the rounds are sprayed over the floor. This is much more likely to hit enemy personnel than fire from the ground, which sprays over the ceiling. A minigun round with good penetration into concrete would make the helicopter weapons system more effective in city fighting. The helicopter's ability to lay smoke screens at any altitude is another very valuable asset in combat on rooftops and in upper stories of highrise buildings.

7. ALTERNATIVE RESPONSES

The only other antisniper weapon available to the rescue force in this event is the grenade launcher. The force presumably used them, but the grenade

launcher is a slow firing weapon and less effective than the gunships for suppressive fire. Infantry mortars or artillery would have been less effective and would have caused a great deal of property damage. An accurate infantry weapon with a flat trajectory, a fragmenting warhead and a good rate of fire is needed as an antisniper weapon. An armored troop-carrying helicopter may have been able to fly through sniper fire to evacuate the prisoners and rescue force. Although armor lowers payload, the short ranges in city combat would allow a very small fuel load that would compensate in part for the weight of the armor and still allow a usable payload. The armored troop carrying helicopter is in the area of the mobility studies being conducted by another contractor.

NORTH AFRICA/MIDEAST - SANDIA

TECHNICAL PROBLEM RESUME

Problem: Firepower 18	Date: 23 Oct 72	Sheet 1 of 18
Operational Area: SANDIA		
Title: Apprehension and Detention of Hostile Personnel		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 18	Date: 23 Oct 72	Sheet 2 of 18
Operational Area: SANDIA		
Title: Apprehension and Detention of Hostile Personnel		

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para. 5.4.b.(1).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, Vol. II, Appendix C, Annex III.
c. U.S. Infantry Reference Data, ST-7-157 FY 72, page 169.
d. U.S. Army FM 31-50 Combat in Fortified and Built-Up Areas, Mar. 64.

2. DESCRIPTION OF PROBLEM

Apprehension and detention of an unsophisticated enemy, such as tribesmen, with present weapons and doctrine, results in considerable loss of life to the enemy and undesirable damage to the area of operations.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. A project should be initiated to acquire data on the time required to apply non-lethal incapacitating chemical agents in cities, the time to incapacitation and to recovery of unprotected individuals, and the residual effects.

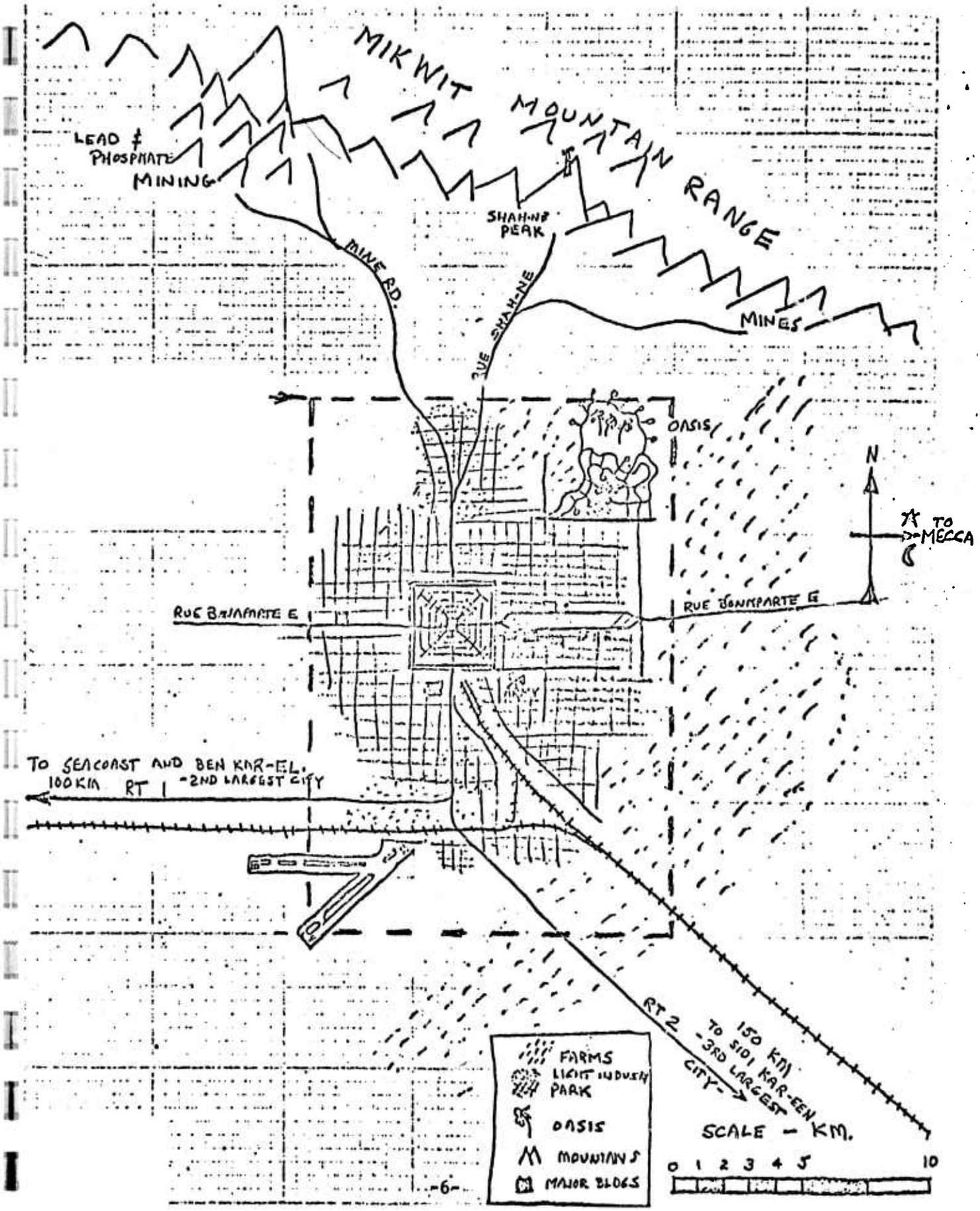
b. Research and analysis should be continued for non-lethal antipersonnel weapons which may be selectively discriminatory or non-discriminatory in application.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

During the late afternoon of 28 October, 5000 mounted and armed Acar tribesmen left the hills north of the city of Sandia (See Figure 1) and moved south to support the Popular Ifnadel Movement (PIM). By 0200 hours on 29 October, they had moved into the southern part of the city between Route 1 and the Medina (walled part of the city).

The Commander of the U.S. and Allied Forces orders the 232nd Infantry Battalion, 233rd Infantry Battalion, 2nd platoon 222nd Cav. Troop, and the 2nd



Area Sketch - Ifnadel, Sandia District City & Surroundings

Figure 1

Battalion, Ifnadel Motorized Infantry to move into positions and be prepared to counter the threat from the Acar tribesmen.

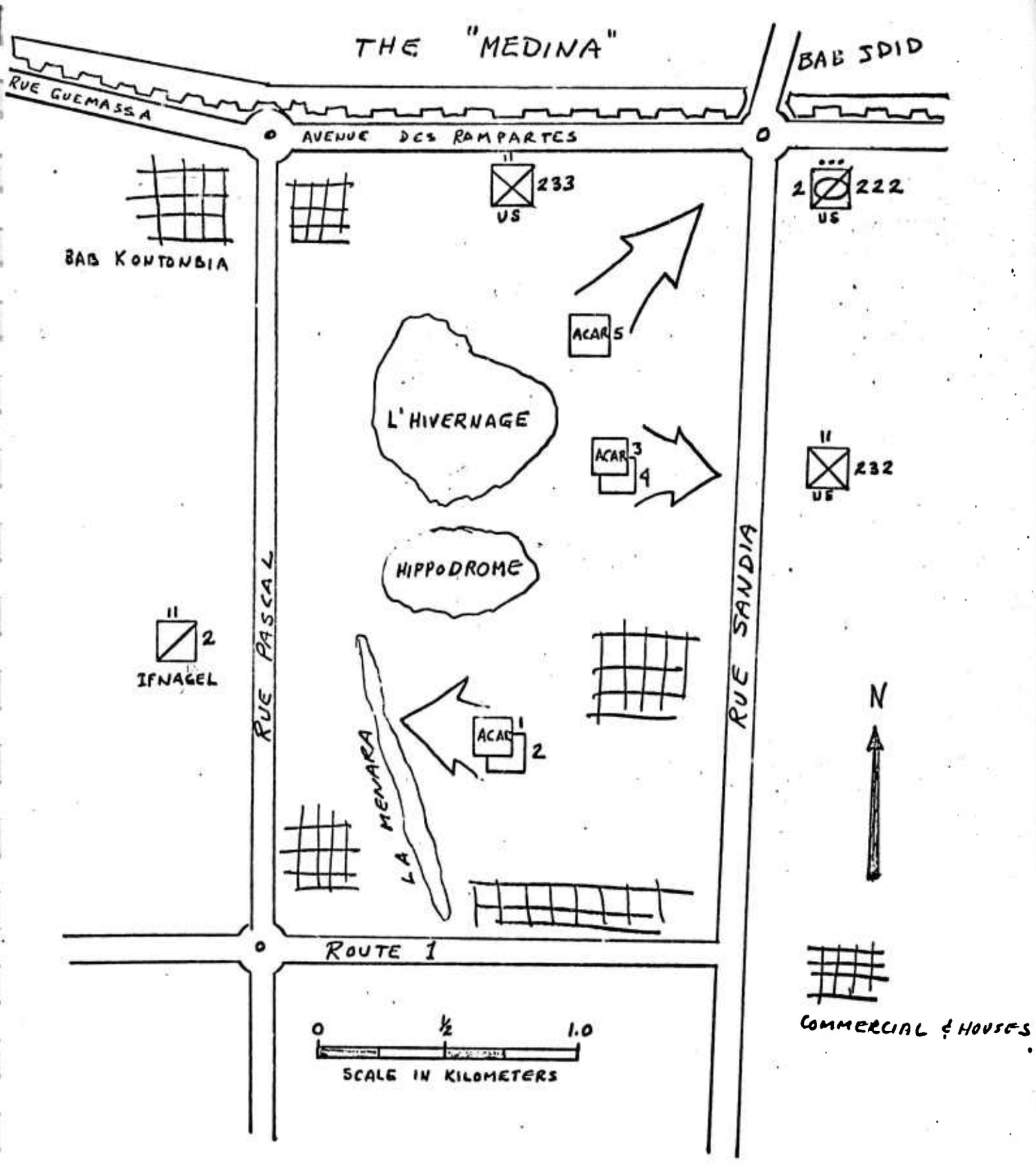
By 0400, 29 October, the 233rd Infantry Battalion had moved out and was deployed along the Avenue des Ramparts (See Figure 2) after encountering no fire. The 232nd Infantry Battalion was deployed along the Rue Sandia. The 2nd Platoon, 222nd cavalry troop had established positions near the Bab Jdid gate. The 2nd Battalion, Ifnadel Motorized Infantry was deployed along the Rue Pascal to close a line around the Acar tribal cavalry, thus containing the Acars within a 12 km^2 area.

In the early morning, the 5th Acar Clan tried a frontal charge toward the 233rd defensive position near the Bab Jdid gate, but were forced to retreat into a wooded area, the L'Hivernage, after their attempt to get through the gate was stopped by rifle fire from the 233rd and tank fire from the 2nd Platoon of the 222nd Cavalry troop.

The 3rd and 4th Acar Clans attempted to break through across the Rue Sandia south to the army barracks but were turned back by fire from the 232nd Infantry Battalion and were forced to retreat to the hippodrome area.

The 1st and 2nd Acar Clans tried to move west across the La Menara, a small ridge line, but retreated after they came under heavy fire from the 2nd Ifnadel Motorized Infantry Battalion.

The Commander of the U.S. and Allied forces then issued orders to the 233rd Infantry Battalion, the 232nd Infantry Battalion, and the 2nd Ifnadel Battalion, to close in on the Acars from all directions, and to capture and detain them. The Acar were expected to surrender when surrounded. The 240th Engineer Company was ordered to set up a detention facility for the expected



Area Sketch - Sandia

Figure 2

5000 prisoners and horses. Public health and safety were to be considered in choice of location and facility construction.

b. Characteristics of the Area of Operations

Sandia, because of its distance from the coast and its proximity to the Mikwit Mountain range (with elevations to 1500 meters), can be classified as both semi-arid and semi-isolated (See Figure 1). The climate is rainy and cool between October and May, with an average of 9 inches of rain per year, and warm and dry the rest of the year. Mean temperatures range from 50 to 85°F. The gravel plains on which the city stands are roughly 500 meters above sea level and have been successfully cultivated through irrigation to a radius of 20 kilometers from the oasis. Winds usually come from the west or northwest, but 3-day duration reversals called Siroccos bring dry, hot air from the desert and are accompanied by sandstorms. Temperatures of plus 108°F in the medina, together with sand blowing across the roof tops during the Siroccos, cause excessive static electricity throughout the whole area. The city geography is typical of cities in this area. It has an ancient crowded core called "medina" (walled city) surrounded by a modern European business, commercial, and residential section. Within the medina (Figure 2) buildings are made of brick and cement, with little reinforcing, and are generally small, two-story structures. Many units have common walls with adjacent buildings, and most have flat roofs which are used as patios and small courtyards in the rear. The streets are narrow and dirt packed. Buildings face directly on the street with heavy wood doors flush with the front walls. Shops commonly are open to the street with roll down steel shutters which close and lock during non-business hours.

The area of interest, Figure 2, is the area south between the "medina" and the airport and bounded by Rue Sandia South and Rue Targon South.

c. Description of U.S. Forces

(1) The U.S. 232nd Infantry Battalion, 201st Infantry Brigade is deployed along Rue Sandia South between Avenue des Ramparts and Route 1. The Battalion organization is shown in Figure 3. Major weapons are shown in Table 1.

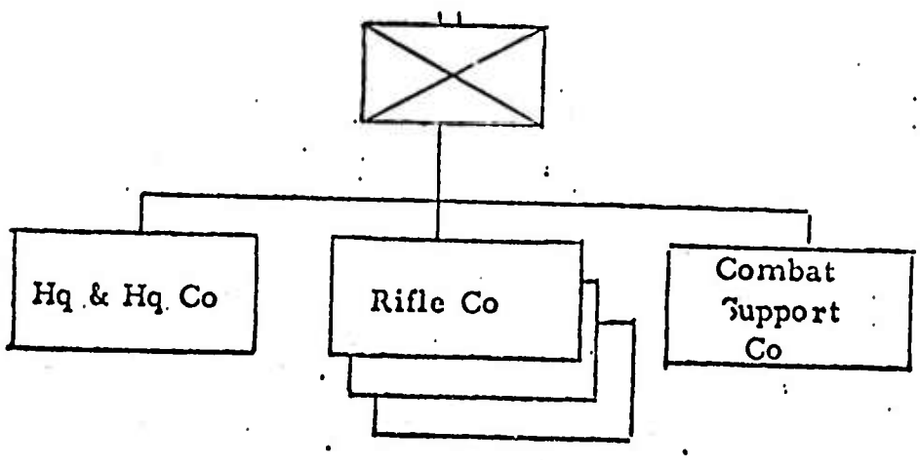
(2) The U.S. 233rd Infantry Battalion, 201st Infantry Brigade is deployed along the Avenue des Ramparts between the Bab Jdid gate and Bab Kontonbia. The Battalion organization and major equipment lists are shown on Figure 3 also.

(3) The U.S. 2nd Platoon, 222nd Armored Cavalry Troop has established positions outside the medina at the Bab Jdid gate. The platoon organization is shown on Figure 4.

(4) The 2nd Ifnadel Motorized Battalion is deployed along the Rue Pascal between Route 1 in the south and the L'Hivernage area in the North. The Battalion organization is shown on Figure 5.

d. Description of Enemy Force

The Acar Tribe, some 5,000 men, are mounted on horses. They are armed with individual weapons, mostly rifles, and have been engaged as mercenaries by the Popular Ifnadel Movement (PIM). Their mission is to support the insurgent forces by taking offensive action against U.S. and allied forces presently deployed around Sandia. The organization of the Acar Tribe is shown on Figure 6.



U.S. Infantry Battalion

Figure 3

678 Rifles 5.56 mm (86 w/grenade launchers)

28 LMG 7.67

14 MG 50 cal. HB flexible

9 Mortars 81 mm

4 Mortars 42 mm

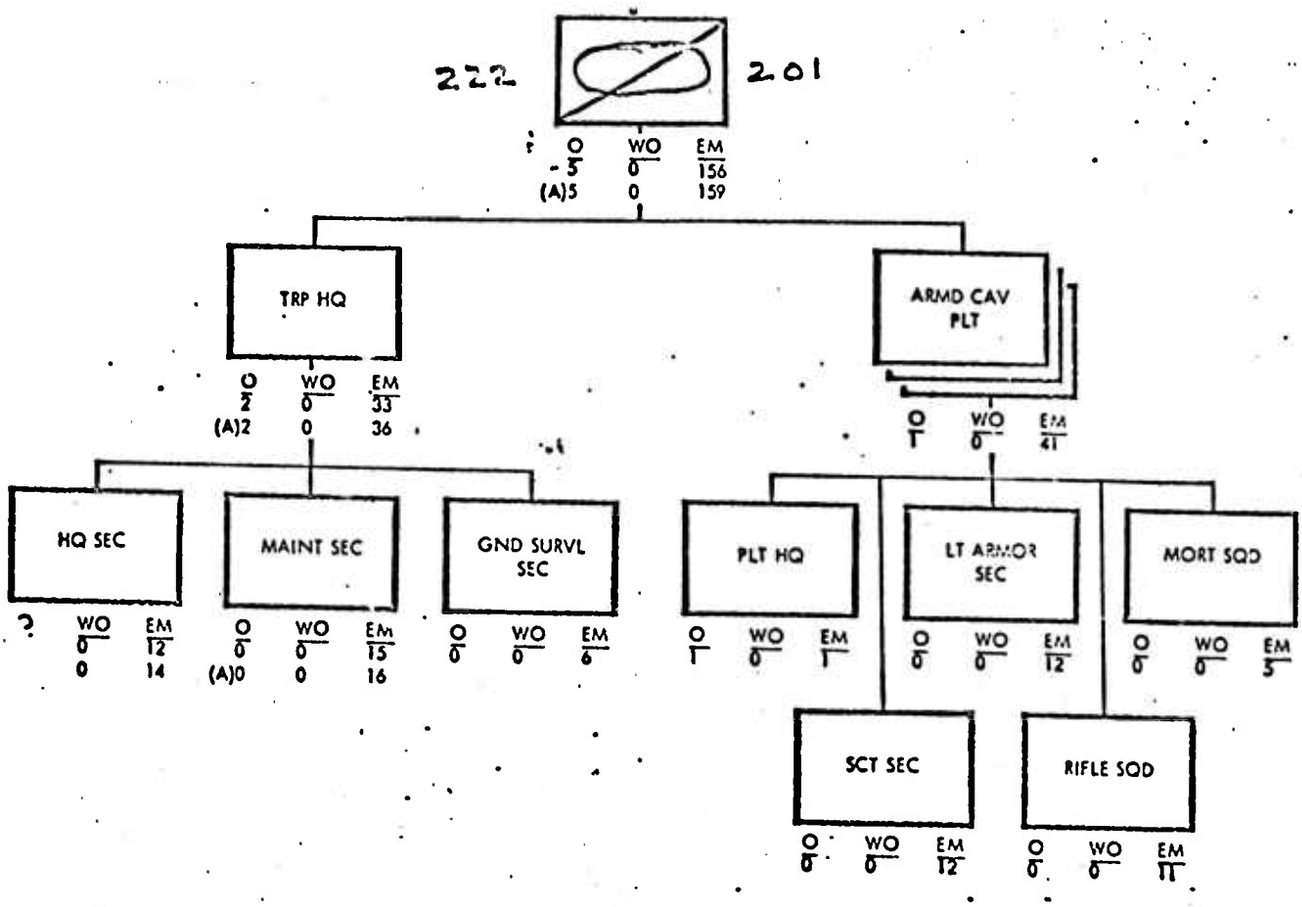
6 TOW

18 Recoilless Rifles 90 mm

U.S. Infantry Battalion

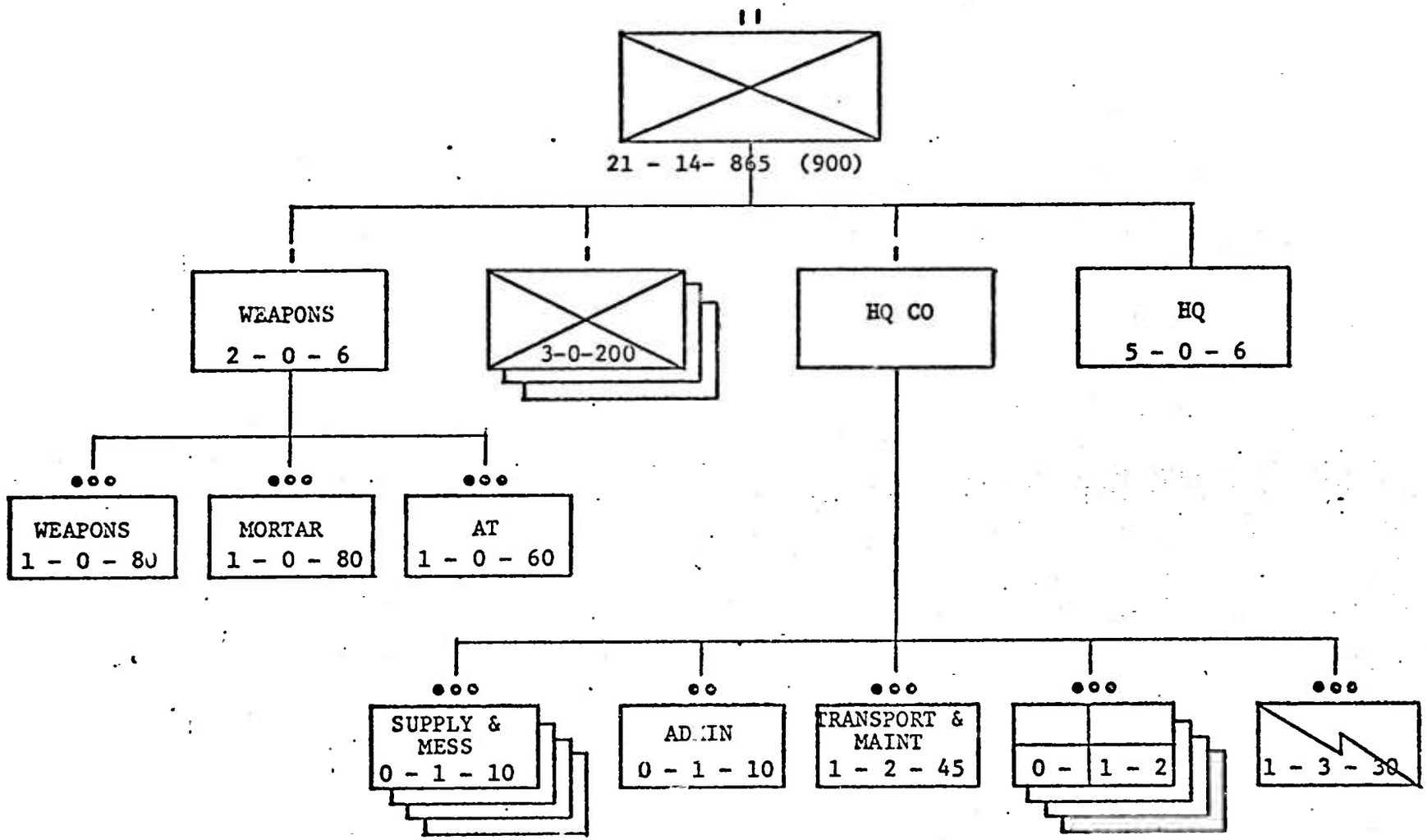
Table of Weapons

Table 1



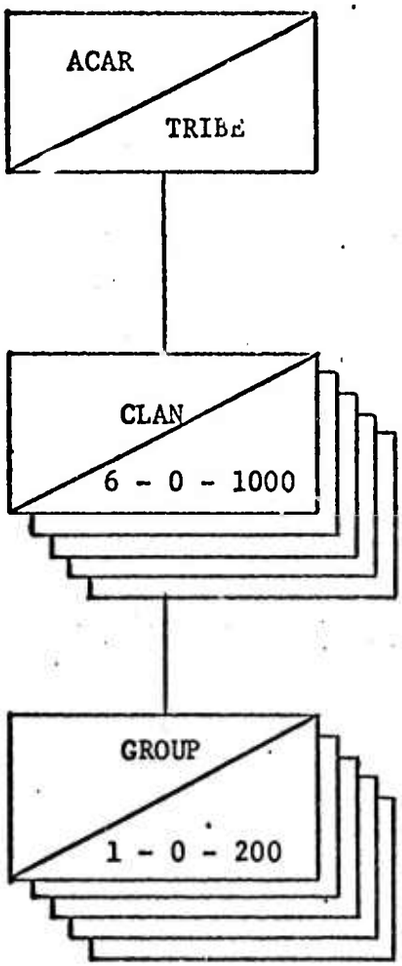
TO&E 222nd Armored Calvary Troop, 201st Infantry Brigade

Figure 4



Ifnadel Army - Infantry Battalion

Figure 5



Enemy Organization

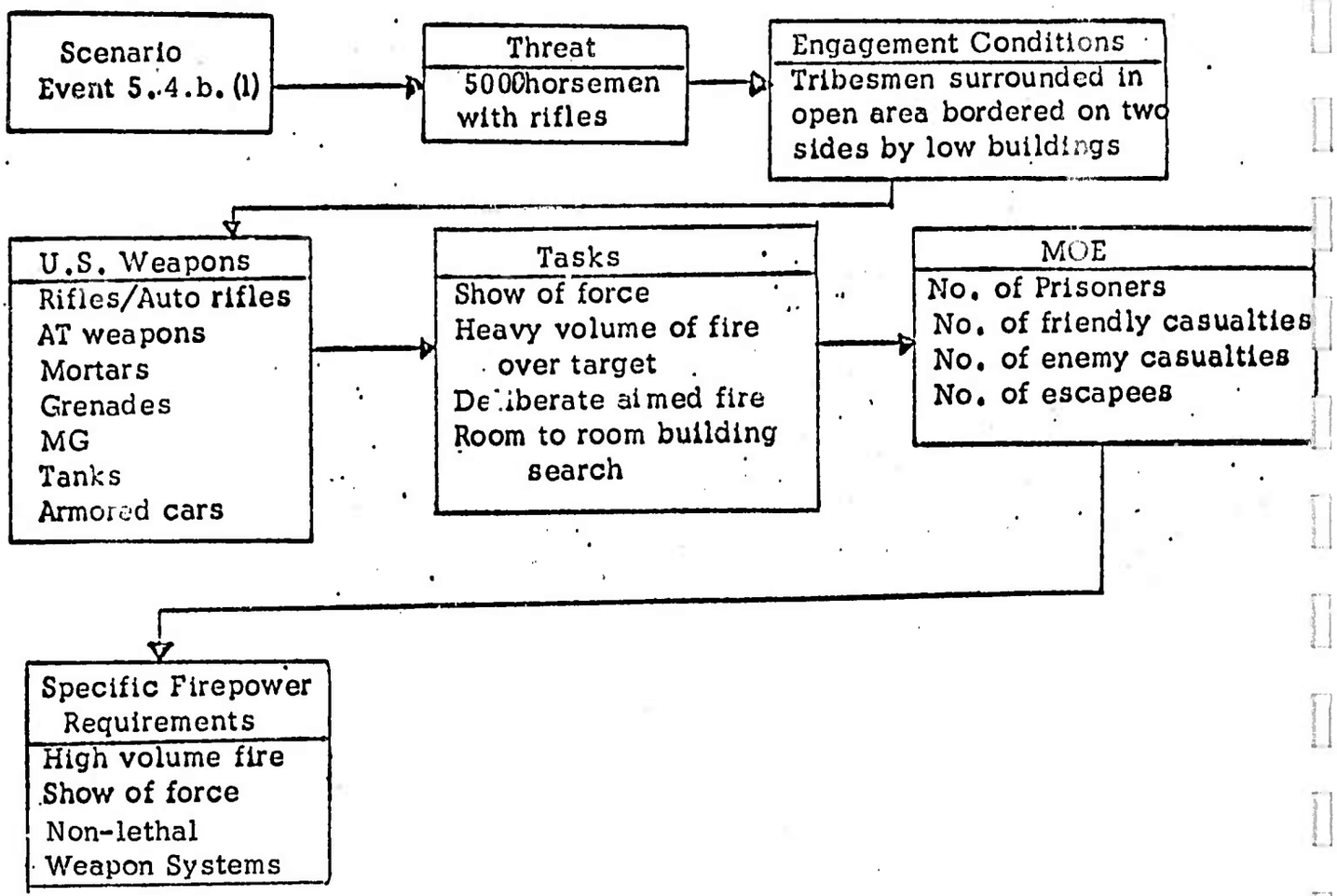
Figure 6

5. PROBLEM ANALYSIS

On order, the 232nd Infantry Battalion, the 233rd Infantry Battalion, and the 2nd Battalion, Ifnadel Motorized Infantry, will move forward three companies abreast. The 2nd platoon, 222nd Armored Cavalry Troop will act as the battalion reserve responsible for protecting the battalion flanks and rear.

All personnel have been briefed that in the event the Acar tribesmen try to break out, they are to place heavy volumes of fire in front of the battalion to prevent a breakthrough of our lines. Furthermore, they are to withhold fire until fired upon. In the event of sporadic fire, initial small arms fire in heavy volume will be fired over the heads of the tribesmen. Lethal aimed fire, which will be undertaken only on command, will be employed only in the event a determined hostile action develops. Personnel were briefed also that it is hoped that with our display of firepower, we will be able to win the hostiles over to our side. Should this approach fail, we will attempt to isolate and capture the Acar tribesmen by small groups. The situation is summarized in Figure 7 which shows the individual tasks that must be accomplished by the individual soldiers.

On order, the battalions deployed and began moving forward towards the Acar tribesmen. The Acar tribesmen had moved into the L'Hivernage area and were in the process of regrouping for another assault. Upon seeing the U.S. and Ifnadel battalions moving towards them, the Clan leaders decided that they must attempt to break through the encircling forces. The Clan leaders launched their attack against the U.S. 232nd Infantry Battalion with 1st and 2nd Clan leading the assault. The 3rd and 4th Clans were following behind and the 5th



FIREPOWER EVENT

APPREHENSION AND DETENTION OF HOSTILE PERSONNEL

Figure 7

Clan was kept in reserve. They elected to attack in this direction, east, because the barracks to the east of Rue Sandia (see Figure 2) were occupied by PIM insurgents.

As the Acar tribesmen neared the 232nd Battalion, the battalion took up positions and on order fired over the heads of the oncoming tribesmen. Although no casualties were inflicted, many houses beyond the tribesmen were hit and damaged. At the same time, the 2nd Platoon of the 222nd Armored Cavalry Troop moved its tanks into position and opened fire with their secondary weapons over the heads of the oncoming charging tribesmen. Although the volume of fire appeared to slow the attackers down, tribesmen, firing their rifles, still kept on coming. At a distance of approximately 200 meters, the battalion commander ordered his forces to fire lethal aimed fire at the lead elements of the attacking Acar force. The fire was most effective and many Acar tribesmen in the lead elements went down. The remaining Acar tribesmen broke off the attack and retreated. However, by this time, the encircling U.S. and Ifnadel forces had moved up and established positions to cut off any possible escape in another direction. Seeing that their situation was hopeless, the Clan leaders ordered the tribesmen to lay down their arms and surrender. As soon as this was done, the U.S. and Ifnadel forces moved in and the Acar tribesmen were led off to the prisoner compound which had been prepared for them by the engineers.

U.S. and allied casualties were very light. However the Acar tribesmen suffered 200 casualties to their lead elements, the 3rd and 4th Clans, from the fire laid down by the 232nd Infantry Battalion.

The use of controlled artillery and mortar fire in this situation in addition to a high volume of small arms fire would certainly have dissuaded the Acar tribesmen from attempting an attack against the encircling forces. However, since there would have been very little time to set up and register the indirect fire weapons, there probably still would have been casualties to the tribesmen. Additionally, there were scattered houses in the area where the action took place; these certainly would have been hit by the artillery and mortar fire. This would have resulted in heavy damage to the houses as well as possible loss of life to their civilian occupants.

It would have been possible to use some type of nonlethal gas in this situation. The gas would have been most useful against this unsophisticated enemy who, without protective equipment, would have been forced to disengage and capitulate. However, in order to use gas, the wind and atmospheric conditions would have had to be exactly right in order to keep it localized. Otherwise unprotected citizens would also be adversely affected.

The real requirement in this situation is for nonlethal antipersonnel weapons, not presently available to U.S. forces. Had such weapons been available, the tribesmen could have been stopped with few or no casualties.

Another alternative may be in the development and use of the so-called sound weapon. This weapon also of the nonlethal variety, causes physiological changes to occur in the recipient such that he loses all sense of balance and coordination. Use of a weapon of this type would also have accomplished the task with few if any casualties to the tribesmen and noncombatants and only a minimum of damage to the houses in the area.

6. RESULTS OF ANALYSIS

The current doctrine applied in this situation accomplished the task with available weapons and with minimum friendly casualties. However, because of the necessity to use lethal aimed fire against the Acar tribesmen, casualties to the tribesmen had to be expected. There was also fairly extensive damage to many of the houses in the area resulting from the fire against the attacking tribesmen. This must be expected when fighting in an urban area such as this. However, these drawbacks, damage to housing and casualties to the tribesmen, suggest that alternative responses should be considered.

A study should be conducted to determine the feasibility of developing non-lethal chemical agents for use against an unsophisticated enemy in urban areas. The study should determine the appropriate operational characteristics such as delivery method, persistence, concentration and affects against individuals.

An investigation should be made into other types of non-lethal weapons. The entire spectrum of crowd control systems should be examined to see if new concepts or improvements are feasible, which in turn should be evaluated against current weapons to determine whether a combat potential exists. The measures of effectiveness which should be used are numbers of hostile and neutral deaths versus number of individuals incapacitated. Collateral damage should also be a measure of effectiveness.

7. ALTERNATIVE RESPONSES

Possible alternatives would include the use of high pressure water or flame throwing systems as intimidators. The former method has the advantage of being completely non-lethal. The responsibility for escalating the level of fighting

clearly is shifted to the opposing force. The latter is more intimidating. Past riot situations should be studied to determine whether such actions can produce the desired results. Perhaps much can be learned by studying mob reaction to control devices.

TECHNICAL PROBLEM RESUME

Problem: Firepower 19	Date: 27 Dec 72	Sheet 1 of 16
Operational Area: SANDIA		
Title: FLUSH OUT SNIPERS		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 19	Date: 27 Dec 72	Sheet 2 of 16
Operational Area: SANDIA		
Title: FLUSH OUT SNIPERS		

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para 5.4.c.(2).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, Vol. II, Appendix C, Annex III.
c. U.S. Infantry Reference Data, ST-7-157, FY 72.
d. U.S. Army FM 31-50 Combat in Fortified and Built-Up Areas, Mar 64

2. DESCRIPTION OF PROBLEM

During urban conflict dismounted or unprotected U.S. infantrymen frequently undergo sniper fire. With present equipment and techniques it is difficult and time-consuming to locate the snipers and costly in time, lives, and collateral damage to eliminate them.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

Analysis should continue on the benefits and costs of rapid detection of snipers. The use of a simulation model, with inputs from GTE Sylvania, is recommended.

Firepower for killing or suppressing snipers needs further study and improvement. A small caliber direct fire weapon, firing a volume of fragmenting munitions with good accuracy at medium ranges may be worth developing.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

By 0830 C Company, 234th Battalion and the 3rd Platoon, 222nd Armored Cavalry Troop, had advanced along Avenue Marechal to Place Jemaa el Fua with little resistance. (Figure 1). When they tried to proceed south on Rue Riad Altoun and east toward Arset Achrine, they were stopped by roadblocks, plastic explosive charges and very heavy sniping from buildings along both sides of the street.


Dar Glaoui
Bab Jdid
Souk El Mellah
Bab Robb
SCALE
KEY.
SECTION OF CITY OF SANDIA
- HEAVY POPULATION - NATIVE QUARTERS
- ORCHARD
- GRASS
- MAJOR BUILDINGS AND BARRACKS
- WALL
- CEMETARY, AZAS
- GARDEN
- LIGHT TANK
- A.F.V.
- A.P.C.
- ENEMY STRONG POINT
- AMBUSH POINT
- ANTI-VEHICLE BARRIER
- VIEW DIRECTION FOR PHOTOGRAPH

FIGURE 1

The Company Commander told the 1st Platoon to clear snipers from the buildings along Rue Riad Zitoun. The 2nd Platoon was to supply covering fire from the street, and the Cavalry Platoon to remove the roadblock, which was a wrecked police jeep lodged crossways in the street.

b. Characteristics of the Area of Operations

Sandia, because of its distance from the coast and its proximity to the Mikwit Mountain Range (with elevations to 1500 meters), can be classified as both semi-arid and semi-isolated. Within the medina buildings are made of brick and cement, with little reinforcing, and are generally, two-story structures. Many units have common walls with adjacent buildings, and most have flat roofs which are used as patios and small courtyards in the rear. Streets are narrow and dirt packed. Buildings face directly on the street, with heavy wood doors flush with the front walls. Shops commonly are open to the street with roll-down steel shutters which close and lock during non-business hours. The side streets in the area are less than three meters wide and are lined on both sides by two-story, flat-roofed, concrete buildings with heavy wooden doors flush with the wall. The main streets are four meters wide with identical building construction on both sides, but with open shops on ground level. Streets twist and turn, and little cross traffic is possible between main streets.

c. Description of U.S. Forces

(1) C Company, 234th Infantry Battalion is deployed south along Rue Riad Aitoun from the Place Jemaa el Fua. (Figure 1). The company organization and major equipment is shown on Figure 2.

(2) The 3rd Platoon, 222nd Armored Cavalry Troop is also deployed south on the Rue Riad Aitoun with Company C, 234th Infantry Battalion. The Platoon organization is shown on Figure 3.

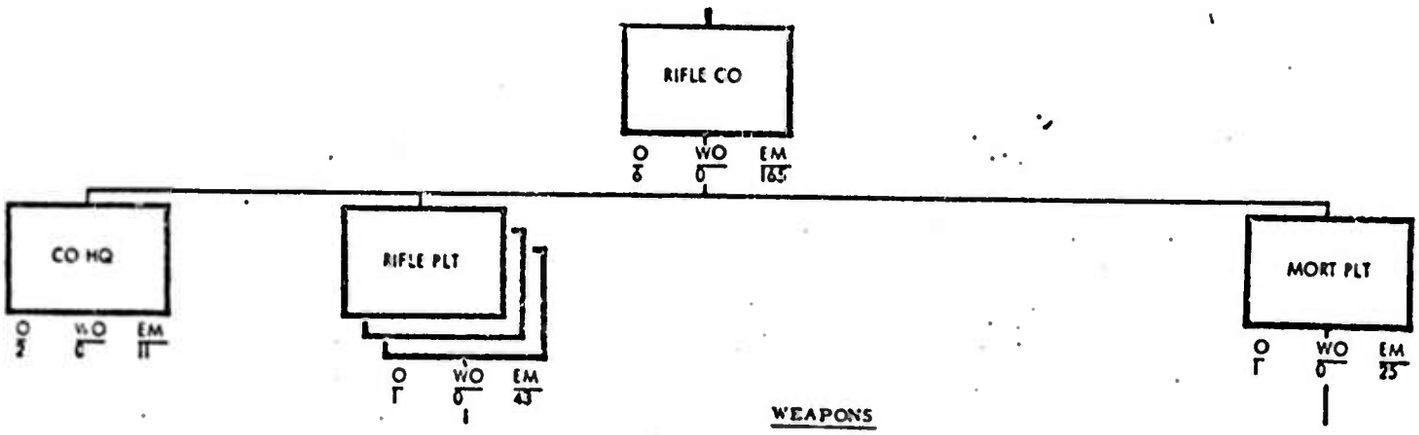
d. Description of Enemy Forces

(1) Organized defectors from the IFNADEL Army, uniformed and armed with individual weapons, crew-served weapons, and grenades, have the mission of attacking U.S. and allied military personnel and equipment.

(2) Small groups of defectors are equipped with explosives, fuses, arming devices and booby traps. These personnel may be wearing army uniform or civilian clothing.

(3) Other groups of defectors from both the Army and civil police are equipped with two-way radios, codes and ciphers, maps, and optical devices. These personnel may be wearing army uniform or civilian clothing. Their mission is to collect and report information on U.S. and allied forces in the urban complex.

(4) UAR volunteer teams have agents who carry no special equipment and wear civilian clothing. Their mission is to incite and to arm the civil population to take action against U.S. and allied forces.

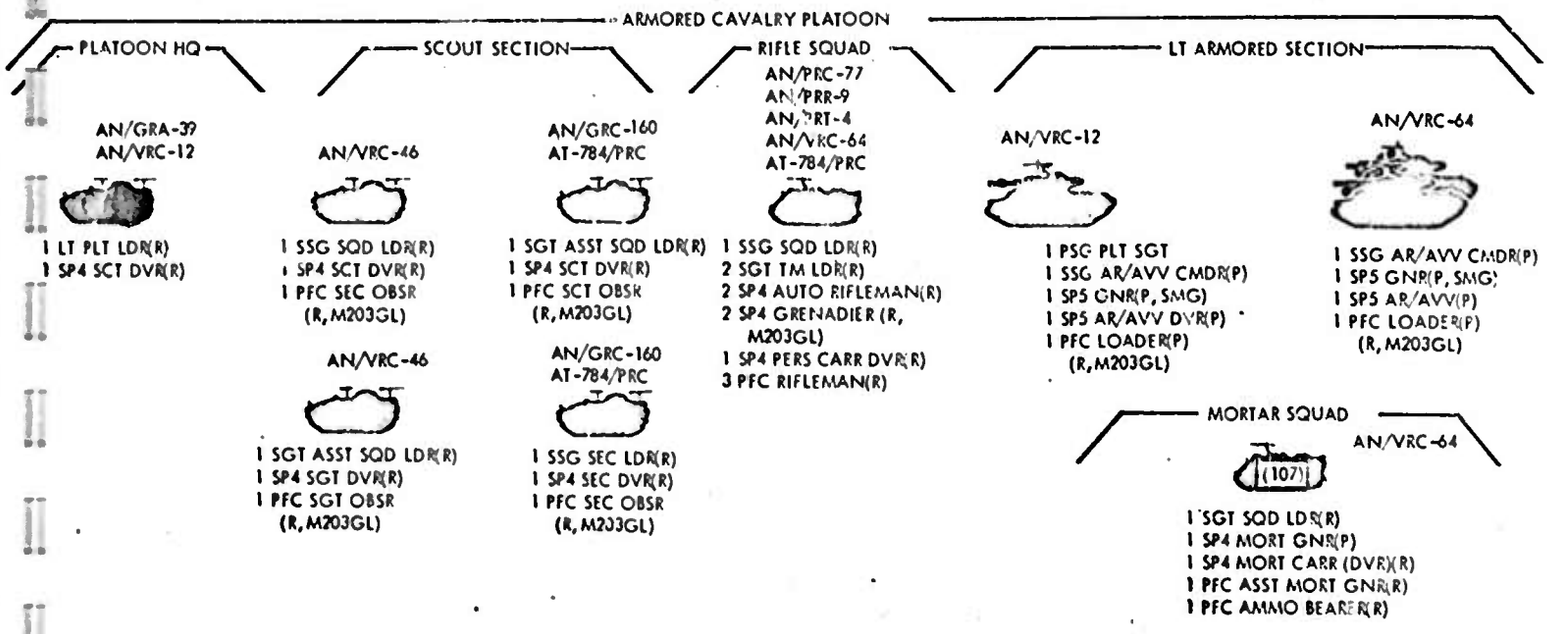


WEAPONS

Launcher Grenade M203 for XM16E1 Rifle	23
Machinegun 7.62-mm Lt Flexible	6
Mortar 81-mm On Mount	3
Pistol Cal .45 Automatic	31
Rifle 5.56-mm WE	140
*Rifle Recoilless 90-mm	6

Company C, 234d Inf. Bn

Figure 2



ARMORED CAVALRY PLATOON

Figure 3

The 1st UAR Volunteer Support Team and the weapons company of the Ifnadel Army Defectors Battalion are the organized troops involved in this event. Their major equipment and organization is shown in Figures 4 and 5.

5. PROBLEM ANALYSIS

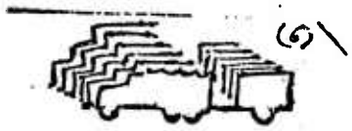
The Company Commander ordered the 1st Platoon with the attached anti-tank section from the Weapons Platoon to clear the area of snipers. The platoon leader assigned one rifle squad to clear each of the three buildings of snipers who were blocking the advance of the company along Rue Riad Zitoun. Prior to entry, the recoilless rifles fired into each window and doorway to cover the entrance of the squad personnel. When the recoilless rifle fire lifted, the squads rushed their assigned buildings. The squads entered through the ground floor entrance and windows. Once in the building, the first floor was cleared first, then each floor in turn. The squad signalled as each room on each floor was cleared, and then when the building had been cleared. Squad personnel were briefed to use plenty of hand grenades and to consider all occupants of the building as hostile.

The 2nd Platoon with its machine guns took up positions on the street and furnished covering fire to the 1st Platoon. They fired into the buildings and at any hostiles leaving any of the buildings.

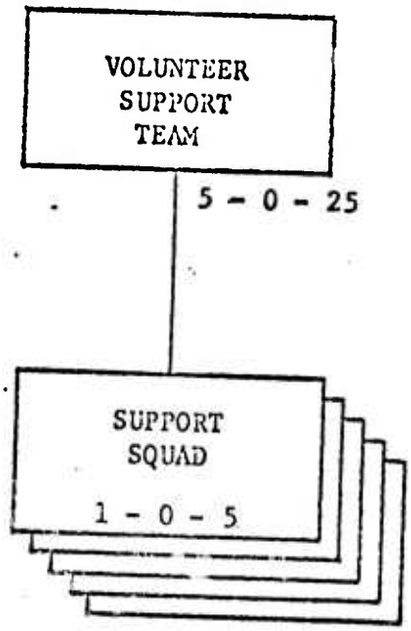
The 3rd Platoon was ordered to take up positions in the street to protect the routes of approach from the rear. They were briefed to

UAR VOLUNTEER SUPPORT TEAM

HF Radio

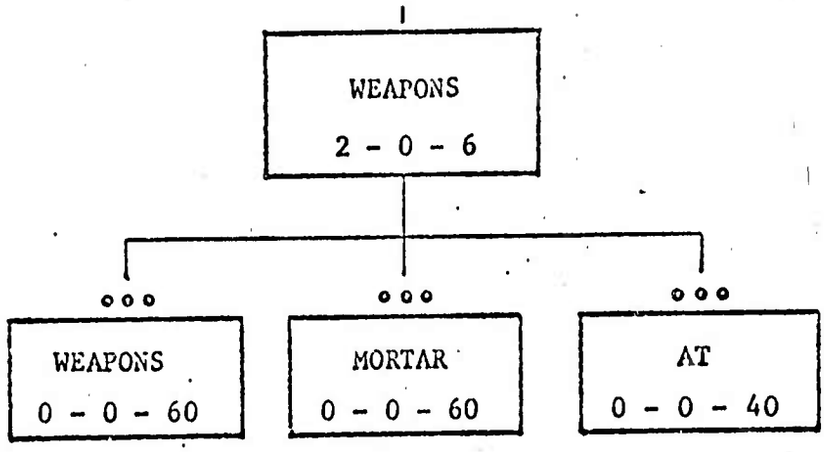


1	Team Ldr	Pistol
1	Asst. Team Ldr, Driver	Pistol
4	Weapons Specialist	Rifle
33	Rifles	
40	Kg Plastic Explosive	
3300	rnds ammo	



1st UAR Volunteer Support Team

FIGURE 4

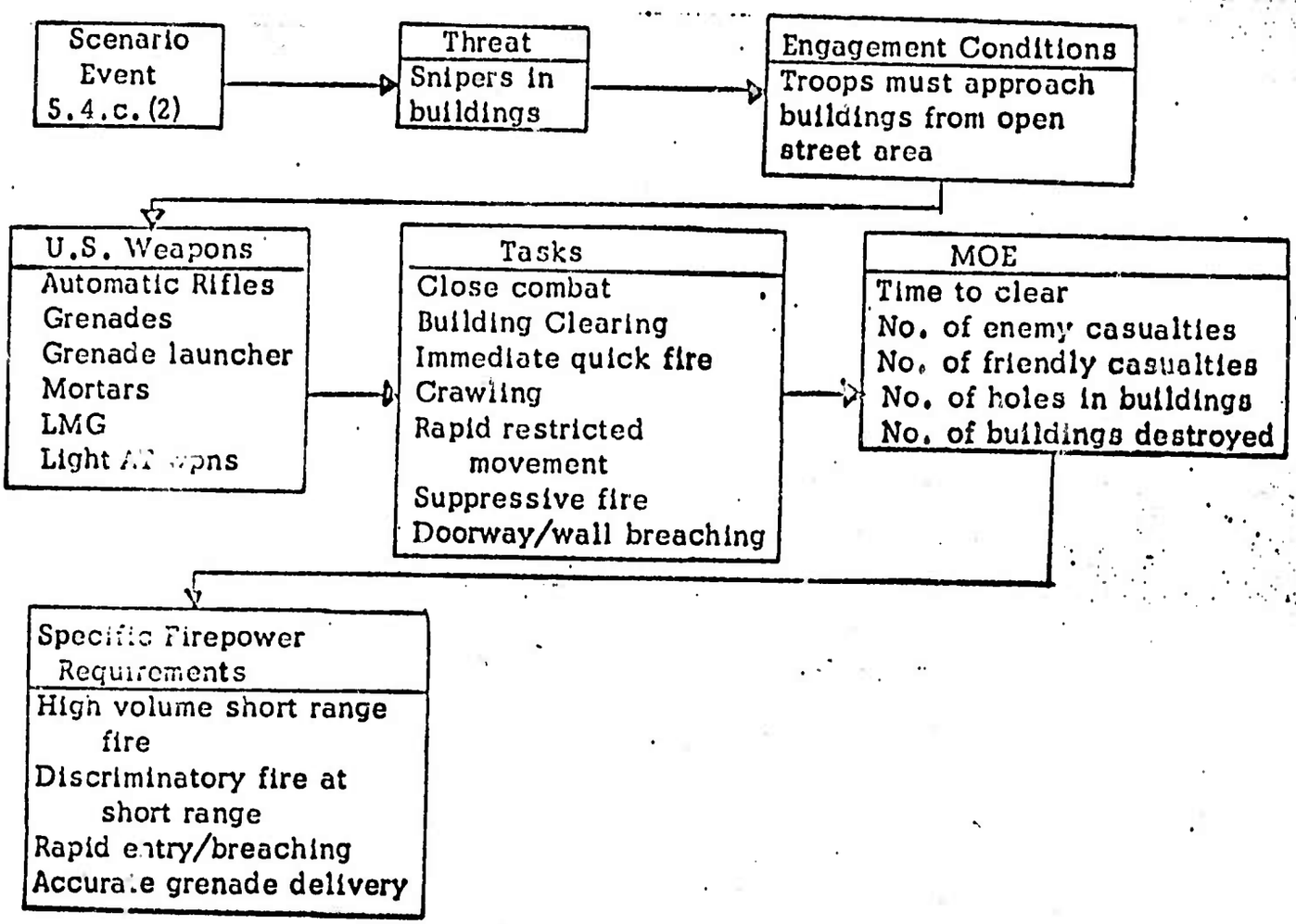


Weapons Company, Ifnadel Army Defectors Battalion

FIGURE 5

be especially alert for the presence of enemy approaching from the side streets. Once the roadblock had been removed by the 3rd Platoon, 222nd Armored Cavalry Troop, the platoon passed through the 1st and 2nd platoons and provided the advance guard for the company with the Cavalry Platoon. The situation is summarized in Figure 6 which shows the individual tasks that must be accomplished by the individual soldiers.

The Company Commander of Company C deployed his platoons to flush out the snipers which were firing on the Company. Since most of the fire was coming from 3 buildings along the street near the roadblock, the 1st Platoon moved forward to enter these 3 buildings. While the 1st Platoon and the AT Squad moved forward, the 2nd Platoon placed heavy covering fire on all the windows. Once the 1st Platoon was in position, the AT Squads began firing their recoilless rifles. As soon as the fire was lifted, the squads rushed the buildings. The squads came under heavy fire and suffered some casualties before they reached the entrance to the buildings. Once inside they began firing and throwing hand grenades to clear the rooms. As they moved from floor to floor, the enemy resistance stiffened as the snipers in the lower floors had been retreating towards the roof. The U. S. personnel received heavy fire as they attempted to assault the roofs of the buildings. The squad leaders requested covering fire on the roofs to suppress the hostiles there; the 2d Platoon did so. As soon as the fire was lifted, the 1st Platoon moved on to the roofs of the buildings. They met only sporadic



FIREPOWER EVENT

FLUSH OUT SNIPERS

FIGURE 6

resistance from the enemy survivors who were still there. As soon as the buildings were cleaned out of snipers, the Cavalry Platoon moved forward and removed the overturned jeep from the street. The 3rd Platoon, Company C, moved forward, joined up with the Cavalry Platoon, and those two platoons continued the advance from Rue Riad Zitoun towards the palace. Company C had suffered moderate casualties from the snipers, most of them coming during the action within the three buildings. The remainder of the casualties were received from the sniper fire as the Company was moving down the street into position. A large number of hostiles were killed in the action as well as several civilians who were being kept prisoners in the buildings by the hostiles.

One feasible alternative method with current doctrine and weapons would be to use only aimed fire at known sniper locations. This would have limited the number of lethal projectiles and restricted the areas into which they were fired. The result would have been fewer civilian casualties and less damage to buildings. However, the inability to pinpoint sniper locations would leave many snipers unintimidated. More sniper activity could have been expected which would have increased friendly troop casualties.

The Company could have employed mortar fire in addition to small arms fire. This situation (and other similar situations) tended to arise very quickly. Due to this spontaneity, there was little time to set up and register the mortars. The proximity of friendly troops in the area around the buildings would have made quick registration difficult and

dangerous. In this situation, the mortar would have only been effective against the hostiles on the roofs of the buildings. Mortar fire on the roof tops would cause considerable collateral damage.

Shoulder fired recoilless rifles used in a carefully controlled manner could have been effective in this situation. However, damage to buildings would not have been reduced.

It would have been possible to employ either smoke or gas in this situation. Smoke would have provided cover for the company in the area but would also have concealed snipers, permitting their escape. Gas could have been used too. However, if the snipers were prepared with protective equipment, the capabilities of both sides would have been hindered by using such equipment, resulting in no real advantage. Gas is more useful against an enemy without protective equipment. Unprotected civilians would also be adversely affected.

The inability to effectively suppress the snipers in the buildings without having to clear the buildings with infantry indicates the need for a counter-sniper weapon, a weapon not presently available to the U.S. forces. A weapon of this type would reduce friendly casualties, civilian casualties, and certainly limit the damage to the buildings.

Another possibility is the development and use of a surveillance device for accurately and quickly locating snipers. This, combined with a countersniper weapon would be effective in this situation.

Increased penetrability of small arms projectiles would reduce the protection of the building. However, increased penetration without some firing restrictions could increase civilian casualties and damage to buildings.

6. RESULTS OF THE ANALYSIS

The current doctrine applied in this situation accomplished the task with available weapons and with few friendly casualties. However, inability to pinpoint sniper-occupied rooms and buildings and the necessity for suppression by a high volume of covering fire, including recoilless rifles, resulted in casualties to non combatants. Also, damage to the buildings was extensive due to the use of hand grenades and the recoilless rifles as well as the small arms fire. These drawbacks: civilian casualties, friendly casualties, and extensive damage to buildings, suggest that some new concepts should be considered.

This situation shows the importance, in terms of friendly casualties and the time to accomplish a mission, of quickly locating sniper positions. A very small force hidden in the 3-dimensional cover of the urban environment can significantly slow the advance of much superior forces. The problem of sniper neutralization deserves a thorough study. The study should encompass firing and observation methods (the British use anti-sniper teams with one firer and one observer), smoke or other screening devices, use of protective armor, improved surveillance devices (muzzle energy locators sensitive to IR, or visible light) and suppressive fire weapons. The development of a

sniper simulation model would provide a means of evaluating tactics and the potential of new surveillance equipment. This problem should be attacked with the firepower and surveillance contractors working jointly.

Consideration should be given to replacing the large caliber direct fire infantry weapons (90 and 106mm recoilless rifles) with a smaller caliber (20-40 mm) weapon firing fragmenting munitions for using against snipers and other enemy forces inside buildings. The weapon should fire at a good rate with a flat trajectory and good accuracy at medium ranges. The sights and the traversing and elevating mechanism should give a fast lay on target, with emphasis on a large angle of elevation to fire at snipers on rooftops and upper story windows. It could be vehicular or ground mounted. Small caliber fragmenting munitions are less efficient in lethal volume per unit weight and per dollar, but this cost may be justified in effective fire with low collateral damage.

7. ALTERNATIVE RESPONSES

Evaluate types of covering rounds such as smoke screens or small CS rounds which produce an eye irritant.

Consider an area denial foam, delivered ballistically into buildings, to neutralize defenders. A chemical mixture can expand into a foam occupying many times the volume of the components. Various effects, physiological and physical, may be possible with different chemicals.

TECHNICAL PROBLEM RESUME

Problem: Firepower 20	Date: 26 Oct 1972	Sheet 1 of 12
Operational Area: SANDIA		
Title: Establish New Defensive Positions		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 20	Date: 26 Oct 1972	Sheet 2 of 12
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Title: Establish New Defensive Positions		

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para. 5.4.e.(1).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, Vol. II, Appendix C, Annex III.
c. U.S. Infantry Reference Data, ST 7-157 FY 72.
d. U.S. Army FM 31-50 Combat in Fortified and Built-Up Areas, Mar. 64.

2. DESCRIPTION OF PROBLEM

Withdrawal across open plazas and along streets in a city against a superior enemy.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Examine technology for producing quick-acting, very dense, but non-persistent smoke curtains for concealment in the streets and open areas of cities.

b. Examine technology for combining smoke and irritant agents in one quick-acting, non-persistent munition for blinding enemy forces.

c. Adapt high-volume-of-fire antipersonnel weapons now mounted in aircraft (Army and Air Force gunships) for use on armored vehicles in city fighting.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

By 1500, 30 October, Brigade G-2 reported that an apparent stalemate existed between U.S. and insurgent forces inside the walled city, with neither side able to gain further ground. The corridor to the palace was open but narrow at the Souk El Mellah area. (See Figure 1).



Figure 1

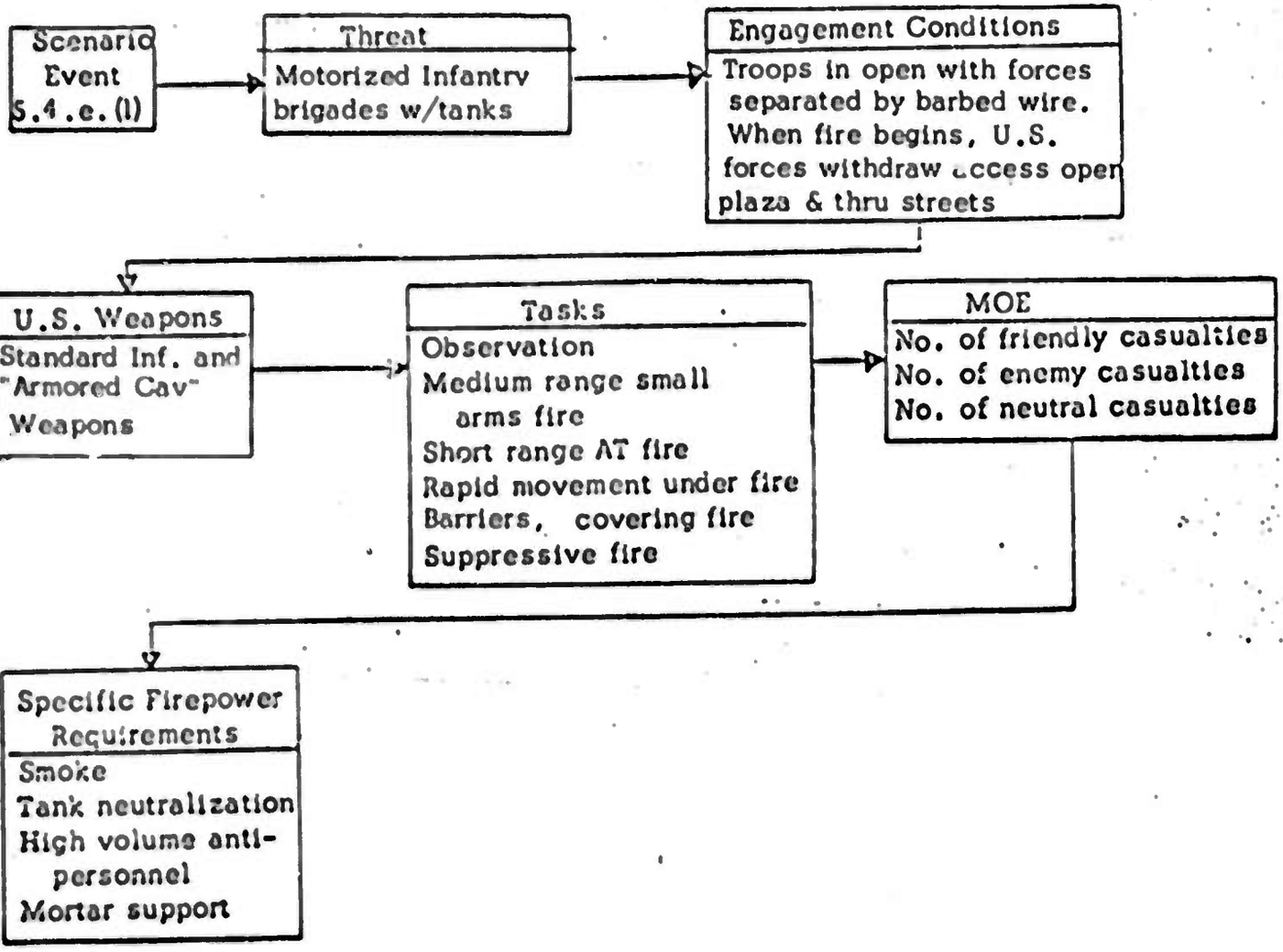
Reconnaissance reports state that two motorized infantry brigades with tanks from the UAR 3rd Division have moved into the walled city and erected barbed wire barracades along main streets near the palace. The UAR troops have not fired their weapons, but a front exists along the barricade with an apparent stalemate between opposing forces at the Mellah Plaza and at other points near the palace. G-2 estimates that an attack on the palace is probable. U.S. troops have orders not to fire on uniformed troops unless fired upon.

At 1530, UAR infantry moves across the Mellah Plaza with tanks and closes off the palace. Firing at the U.S. troops by UAR troops commences. C Company of the 232nd Infantry Battalion (1st Platoon, 222nd Armored Cavalry Troop attached) retreats from the plaza south to defensive positions some 100 meters from the plaza.

The 1st Platoon, 222nd Armored Cavalry Troop, with 1st Platoon, Co. C attached, covers the withdrawal of the company to the new defensive position, 100 meters south and to the rear. Movement by the enemy towards our lines is to be reported immediately to the company commander. If enemy forces cross the barricade, the platoon will take them under fire. The platoons are to hold this position until notified that the remainder of the company has successfully withdrawn. At that time, the covering force moves to the new position under covering fire of the platoons already in that position. When all units have withdrawn to the new defensive positions, C Company and the Cavalry Platoon will be prepared to engage any UAR units which may attack. The situation is summarized in Figure 2 which shows the individual tasks that must be accomplished by the individual soldiers.

b. Characteristics of the Area of Operations

Sandia, because of its distance from the coast and its proximity to the Mikwit Mountain Range (with elevations to 1500 meters), can be classified as both semi-arid and semi-isolated. The climate is normally rainy and cool between October and May but a 3-day duration reversal (called Sirocco) has brought dry, hot air from the desert. Temperature is 108°F in the city,



FIREPOWER EVENT

ESTABLISH NEW DEFENSIVE POSITIONS

Figure 2

with sand blowing across the roof tops during the sirocco. This has caused excessive static electricity throughout the whole area.

Within the walled city, buildings are made of brick and cement, with little reinforcing, and are generally two-story structures. Many units have common walls with adjacent buildings, and most have flat roofs which are used as patios and small courtyards in the rear. Buildings face directly on the street, with heavy wood doors flush with the front walls. Shops commonly are open to the street with roll-down steel shutters which close and lock during non-business hours. The side streets in the area are of dirt, less than three meters wide, and are lined on both sides by two-story, flat-roofed, concrete buildings with heavy wooden doors flush with the wall. The main streets are paved, four meters wide, with identical building construction on both sides, but with open shops on ground level. Streets twist and turn, and little cross traffic is possible between main streets.

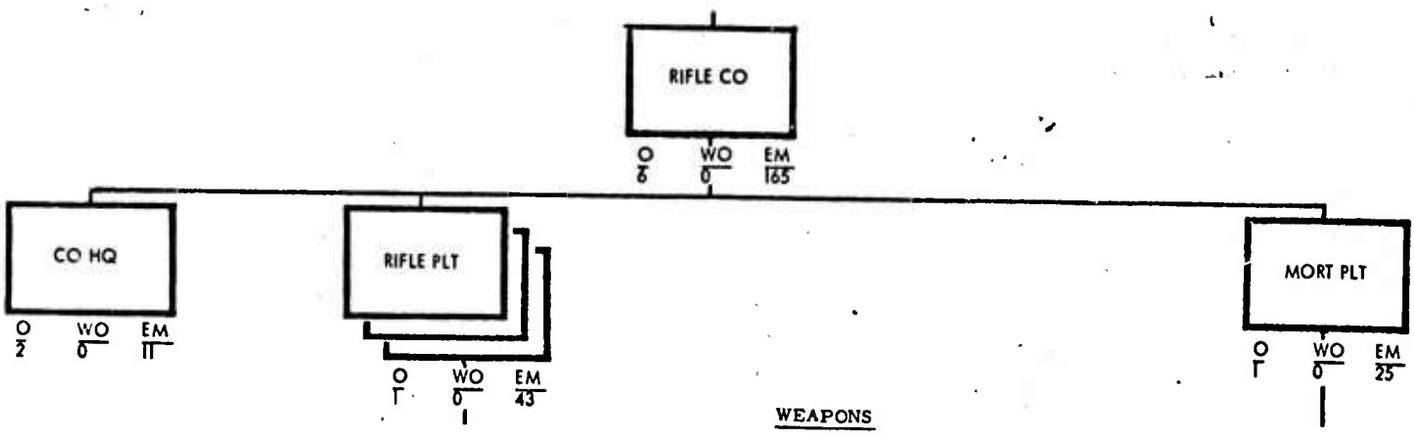
c. Description of U.S. Forces

(1) C Company, 232nd Infantry Battalion is deployed in and around the Mellah Plaza with its CP located in the Post Office Building. The Company organization and major equipment is shown on Figure 3.

(2) The 1st Platoon, 222nd Armored Cavalry Troop is attached to C Company, 232nd Inf. It is deployed just west of the Mellah Plaza and south of Ksibet Nhas. The platoon CP is located in the Post Office Building along with Charlie Company. The organization of the 222nd Armored Cavalry Troop is shown on Figure 4.

d. Description of Enemy Forces

3rd UAR Motorized Division occupies the eastern section of the city and has deployed two of its brigades into the walled city. The brigades have the mission of seizing and occupying the palace and establishing defensive positions in order to thwart any attempt by U.S. and allied ground forces to recapture the palace and the central area of the walled city. Fig. 5, 3rd UAR Motorized Division.

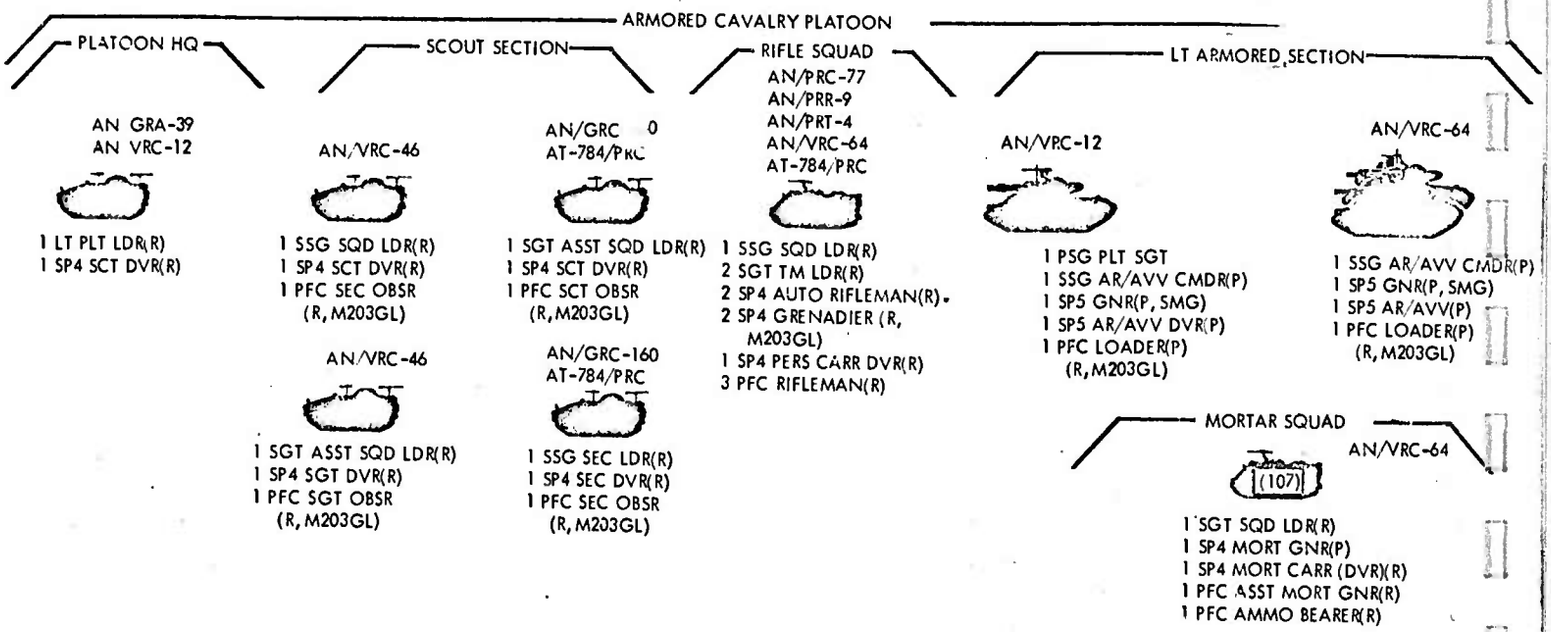


WEAPONS

Launcher Grenade M203 for XM16E1 Rifle	23
Machinegun 7.62-mm Lt Flexible	6
Mortar 81-mm On Mount	3
Pistol Cal .45 Automatic	31
Rifle 5.56-mm WE	140
*Rifle Recoilless 90-mm	6

Company C, 232d Inf. Bn

Figure 3



1st Platoon, 222d Armd Cav Troop

Figure 4

UAR Force Structure

1st UAR Volunteer Support Team
2nd UAR Volunteer Support Team
3rd UAR Volunteer Support Team

UAR 3rd Motorized Rifle Division
- 3rd Hq & Hq Elements
- 3rd Service Battalion
- 3rd Signal Battalion
- 3rd Engineer Battalion
- 3rd Recon Company
- 3rd Medical Battalion
- 3rd Frog Rocket Battalion
- 3rd Anti-tank Battalion
- 3rd Motor Transport Battalion
- 3rd AAA Battalion
- 301st Artillery Brigade
- 301st Tank Brigade
- 301st Motorized Rifle Brigade
  - 311th Motorized Rifle Battalion
  - 312th Motorized Rifle Battalion
  - 313th Motorized Rifle Battalion
  - 314th Tank Battalion
- 302nd Motorized Rifle Brigade
  - 321st Motorized Rifle Battalion
  - 322nd Motorized Rifle Battalion
  - 323rd Motorized Rifle Battalion
  - 324th Tank Battalion
- 303rd Motorized Rifle Brigade
  - 331st Motorized Rifle Battalion
  - 332nd Motorized Rifle Battalion
  - 333rd Motorized Rifle Battalion
  - 334th Tank Battalion

3rd UAR Motorized Division

Figure 5

5. PROBLEM ANALYSIS

As soon as the UAR force on the other side of the barricade opened fire, the U.S. forces returned the fire from their positions in Mellah Plaza and in the Ksibet Nhas. It soon became apparent to the Company Commander that his force was not going to be able to remain in their present positions. The UAR force opposing them was much larger and included at least one company of T-60 tanks. C Company Commander ordered his force to withdraw to their next defensive positions, some 100 meters back from the barbed wire barracade. The 1st Platoon and the Cavalry Platoon remained in position to cover the withdrawal. The withdrawal was orderly, but not accomplished without casualties. The UAR force pressed its attack and the 1st Platoon and the Cavalry Platoon were forced to disengage and withdraw before the remainder of the company was in position. Although some of the UAR tanks were knocked out, the Cavalry Platoon had also lost most of its armored vehicles. Damage to buildings and houses in the area was extensive. The UAR force then moved forward and occupied the Mellah Plaza and the Post Office building, thereby cutting off the only open entrance to the palace. Under heavy fire from the UAR forces, the Commander of C Company was able to recover the remainder of the 1st Platoon and Cavalry Platoon and deploy his force in the new defensive positions from where they continued to engage the enemy. The UAR force did not press its attack any further and appeared to be content with the newly acquired positions.

The current doctrine applied in this situation accomplished the withdrawal with available weapons but not without heavy friendly casualties, both personnel and material. The conditions under which the withdrawal took place were far from ideal; at close ranges, in an open area, and against a force superior both in number of personnel and in firepower. Had the UAR force pressed its attack, it is doubtful that C Company and the Cavalry Platoon could have made it out of the walled city. Damage to the buildings in the area was extensive - caused mainly from the tank and anti-tank weapons. Houses along the routes to the new defensive position were also damaged from enemy fire at the withdrawing U.S. force. Additionally, many civilian

casualties occurred as a result of this action - most being caught in buildings that were hit by the heavy small arms and the tank versus anti-tank fire. These drawbacks (high friendly personnel and material casualties, civilian casualties, extensive damage to buildings, and the inability of the defending friendly force to keep open the only route to the palace) indicate that alternative responses should be considered.

6. RESULTS OF ANALYSIS

The U.S. forces needed concealment while they fell back across the open plaza and down the streets to their new positions. Quick-acting smoke devices would have helped, either carried by the infantry or mounted on the armored vehicles. The smoke needed for this situation need not persist for more than five minutes, but it should form an effective curtain to observation within fifteen seconds. Another approach is a quick-acting, nonpersistent combination of smoke and blinding chemical agent. Projected into the UAR forces, it would temporarily interfere with their ability to see and to fire effectively. Concealment could also be provided by a foam device that would rapidly produce a linear barrier across a street, blocking observation. The foam barrier need not last long, nor stop movement.

A heavy and punishing fire can suppress the enemy fire and similarly give friendly troops a break in which to make their withdrawal. The M16 rifle/M60 machine gun combination in U.S. infantry platoons produces a good volume of fire, but not enough in this case to equalize the superior numbers of the UAR troops. High-volume-of-fire weapons, such as 5.56mm miniguns, mounted on armored vehicles could deliver effective suppressive fire in street fighting. The rapid fire 40mm grenade launcher used on armed helicopters is another possible weapon for armored vehicles. The main armament on armored vehicles should be provided with a high proportion of antipersonnel rounds, such as canister or flechettes, when operating in cities to give them a high volume of antipersonnel fire.

7. ALTERNATIVE RESPONSES

Foam-generated barriers may be feasible for rapid concealment and even for rapid cover in future urban warfare. If a flexible, linear device like a section of fire hose could be stretched across a street and activated to produce rapidly a foam barrier, friendly troops would be given a few minutes for movement, emplacement of weapons, construction of more substantial barriers, or other activities. If the foam barrier could be made bulletproof, instant armor would result. Alternately, it might be possible, chemically or mechanically, to make the foam dangerous to touch. Any such device would require either self-destruction or easy removal by some technique available to friendly forces.

High volumes of antipersonnel fire delivered from aircraft capable of flying in the street canyons of central cities would also suppress enemy ground fires. The weapons systems for this response are available but helicopter performance would have to be evaluated carefully for low and slow flight in the city. Short range but maneuverable weapons platforms might have to be developed.

Agents for making movement on city pavements difficult for infantry and for tracked vehicles would slow the pursuit of withdrawing friendly forces. Such "instant banana peel" has been developed for police use against rioters. Liquid soap and motor oil was poured on the streets to stop Russian tanks in the Budapest fighting in 1956. Development of better agents for this purpose would assist forces defending in cities. Devices similar to current flamethrowers, (both manportable and tank or personnel carrier mounted) could be used to dispense these agents in combat.

SOUTH AMERICA - EL CONDOR

TECHNICAL PROBLEM RESUME

Problem: Firepower 21	Date: 31 Oct 72	Sheet 1 of 13
Operational Area: EL CONDOR		
Title: ESTABLISH A REACTION FORCE		

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TECHNICAL PROBLEM RESUME

Problem: Firepower	Date: 31 Oct 72	Sheet 2 of 13
Operational Area: EL CONDOR		
Title: ESTABLISH A REACTION FORCE		

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para. 7.4.a(3).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, Vol. II, Appendix C, Annex V.
c. U.S. Infantry Reference Data, ST-7-157, FY 72.
d. U.S. Army FM 7-10, The Rifle Company, Platoons and Squads.
e. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, Mar 64.

2. DESCRIPTION OF PROBLEM

Infantry moving under small-arms fire across open areas takes serious casualties.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Study the feasibility of developing an extremely high volume of fire (such as 1000 projectiles per second), direct fire weapon for the infantry for suppressive fires.

b. Study the feasibility of producing an air transportable armored vehicle mounting a high volume of fire weapon. Existing and new automatic weapons, snowmobile-type suspension, and ceramic armor are possibilities for investigation.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

In reply to a request from the Government of Carebobo for military support in suppressing the revolution, the U.S. Government dispatches the 401st Infantry Brigade to El Condor. Since the airfield at El Condor is still in government hands, C-141 aircraft airlift the brigade and its equipment into El Condor.

By 0800 hours, 12 September 1975, the advance elements of the brigade arrive at El Condor. During the landings, a large group of civilians is seen crossing the edge of the airport from the direction of Avenida Araura. Since there is concern that these civilians may interfere with the landing operations, the Commander of the advance detachment dispatches a team of 4 U.S. Military Policemen (MP) in a jeep to identify the group and to control the movement of the civilians in this area of the airfield. As soon as the jeep nears the civilians, they brandish previously concealed small arms and begin shooting at the four MP's. The MP's are immediately killed

and the hostiles move forward and occupy the stream bed between the airport and Avenida Araura. From there, they continue to harass the U.S. landings with sporadic small arms fire.

Upon his arrival, the Commander of the 401st Brigade orders the 432nd Infantry Battalion to secure the airfield. The battalion deploys around the perimeter behind a previously installed sensor line. Company A of the 432nd Infantry Battalion is assigned the perimeter area of the airfield facing Avenida Araura. As Company A moves into position, it comes under fire from the hostiles occupying the stream bed between the airport and Avenida Araura. At a distance of approximately 50 yards from their assigned defensive position, Company A begins receiving intense small arms fire and the company commander orders the company to halt and take the enemy force under fire.

b. Characteristics of the Area of Operations

The city of El Condor, (see Figure 1) with a population of slightly over 2,000,000, is located in a narrow valley no more than three miles wide, between 4,000 feet high mountains to the north and a series of hills several hundred feet high to the south. The valley is just nine miles from the coast as the crow flies and at an elevation of 3,104 feet above sea level. El Condor is connected with the El Condor International Airport by an expressway (see Figure 1). The airport is one of the most modern airports in South America. The runway is long enough to accommodate the largest of the world's commercial airplanes. The passenger terminal building is a combination of reinforced concrete construction with much glass. On the other side of

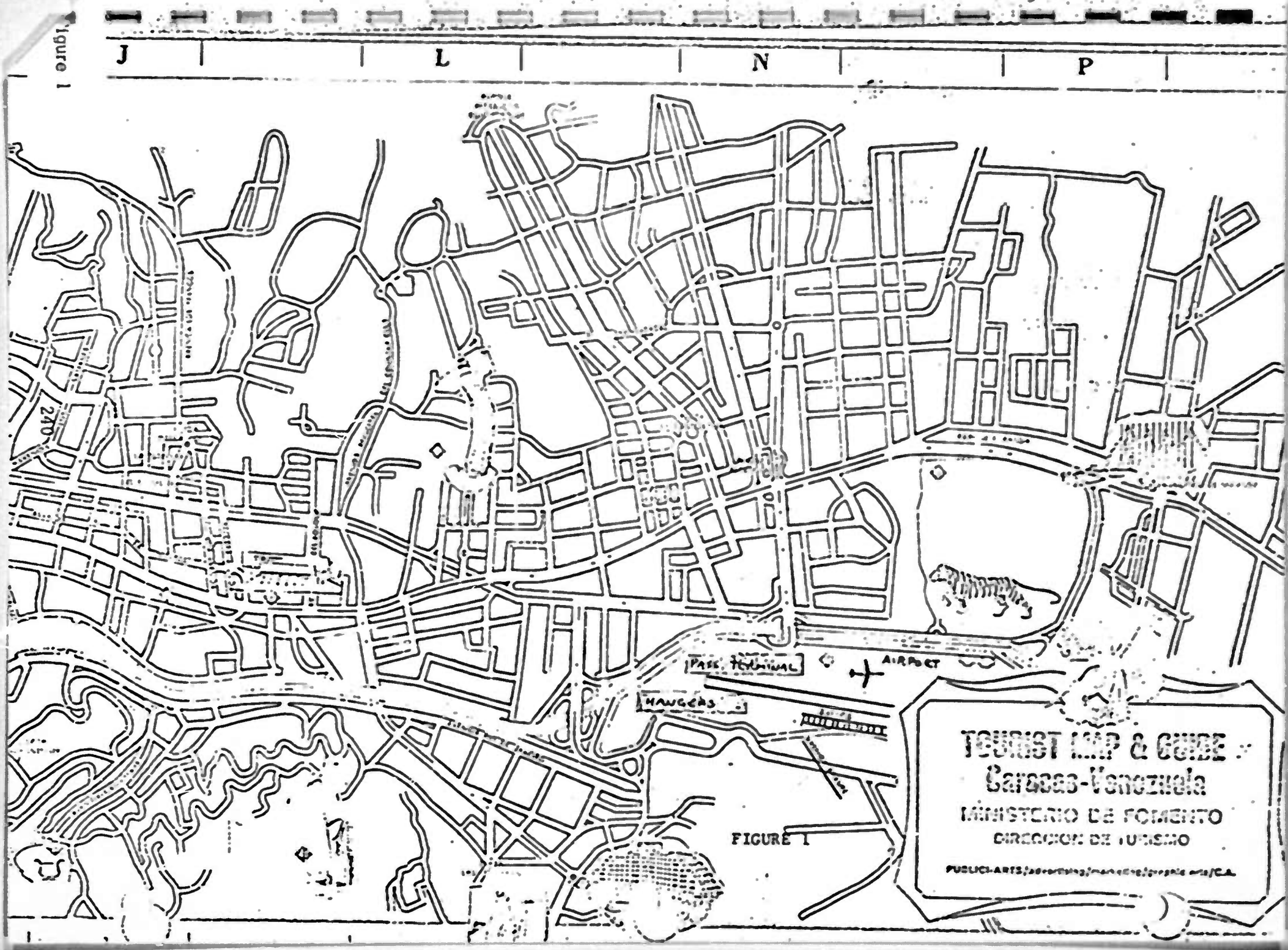

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PASS. TERMINAL
AIRPORT
HANGARS
TOURIST MAP & GUIDE
Caracas-Venezuela
MINISTERIO DE FOMENTO
DIRECCION DE TURISMO

FIGURE 1

the runway are the huge steel hangars and maintenance shops used by the world and national airlines that service El Condor.

The significance of El Condor is based upon its geographic location and its development as the leading governmental, commercial and educational city in the country. The local headquarters of many U.S. companies operating in the country are in El Condor.

c. Description of Own Forces

(1) The U.S. Force in El Condor is the 401st Infantry Brigade. Upon arriving, the Brigade established its CP in the passenger terminal of the airport. The organization of the brigade is shown on Figure 2.

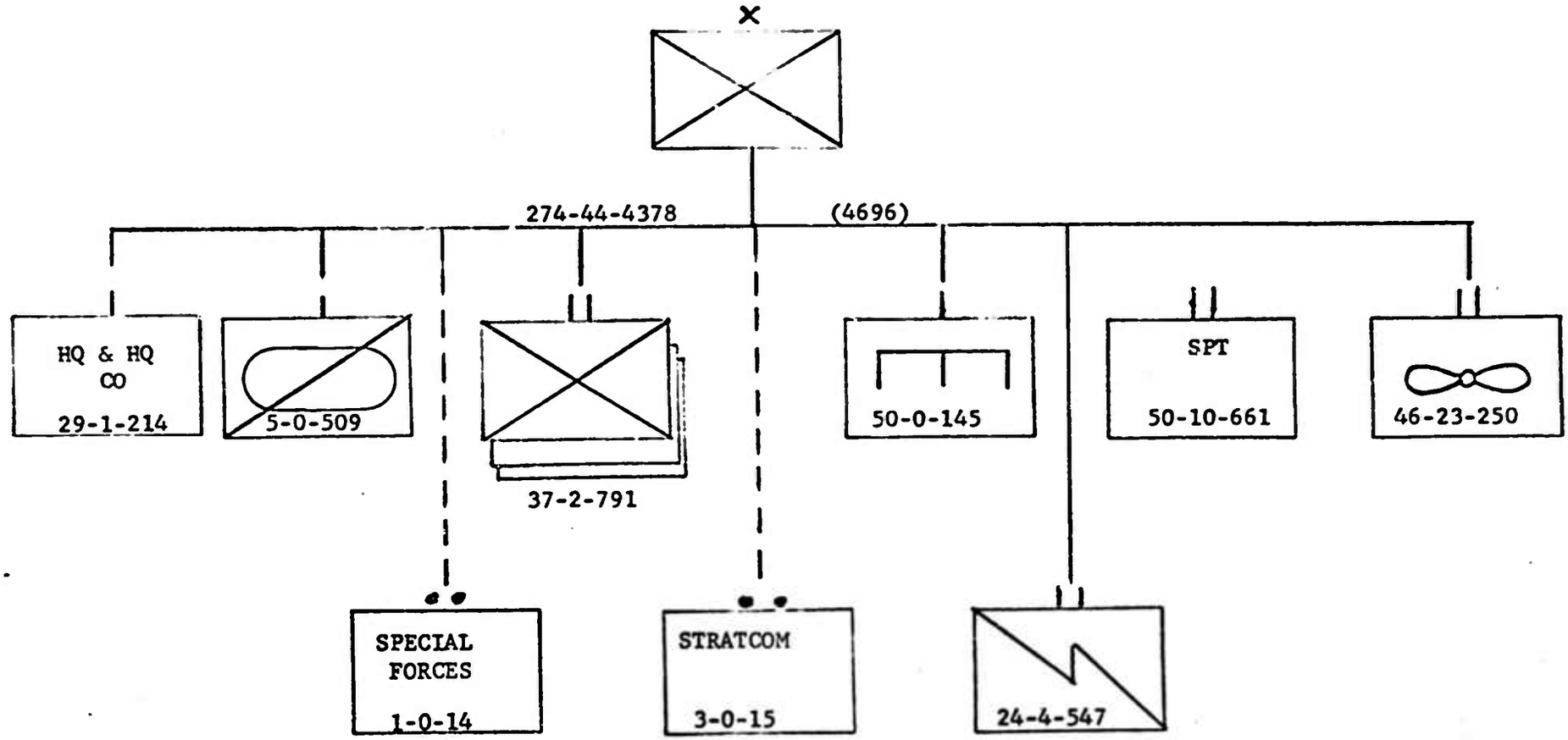
(2) The airfield defense force is the 432nd Infantry Battalion. The U.S. force involved in this event is Company A, 432nd Infantry Battalion. It is deployed along the airfield perimeter facing Avenida Araura. The company CP has been established in one of the maintenance shops. The organization of the company is shown in Figure 3.

d. Description of Enemy Forces

The 100 man Carabobo Revolutionary Movement (CRM) force involved in this event are members of the Immobile Force, a paramilitary unit of the El Condor Regiment. Their mission is to disrupt the U.S. landing operations. They are armed with rifles, hand grenades, and three light machine guns.

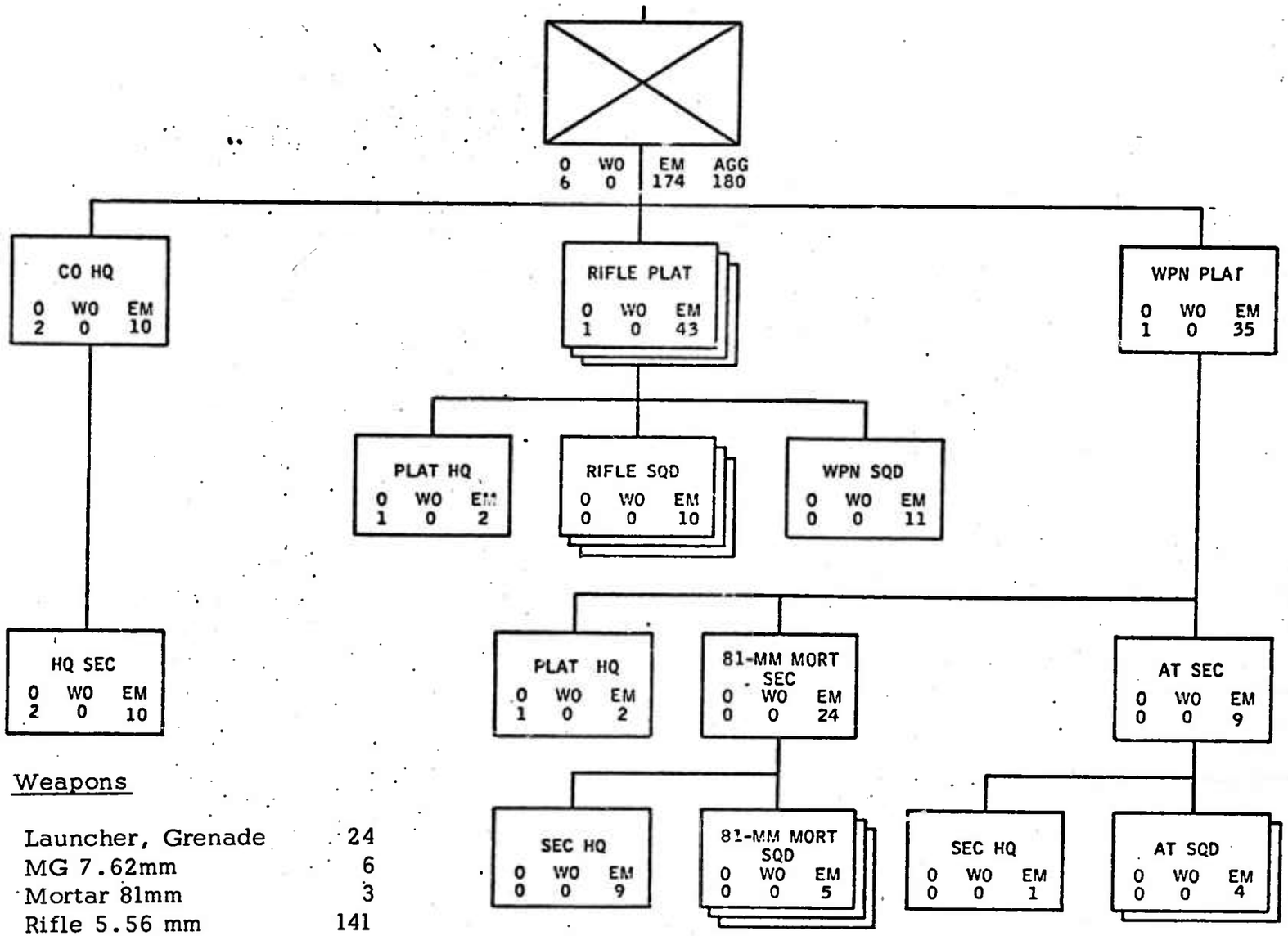
5. PROBLEM ANALYSIS

Company A, 432nd Infantry Battalion had moved forward from the terminal building with two rifle platoons abreast, 1st Platoon on the right,



U. S. Organization - U. S. Army 401st Infantry Brigade

FIGURE 2



Weapons

Launcher, Grenade	24
MG 7.62mm	6
Mortar 81mm	3
Rifle 5.56 mm	141
Rifle Recoilless 90mm	6
Rifle Recoilless 106mm	2

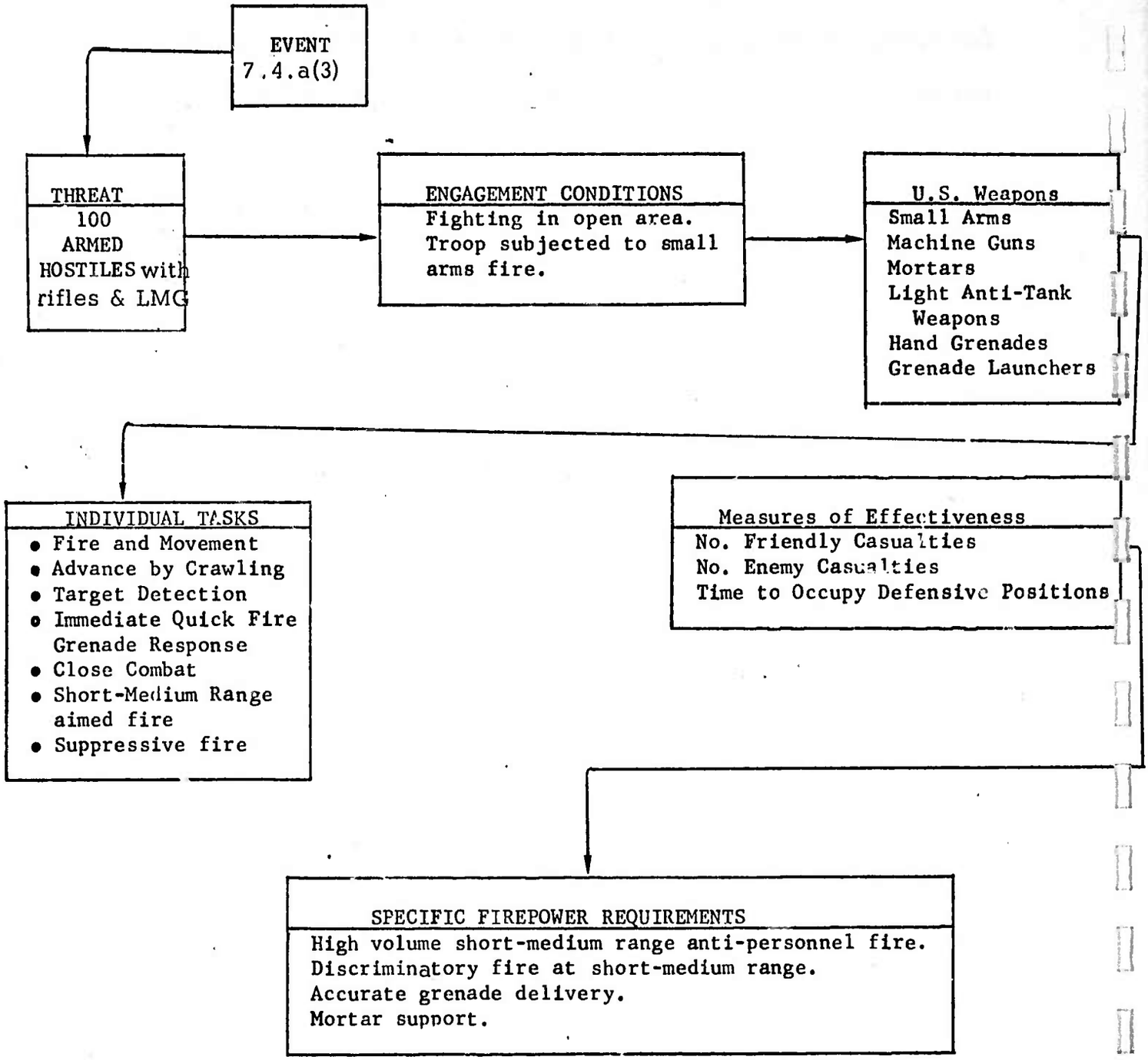
RIFLE COMPANY

Figure 3

2nd Platoon on the left, with frontage of 300 meters. The Weapons Platoon followed in column, prepared to render supporting fire. The 3rd Platoon followed the Weapons Platoon as the company reserve, responsible for protecting the company flanks and rear. When the perimeter area was reached, the mortar section established positions near the maintenance shops. The AT section remained with the mortar section, prepared to move out should enemy mobile units be detected. The Company CP was established in the Varig airlines maintenance shop.

All personnel had been briefed that there were enemy hostiles and civilian noncombatants in the area. If fired upon, they were to return fire and engage all CRM hostiles. The situation is summarized in Figure 4, which shows the tasks to be accomplished by the soldiers.

To accomplish the mission, Company A moved out across the airfield from the passenger terminal towards its assigned defensive position. As the lead elements neared the perimeter and were approximately 300 meters from the stream bed, the CRM hostiles opened fire with intense rifle and automatic weapons fire. Because Company A was exposed, the lead elements suffered many casualties. Attempts to move forward by fire and maneuver were only partially successful. The enemy, firing from well protected positions along the stream bed kept up a devastating fire. The lead platoons, although they were returning the fire, could not gain fire superiority. The company commander then ordered the mortar squad to set up and fire for registration. Additionally he ordered the rifle grenadiers from the 3rd Platoon to provide covering fire for the 1st and 2nd Platoons. Shortly



FIREPOWER EVENT

ESTABLISH A REACTION FORCE

FIGURE 4

thereafter, the mortars completed registration and fired on the enemy positions. Hostiles fire was quickly reduced as their casualties mounted. The company commander ordered the 1st and 2nd Platoons to move forward into their planned defensive positions along the perimeter without further harassment. The remnants of the CRM force ceased fire and withdrew across Avenida Araura.

Localized screening by the use of smoke or tear gas would have been effective in this situation. Had the reaction force been able to move out to its defensive positions against an enemy obscured by smoke, both material and personnel casualties would have been much less. However, the use of smoke or gas near the airfield could have interfered with the use of the airfield by the U.S. forces. A change in wind or in atmospheric conditions could have resulted in having to close the airfield.

Artillery and air strikes could have been used against the CRM Forces, assuming that they were available this early in the U.S. operations. However, with aircraft landing and taking off while this action was in progress, the use of either would have required closing the airport to flight operations at a critical stage of the U.S. buildup.

Had the U.S. company had available in the rifle platoons a short to medium range small arms weapon capable of delivering a high volume of suppressive fire immediately, the number of friendly casualties would probably have been reduced.

Another alternative may be the development and use of a light weight air transportable armored vehicle. A vehicle such as this would have been

most effective against the CRM force in this situation. However, these vehicles without adequate covering fire can become very vulnerable in the close confines of city combat, especially when the enemy has anti-tank weapons.

It is possible that portable shields of lightweight armor could have reduced friently casualties by prcviding additional cover in the open areas.

6. RESULTS OF ANALYSIS

The current doctrine applied in this situation accomplished the task with available weapons but not without heavy friendly casualties. The conditions under which this action took place were far from ideal. The CRM force was in well protected defensive positions while the U.S. force was in the open with virtually no cover available. The action was fought at medium to short range where the CRM force small arms fire proved most effective. Additionally, the U.S. forces had only just arrived on the scene and had not yet brought supporting weapons into the area. Because of the difficulty encountered by Company A in occupying its defensive positions alternative responses should be considered.

Possibly the use of an air droppable or air deliverable lightly armored vehicle would enhance the infantry man's capability, assuming that existing heavier armor could not be made available. A small, low silhouette one or two man mini-tank armed with a .50 cal or 20 mm machinegun could be useful. An inexpensive vehicle is visualized, perhaps with a ceramic covered turtle shell over a snowmobile type drive assembly.

Further, a gatling shotgun which is capable of producing a "wall" of projectiles could be used as a suppressing agent. A 12-guage 0-0 buckshot round with nine pellets to the round would produce a hail of grape shot at close range if fired at 3000 rounds per minute. A few seconds of fire would be effective in suppressing enemy soldiers.

7. ALTERNATIVE RESPONSES

Investigate concepts for portable armor for use by the individual soldier against small arms fire. The armor may be carried or pushed using a wheelbarrow or roller action.

TECHNICAL PROBLEM RESUME

Problem: Firepower 22	Date: 3 Nov 72	Sheet 1 of 19
Operational Area: EL CONDOR		
Title: Attack on Enemy Stronghold		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 22	Date: 2 Nov 72	Sheet 2 of 19
Operational Area: EL CONDOR		
Title: Attack on Enemy Stronghold		

1. REFERENCES

a. GTE Sylvania Special Technical Report, Para. 7.4.b.(2), (3), and (4) and 7.7.b.(4).
b. ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, Vol. II, Appendix C, Annex V.
c. U.S. Infantry Reference Data, ST-7-157, FY 72.
d. U.S. Army FM 7-1^, The Rifle Company, Platoons and Squads
e. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, Mar. 64.

2. DESCRIPTION OF PROBLEM

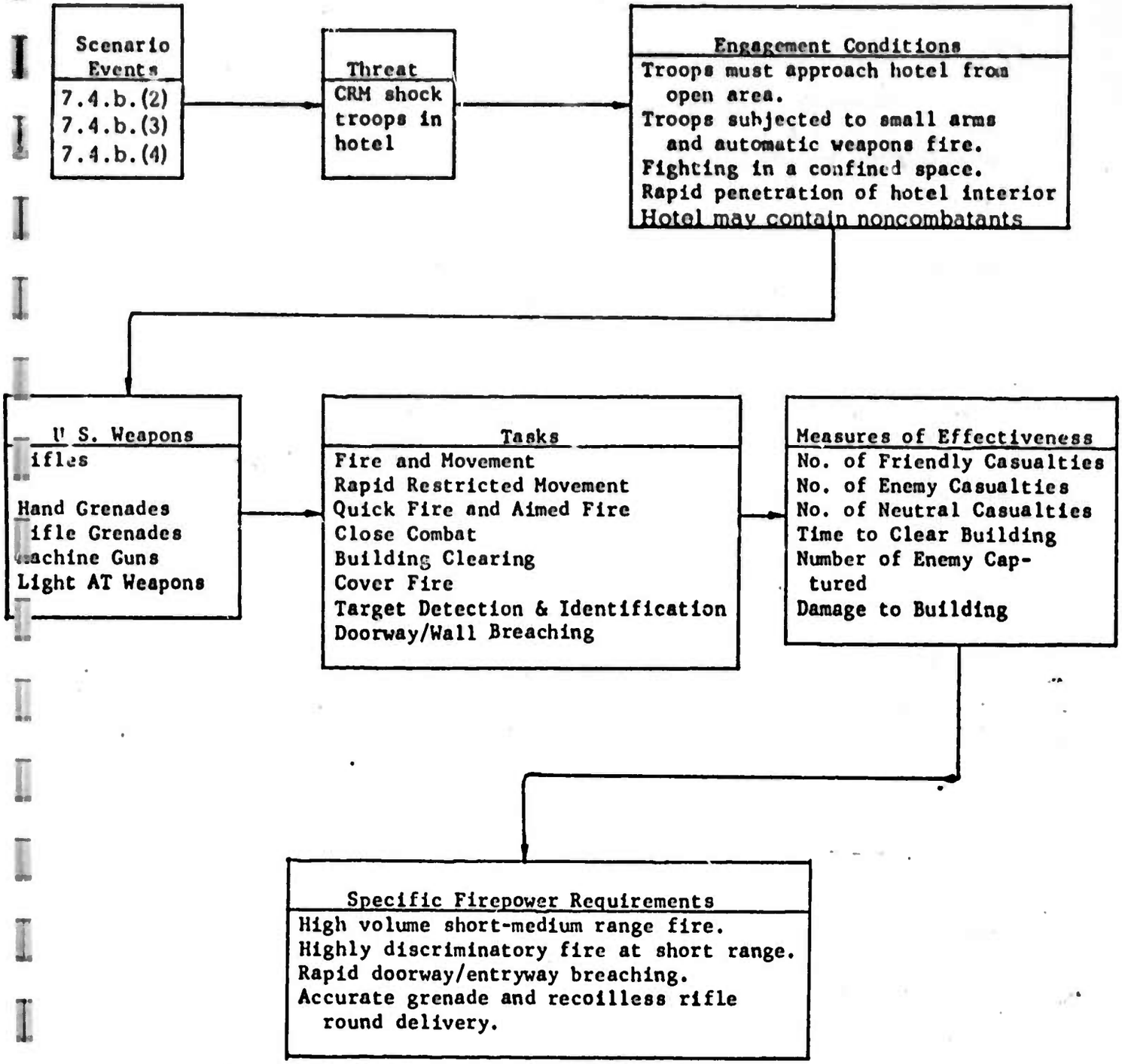
An infantry unit conducts a room-by-room clearing operation in a reinforced concrete highrise building. The defenders are determined, there is confusion over the location of civilian noncombatants, and building damage is to be limited as much as possible. Unique firepower problems are presented to the commander and current weapons and procedures are ill-suited to solve them.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Review and analyze the characteristics of current and projected nonlethal irritant gas rounds for infantry weapons to determine their applicability to city combat. If there are shortcomings in current agents and munitions, prescribe the specific operational characteristics that must be changed to improve the round's utility; e.g. can the agent be delivered in concentrations that will drive determined defenders out into a capture-or-death situation?

b. Evaluate muntions and device s for breaching walls. Munitions to be evaluated include the commerical product Jet-Axe, the rocket propelled foxhole digging device, prepared military shaped charges, and advanced demolitions.

c. Analyze methods of producing, screening smokes for use in partitioning areas. Determine the characteristics required such as persistence, speed of cloud formation, and density.



FIREPOWER EVENT

CONDUCT THE ATTACK/BUILDING PENETRATION

Figure 1

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

During the landing operations at the airport, the commander of the 401st Infantry Brigade is notified by the brigade Air Force liaison officer that Air Force aircraft on final approach are coming under small arms fire from the direction of the Tamanco Hotel. The brigade commander had also been notified by the commander of the battalion securing the airport that the company on the perimeter opposite the Tamanco Hotel was under sporadic small arms fire from the hotel. Local authorities believe that the hotel is "in rebel hands", but cannot say whether it has been cleared of civilian noncombatants.

The 433nd Infantry Battalion (less Company A, which is the brigade reserve) with the 1st platoon of the 422nd Armored Cavalry Troop attached is ordered to clear the enemy forces from the Tamanco Hotel.

The 433nd Battalion moves by truck with the 1st Armored Cavalry Platoon as the advance guard. As the force nears the rubble remains of the Calle-Les-Mercedes overpass, which was earlier destroyed by the rebels, they come under heavy small arms fire from the rebel force in that area. The armored cavalry platoon engages the rebel force in the area of the overpass and provides covering fire as the battalion dismounts, deploys, and moves on foot towards the hotel. The battalion commander moves forward to reconnoiter the hotel and prepare his plan of attack.

The battalion commander completes his planning and gives the following order to his company commanders. Company B will move into the hotel with elements in position to return fire if fired upon. The elements moving will take advantage of the limited cover available in the area. Company B will continue

to move forward through the parking lot in front of the hotel, which is the final coordination line.

Company C will take up firing positions along the access road leading to the parking lot in front of the hotel. From here it will be prepared to furnish covering fire on battalion order to support the advance of Company B. It will be prepared to fire small arms machine guns and recoilless rifles on order into each window of the upper floors of the hotel from which fire is detected, and also at any CRM hostiles attempting to leave the building. Company C will also provide for flank and rear security along Autopesta-Del-Este.

Company B will enter the hotel, and clear the main floor of the hotel. Each floor will then be cleared in turn. On each floor, every room will have to be entered and checked for CRM hostiles. The Company Commander will report as each floor is cleared and as the next floor is entered, in order to prevent accidental fire on his men by Company C. Since it is not known how many rooms are occupied by civilian noncombatants, only aimed fire will be employed after target detection and identification. Civilian noncombatants will not be fired on. Hand grenades will be used in a room only after it has been determined that the room is occupied by CRM hostiles. Company and battalion mortars will be prepared to fire in order onto the hotel roof and on the grounds around the hotel building.

After the hotel has been cleared of the CRM hostiles, Company B will occupy the hotel and prepare to repel the CRM in any attempt to recapture the hotel. All civilian noncombatants will be evacuated with the remainder of the battalion, which will return to the airport. The situation is summarized in Figure 6 which shows the individual tasks that must be accomplished by the

individual soldiers.

b. Characteristics of the Area of Operations

The city of El Condor, (See Figure 2) with a population of slightly over 2,000,000 is located in a narrow valley between 4,000 feet high mountains to the north and a series of hills several hundred feet high to the south. The valley is nine miles from the coast and at an elevation of 3,104 feet above sea level. The original center of El Condor is still the center of the town, and is connected with the El Condor International Airport by an expressway. The airport runway is long enough to accommodate the largest commercial airplanes. The passenger terminal building is very modern and is built of reinforced concrete construction with much glass. On the other side of the runway are the maintenance hangars and shops. The steel hangars and maintenance shops are used by the various world and national airlines that service El Condor.

The Tamanco Hotel is located on the outer edge of the airport near the Calle-les-Mercedes overpass just off the Autopesta-Del Este. The hotel is eight stories high and is constructed of stone and reinforced concrete. The upper windows are recessed, making it difficult to shoot straight down without exposing the upper half of the body. The lower floor of the hotel contains the lobby, a restaurant, many small shops, and offices. The upper floors are served by two stairwells, one at each end of the hotel, and also by a system of three elevators.

The significance of El Condor is based upon its geographic location and development as the leading governmental, commercial and educational city in the country. The local headquarters of U.S. companies operating in the

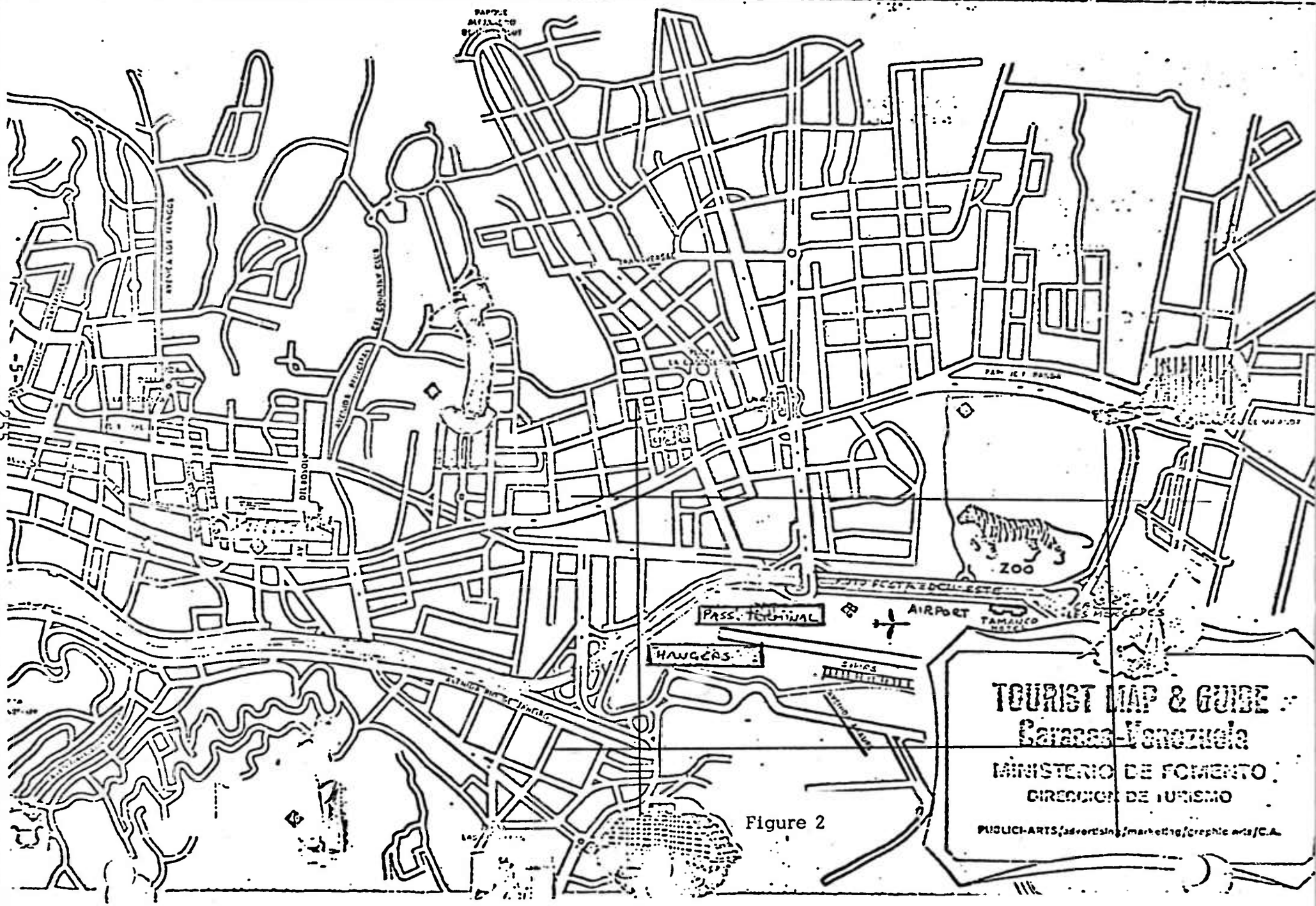

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PUBLICI-ARTS/advertising/marketing/graphic arts/C.A.

Figure 2

co.ntry are to be found in El Condor.

c. Description of Own Forces

(1) The U.S. force in El Condor is the 401st Infantry Brigade. Upon arriving, the Brigade established its CP in the passenger terminal of the airport. The organization of the brigade is shown on Figure 3.

(2) The 433nd Infantry Battalion, less Company A, is ordered to clear the Tamanco Hotel. The battalion organization is shown in Figure 4; the organization of its rifle companies is shown in Figure 5.

(3) The 1st Platoon of the 422nd Armored Cavalry Troop is attached to the 433rd Infantry Battalion. The organization of the 422nd Armored Cavalry Troop is shown in Figure 6.

d. Description of Enemy Forces

The Carabobo Revolutionary Movement (CRM) force occupying the city is the El Condor Regiment. The regimental CP is located in the Presidential Palace. The CRM force occupying the Tamanco Hotel are members of the shock troops of the regiment. There are approximately 100 men, armed with individual weapons and grenades, and have the mission to hold the hotel and to disrupt the landing operations presently going on at the airport.

5. PROBLEM ANALYSIS

The battalion commander orders Company B to move forward and enter the hotel. They come under heavy small arms fire immediately from the upper floors of the hotel. The battalion commander orders both companies to open fire at observed enemy firers only, with rifles, rifle grenades, and machine guns. The enemy fire continues. Company B, although taking casualties, moves

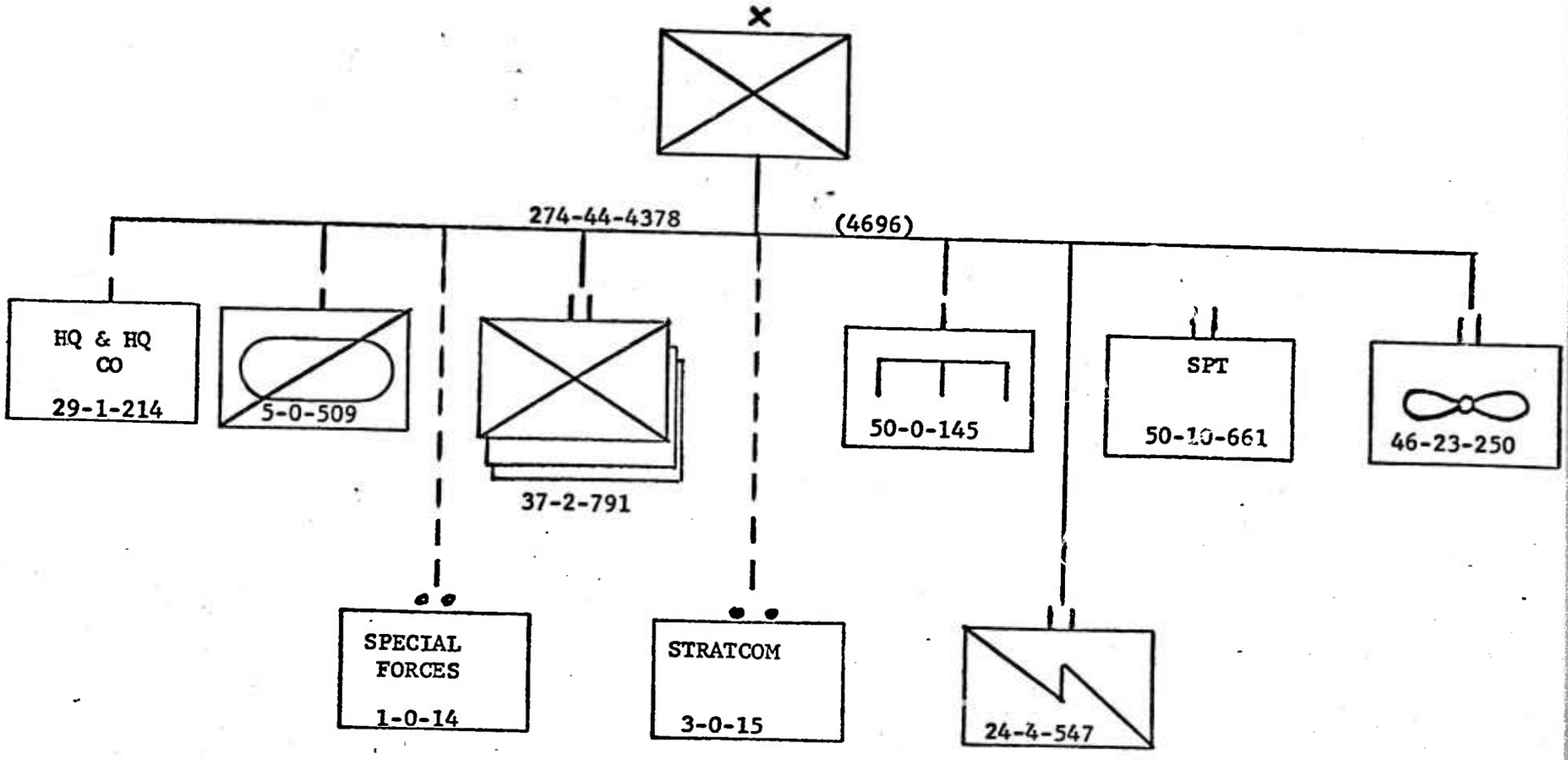
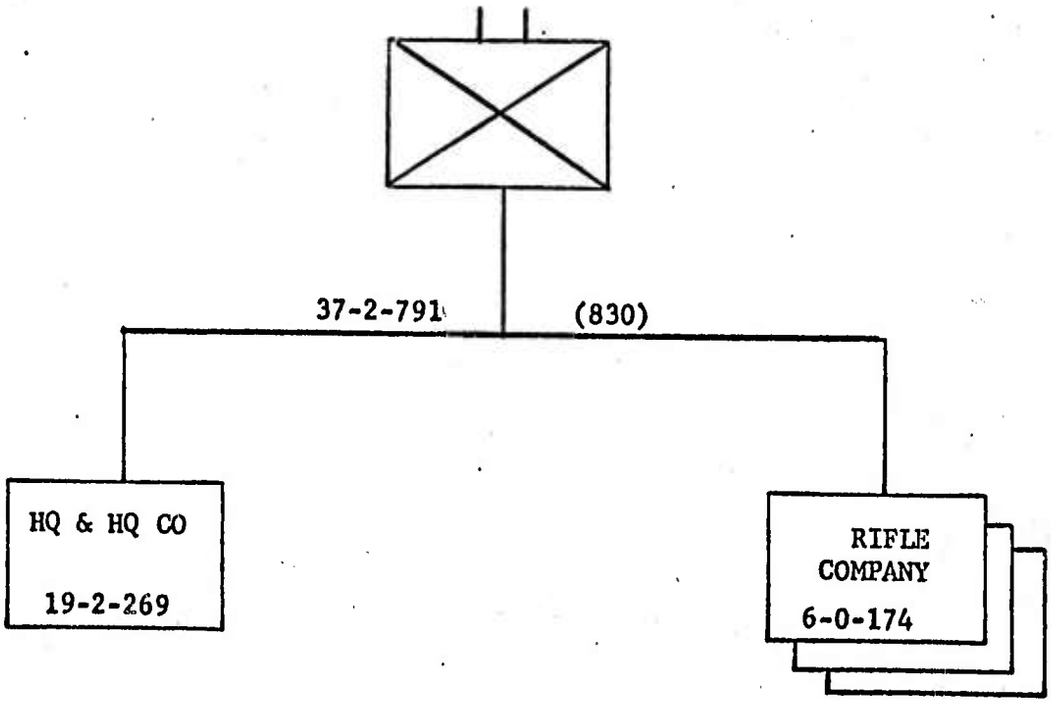


Figure 3
257

U. S. Organization - U. S. Army 401st Infantry Brigade



WEAPONS

Launcher Grenade M203 for XM16E1	86
Machinegun 7.62-mm Light Flexible	28
Mortar 81-mm On Mount	9
Mortar 4.2 Inch On Mount	4
Rifle, 5.56-mm	678
Rifle Recoilless 90-mm	18
Rifle Recoilless 106-mm On Mount	6

U.S. Organization - U.S. Army, 433rd Infantry Battalion

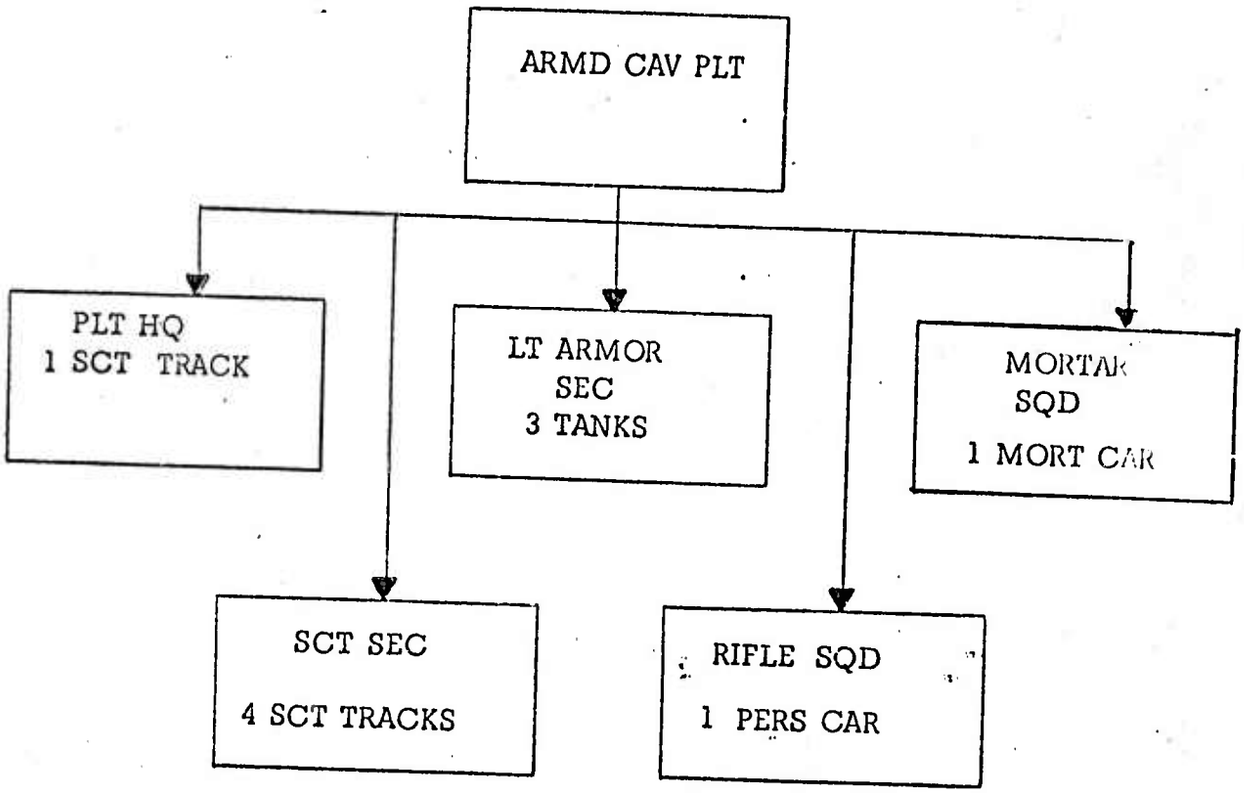
Figure 4

WEAPONS

Launcher, Grenade 40 mm	24
MG 7.62 mm	6
Mortar 81 mm	3
Rifle 5.56 mm	141
Rifle Recoilless 90 mm	6
Rilfe Recoilless 106 mm	2

Rifle Company

Figure 5



Armored Cavalry Platoon

Figure 6

forward using fire and movement and available cover and enters the hotel. Once inside they encounter a large group of civilian noncombatants who say that the upper floors of the hotel have been taken over by the rebels. All of the occupants of the hotel had been forced to vacate their rooms and assemble in the lobby of the hotel. Several have been hit by the U.S. fire.

The only way to get upstairs in the hotel is by stairway, since the electricity in the building is off. The Company B commander orders the 3rd Platoon to remain on the main floor to be prepared to support the 1st and 2nd Platoons if necessary. He then orders the 1st and 2nd Platoons to prepare to enter the stairwell, 1st Platoon on the left stairwell and 2nd Platoon on the right stairwell. The company commander contacts the battalion commander and asks for help in evacuating and treating the civilians. He informs him that all the occupants of the upper floor can be considered hostile, and that he is prepared to move up to the second floor. The Battalion Commander acknowledges this information, and, in light of the fact there are probably no civilian non-combatants in the upper floors, tells the company commander that all personnel that they come into contact with on the upper floors should be considered hostile. He further directs the company commander to use hand grenades to clear out each room on each floor as they ascend upward through the hotel. The battalion places fire on the third floor and the two platoons move up the stairwell. Upon reaching the second floor, they are immediately engaged by a group of rebels in the hallway. After a brief firefight during which the rebels are killed, the platoon begins checking each of the rooms. The doors of the rooms are forced open, hand grenades tossed in, then the soldiers rush in and engage the

occupants. Only about 10 rooms on the second floor were occupied by the rebels. The rebels were soon cleared out and the company was ready to ascend to the third floor. The Company Commander notified battalion that the second floor had been cleared, and after the supporting fire was shifted to the fourth floor, he ordered the platoons to continue their ascent. This process was repeated as the platoons moved to the upper floors. However, as the platoons moved up through the hotel, they encountered more and more rebels and the fighting became more and more intense. By the time they have cleared the 5th floor, Company B had taken 20% casualties and they find the stairways to the 6th floor have been sealed with a masonry wall. The company cannot advanced to the three upper floors unless the wall can be breached. Battalion is notified.

The battalion commander orders Company B to evacuate the 5th floor except for enough men to keep the 6th floor stairwells under surveillance. The rest of the company is to assemble in a covered area outside of the hotel and prepare to reenter to clear the top three floors on order. He then orders Company C to keep the top three floors under observation and to fire at enemy who are seen. Whenever an aircraft approaches to land, Company C is to fire suppressive fire into the windows that face the airport. Only rifles, machine guns and rifle grenades will be used in order to limit damage to the building. He then contacts brigade, reports the situation, and asks for assistance from the brigade engineers in breaking into the 6th floor. He also asks for someone with loudspeakers, preferably from the local government, to try to talk the PRM into surrendering.

Brigade replies that the engineer company is fully occupied with higher priority work and that it will be several hours before they can send a demolitions team to assist the battalion. They (brigade) will attempt to contact local authorities about loudspeakers and negotiators, but that will take some time. Meanwhile, two Spanish-speaking sergeants from the attached Special Forces unit will be sent to the Tamanco Hotel as soon as they return from a patrol. The brigade commander approves the battalion plan for suppressive fire, but warns against any further civilian casualties. He adds that the battalion must not start any fires in such a conspicuous building as the Tamanco because of the bad effect on the local population. The event ends at this point.

The current doctrine and weapons applied in this situation were not successful. The battalion was unable to complete the seizure and occupation of the hotel. Had an engineer detachment been assigned to the battalion, the sealed stairway to the upper three floors of the hotel could have been breached and the task of clearing out the rebels from the hotel completed. A psychological operation might also have completed the job. Even as far as they were able to carry out the task, the battalion suffered heavy casualties in one company. The conditions under which this action took place (at close ranges, in a confined area in the hotel, in confusion over hostiles and noncombatants) were not ideal. Damage to the hotel was extensive; the interior of the hotel was al most totally destroyed. Civilian casualties were light, but avoidable. Had the rebels kept the civilians in their rooms on the upper floors, as hostages, the entire clearing operation would have seen stalemated.

The major drawbacks in this situation were the civilian casualties, the heavy friendly casualties, extensive damage to the hotel, and the inability of the battalion to complete its assigned mission. These drawbacks suggest that other approaches should be evaluated.

Localized screening by the use of smoke or irritant gas would have been effective in this situation. Had the battalion been able to move up to the hotel with the hotel obscured by smoke; material, noncombatant, and friendly casualties would have been lessened. Gas could have been used also against the rebels in clearing the rooms, driving them out of the rooms and into the hallways. Since the U.S. forces had available protective masks and the rebels were without, the hotel could have been easily cleared assuming that an irritant but nonlethal gas powerful enough to force men out to surrender was available.

Artillery and air support could have neutralized the CRM forces in the hotel. However, the use of either would have forced the closing of the airfield until the attack had ceased. Either would have largely destroyed the hotel.

Had the attacking force available a short to medium range small arms weapon capable of delivering both high volume suppressive fire and providing for improved accuracy against individual targets in an enclosed area, the number of friendly casualties most certainly would have been reduced. A small arms weapon system with improved quick fire capability and individual salvo rounds satisfies this requirement.

The inability again to effectively suppress the firers in the upper floors of the hotel indicates the need for an accurate counter sniper weapon, a weapon not presently available to U.S. forces. Additionally, the attacking U.S. force required a sniper detection system. The small arms weapon system described above can be utilized to its maximum effectiveness if a sniper detection system is also available.

6. RESULTS OF ANALYSIS

Room-to-room searching via hallways is an extremely hazardous task normally involving a high friendly casualties. While operating in the hallways personnel are extremely vulnerable to fire from any doorways. Two techniques would be helpful. The first is the use of a wall breaching device similar to Jet Axe described in TPR 25 (Combat in Highrise Apartments), which allowed passage from room-to-room without using hallways. The second is the use of coordinated fire from covering troops on the outside. Using a CS penetrating round similar to the one described in figure 7 the individual enemy soldiers would be driven into the hallways which are covered by friendly fire. Such a device then reverses the positions of the opposing forces. The friendly troops can utilize cover rather than having to work in the open hallways.

CS rounds for room clearing need only dispense small amounts of gas. There is no requirement for persistence, so a quickly dissipating agent can be used. In this manner, the building is ready for use in a short time. This method is valuable in keeping collateral damage and neutral-enemy casualties to a minimum.

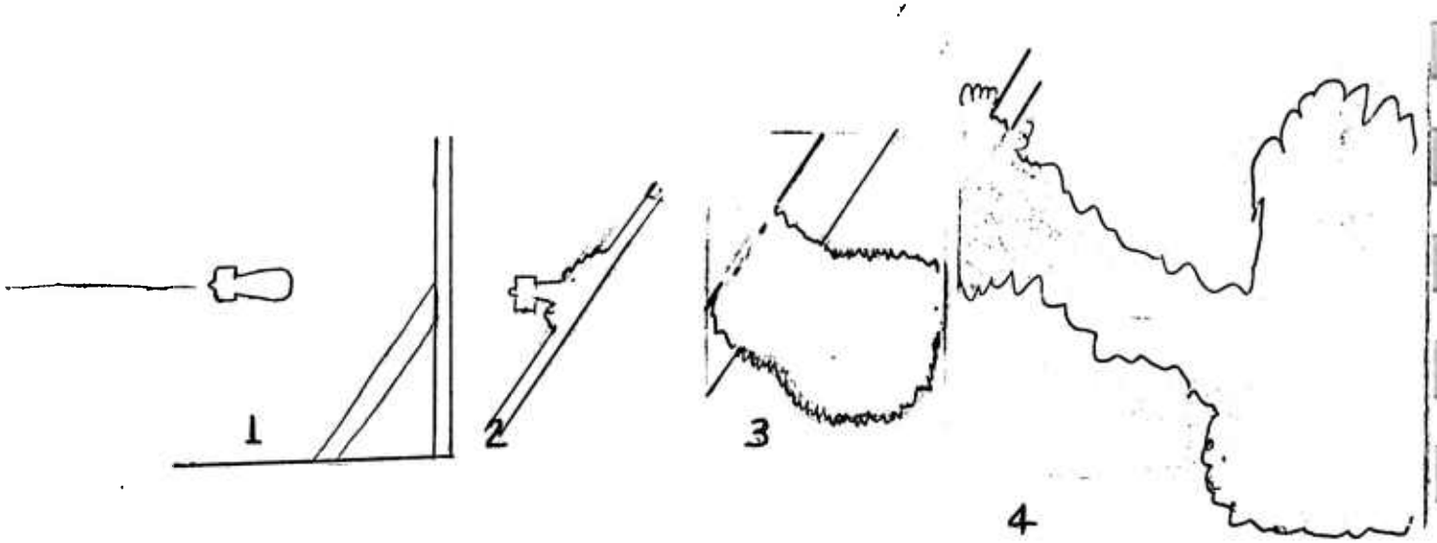
AAI Corporation

FERRET™*

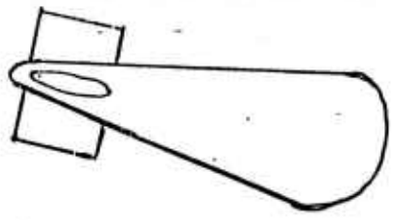
LIQUID CS, BARRICADE-PENETRATING CARTRIDGE

PAT. PEND.

FERRET Liquid CS, Barricade-Penetrating Cartridges, SGA-100, permit immediate response to barricade situations without the delay caused by the acquisition and assembly of special equipment. These cartridges were developed by AAI Corporation, developers and manufacturers of the MPG™ Multi-purpose Grenade System and the TG Guard™ Property Protection System.



ACTUAL SIZE



CS PROJECTILE FITS INTO 12 GAUGE SHELL

Figure 7

During the entry phase some types of blinding or screening smoke appears to be necessary, either to blind the enemy in his positions or to form a curtain or screen between enemy and friendly troops.

7. ALTERNATIVE RESPONSES

Determine the characteristics that would be required of portable shielding devices such as size, stopping capability, movement speed, weight and so on to determine whether such a device would significantly improve unit performance and is technically feasible to construct.

Refer the civil interaction in this event (intelligence on location of noncombatants, care of noncombatant wounded and refugees, psychological operations to persuade defenders to surrender, actions when faced with defenders holding hostages) to GTE Sylvania and Battelle.

FAR EAST - HUNG SHAN

TECHNICAL PROBLEM RESUME

Problem: Firepower 23	Date: 14 Sept 1972	Sheet 1 of 20
Operational Area: HUNG SHAN		
Title: Establish a Reaction Force		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 23	Date: 14 Sept 72	Sheet 2 of 20
Operational Area: HUNG SHAN		
Title: Establish a Reaction Force		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, Par. 8.4.a.(2)
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Fort Benning, Ga.
d. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, March 1964.
e. TET, Don Oberdorfer, Avon Publishers, New York, N.Y. October 1972.

2. DESCRIPTION OF PROBLEM

Neutralize snipers and prevent harassing fire at personnel working or fighting in open areas.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Analyze the value of high volume small arms suppressive fire against sniper positions in urban areas. Examine the trade-off between possible low effectiveness and friendly casualties, neutral casualties, and collateral damage.

b. Conduct a study to analyze capabilities and characteristics of current munitions against specific structural materials at ranges associated with urban combat.

c. Perform a study to determine optimum user techniques and munition characteristics for smoke delivery munitions in the city.

d. Investigate technological feasibility of a small caliber projectile or other munition with a sharply defined range-effectiveness limitation. Such a system would enable firepower to be applied more selectively with respect to hostiles vis-a-vis non-military personnel and materiel in the vicinity. There is evidence that frangible bullets (of certain materials) are highly lethal at short ranges and become harmless beyond a sharply defined maximum range.

e. Examine performance of a contact-fuzed fragmentation or concussion grenade against personnel behind light protection. Such munitions should have severely limited lethal radius and thus permit more discriminate fire in situations such as this which are frequently encountered in city combat.

f. Evaluate the tactical and economic feasibility of applying "smart" munitions, such as laser guided weapons, to situations of this kind. This is still another means to apply intense firepower with localized effects.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

At 0700 the commanding officer of the 434th Infantry Battalion establishes a reserve force with Companies B and C in the center of the air base complex. Company A is sent out to search for and clear the facility of any possible infiltrators. They will not interfere with the normal work in process on the base; however, personnel who do not appear to be working, or who are moving from one area to another on the base, will be checked. While this is going on, a Morean Air Force AD aircraft attempting to land on a short east-west runway overshoots the strip. It crashes into the POL storage area and burns. The base crash team responds to the fire call, but is pinned down by sniper fire. The crash team reports this immediately by radio to the control tower, and the control tower then passes the report to the commanding officer of the 434th Infantry Battalion for action. Company C is sent out to suppress the sniper fire and to help the crash team in its efforts to extinguish the fire. First reports indicate that there are at

least six snipers who are operating from small outbuildings in the POL area and from positions outside the fence of the air base. Upon opening fire, they killed one member of the crash team and wounded one of the patrol members of the 432nd Infantry Battalion, which is on perimeter defense in that area. While these actions are occurring, the remaining elements of the 403rd Airborne Brigade arrive by C5A aircraft on the long runway. The brigade commander is among this group and he immediately establishes his command post at the air base. Communications are established with the subordinate battalions by radio, and radio and telephonic communications established with the marine guards at the U.S. Embassy.

This event begins as a sniper action against a civilian fire fighting team and a small perimeter defense unit. The major components of the fire fight are outlined in Figure 1. The action expands as an airborne infantry company (See Figure 2) is dispatched to suppress the sniper fire and to help in extinguishing the fire. The size of the enemy force is established, for purposes of this analysis, at 2 cells (squad equivalents) of 6 men each. The houses near the airfield are occupied by neutrals and, in addition, the plane crash and resulting POL fire have drawn other curious civilians to the airfield perimeter.

b. Characteristics of the Area of Operations

The terrain is flat and open causing the firing distances to be rather long. The initial range is 200 meters, with units closing by fire and movement to approximately 25 meters prior to the assault action on the small sheds.

The map shown in Figure 3 provides an overview of the tactical situation.

There are several POL sheds in the area. The POL sheds are made of 3/4 in. plywood siding over a 2x4 frame construction. One shed has corrugated sides and roof in place of plywood. The door openings are 30 x 72

Figure 1

Firepower Event 1 - Sniper Action at POL Dump

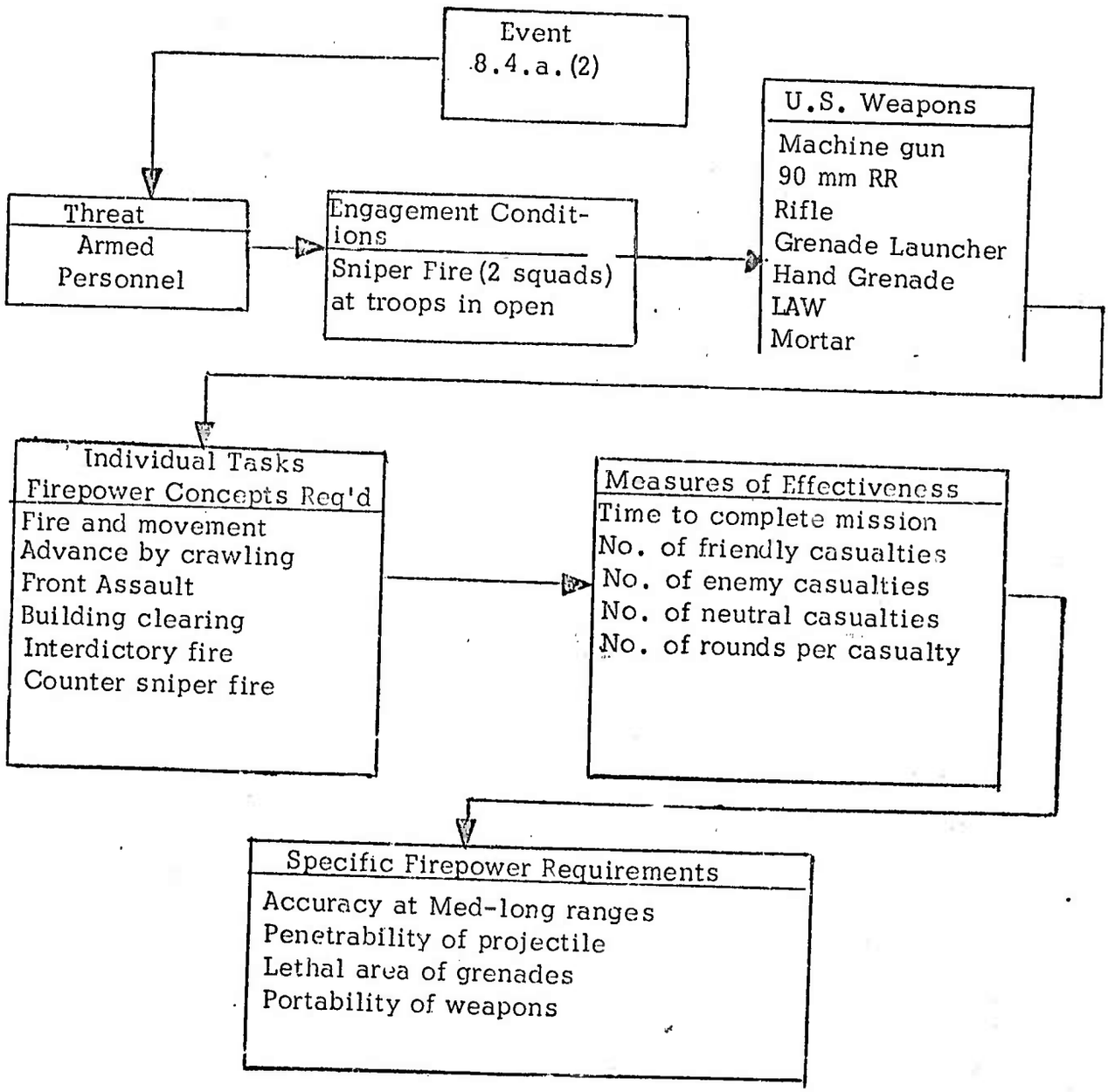
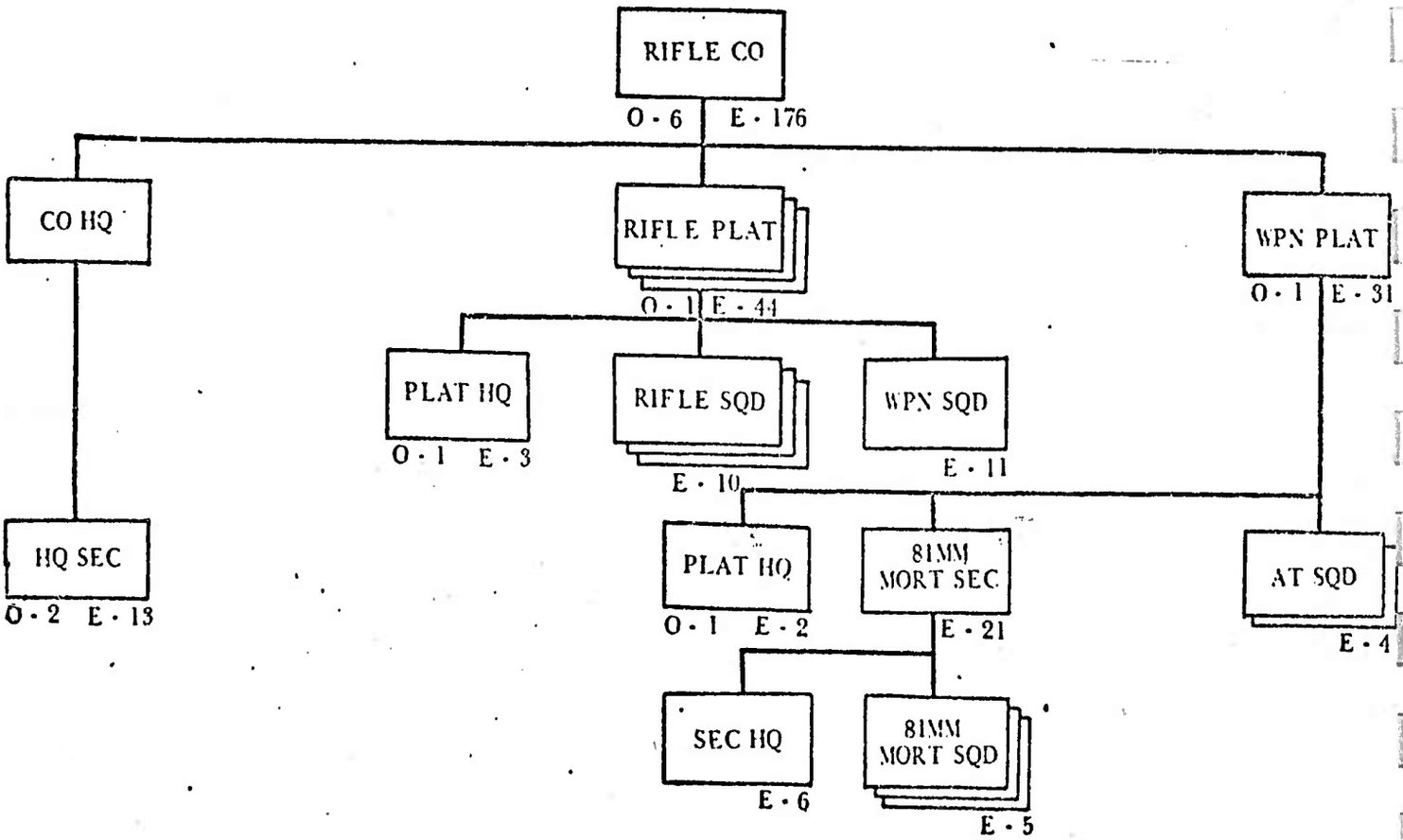
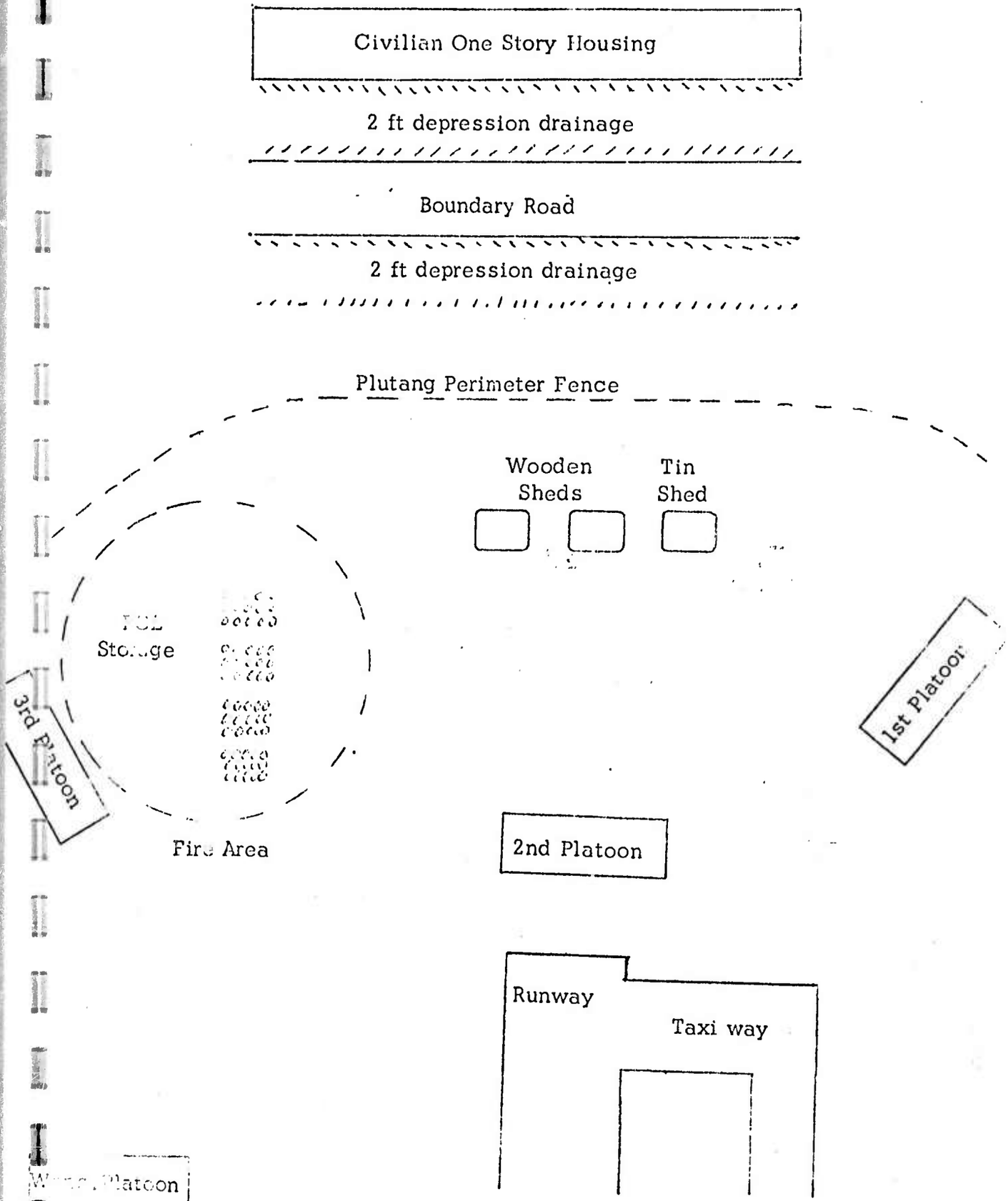


Figure 2

Rifle Company, Infantry Battalion, Airborne Brigade





SITUATION MAP

Figure 3

inches, the window openings are 18 x 18 inches. Each shed has a single door; there is a single window on each of the four sides affording good visibility. Empty 50 gallon drums are available for cover.

c. Description of Own Forces

The primary unit is a rifle company of an infantry airborne brigade. Figure 2 shows the major elements of the unit and Table 1 shows the organization of the platoon.

d. Description of Enemy Forces

The enemy force consists of two trained squads armed with AK 47 rifles and 100 rounds of 7.62 mm ammunition. They were trained in marksmanship by cadre of the PVO and have achieved an average level of expertise with the weapon. They are under orders to harass the air base personnel causing the U.S. and Morean forces to commit resources in its defense. They are also in contact with Company A and Company B of the PVO and expect to provide the tactical intelligence for the taking of the airfield by the larger units.

5. PROBLEM ANALYSIS

This situation reflects a problem of increasing importance as attention is turned toward urban areas. Airport facilities become key strong points since they are the entry and exit points to urban areas for strategic forces. Once troops have been committed, the airport becomes the most important link to rear echelons in the logistical chain. The facility is used to funnel in supplies and reinforcements and evacuate casualties and other personnel. Contingency plans must contain in detail the plans for capturing and holding such key facilities, taking into consideration their characteristics and limitations, the types of terrain, and structures in the surrounding area. In many cases, the facility will become the location of the major headquarters for the operation and the operating base for friendly airpower. During the TET offensive there was a major battle fought over the possession of the Saigon Airfield.

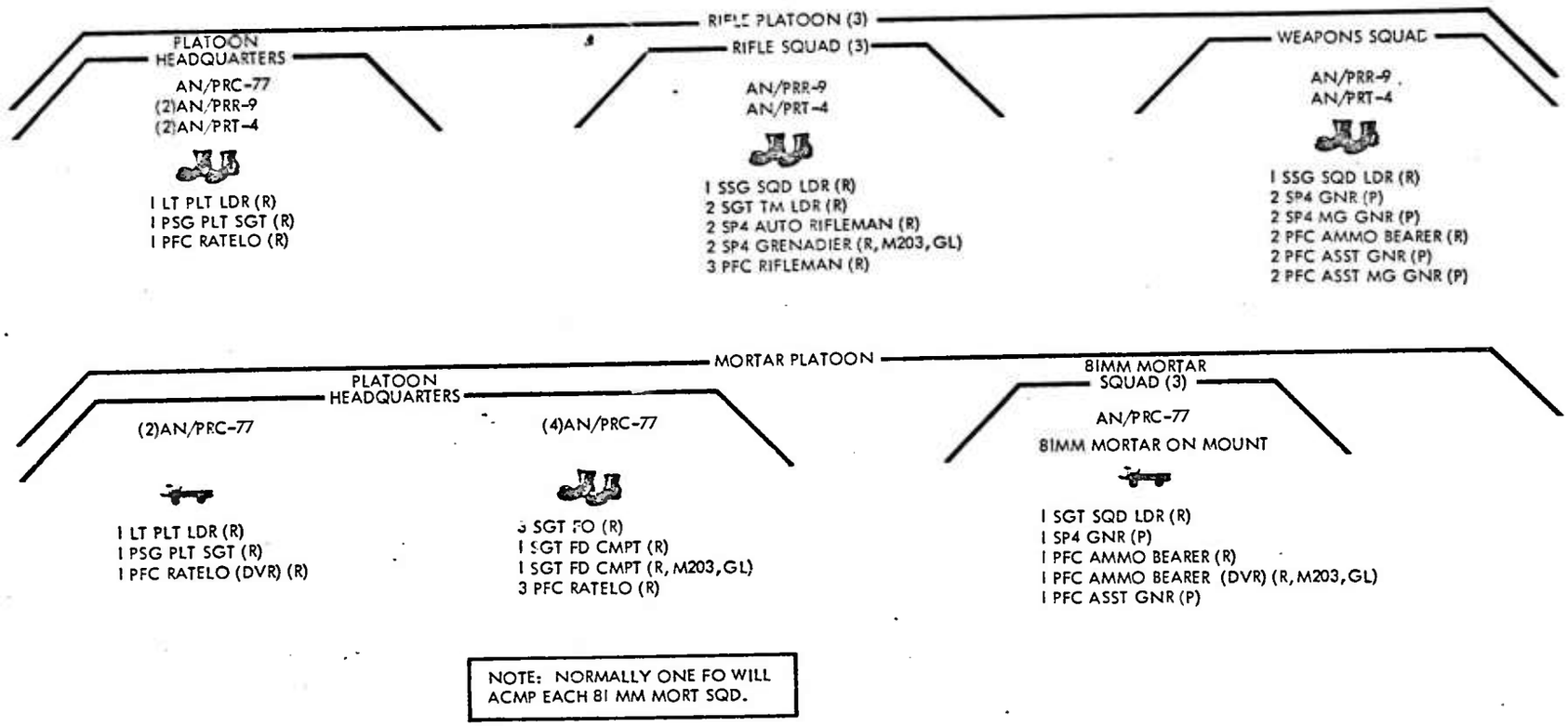


Table 1: Rifle Platoon Organization

Since airport facilities are of extreme importance, tactics and weapons should receive particular attention in the role of airport combat. A small airport mini-model could be useful in analyzing the problems of taking and securing airfields against various threats.

The Hung Shan situation is summarized in Figure 4, which shows the individual tasks that must be accomplished by the friendly soldiers. The figure reflects the actions of the platoons as men attempt to carry out orders. In each case, the major action is characterized by high volume small arms fire at snipers and suspected sniper positions. Concealment is given to the snipers by the POL sheds and empty oil drums in the area.

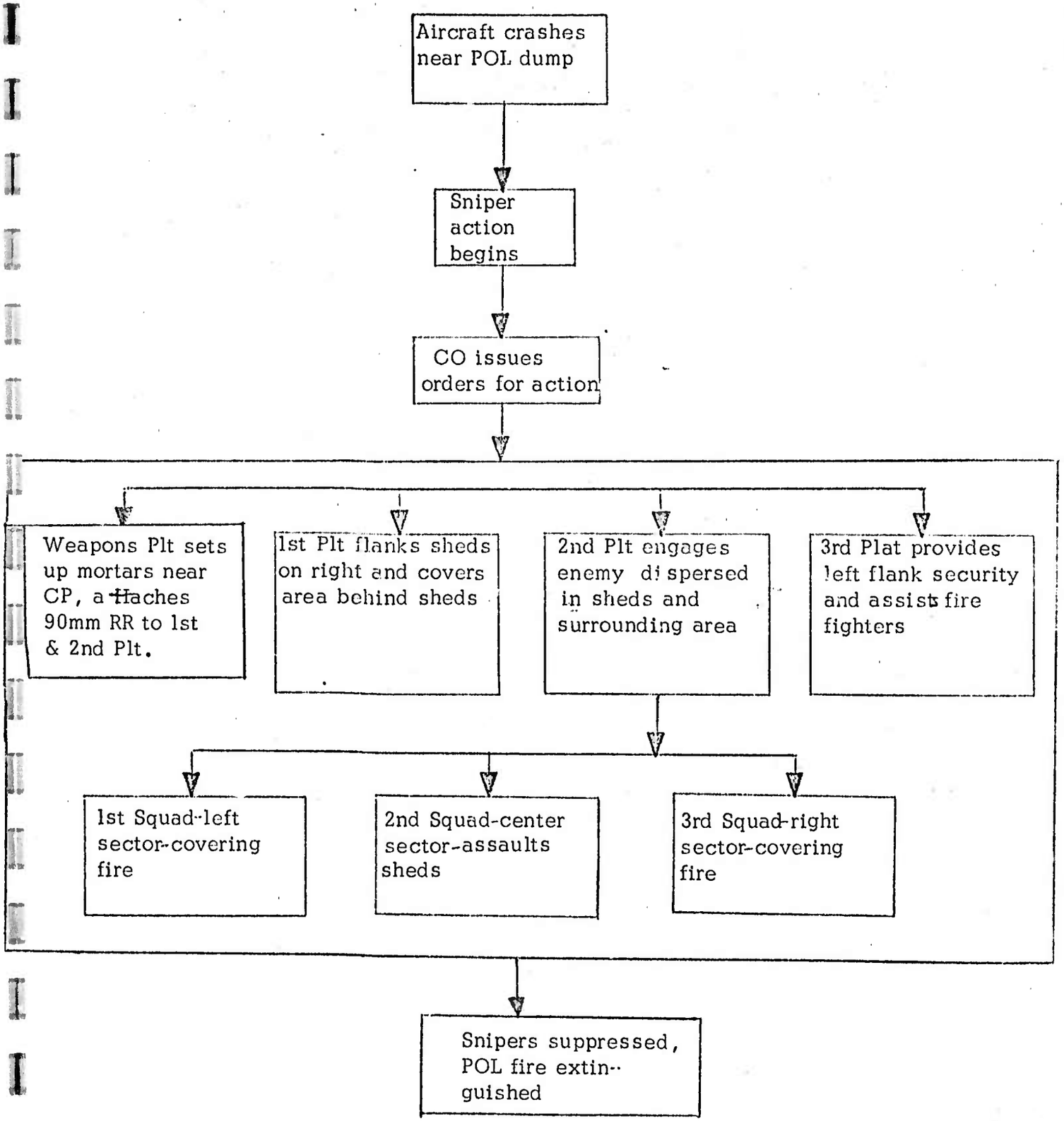
Attacking friendly troops are in the open and have little cover available. Movement is restricted to crawling with an occasional rush at enemy positions. The individual tasks which must be performed are:

- Covering fire - using aimed supported firing technique from prone position
- Fire and movement by crawling - approach to within assault range utilizing available ground cover and covering fire
- Assault - rush enemy position after reduction of resistance.

Current doctrine recommends that covering troops (base of fire elements) use a heavy volume of small arms and grenade fire to neutralize snipers. This forces the snipers to remain behind cover without firing. The maneuver elements attempt to get into hand grenade range. After grenades are thrown, the covering fire is lifted and the buildings are assaulted and the snipers killed or captured.

The initial problem concerns the proximity of neutrals who are drawn to the area by the plane crash, the fire, and the commotion created by the troops and snipers. The high volume suppressive fire which is effective against the snipers causes civilian casualties.

One feasible alternative method within current doctrine and weapons would be to use only aimed fire at known sniper locations. This would limit the



Flow Diagram

Figure 4

number of lethal projectiles and restrict the areas into which they were fired. The result will be fewer civilian casualties and less collateral damage. However, the lessened intensity of covering fire may not achieve the same degree of sniper intimidation. More sniper activity may be expected, which will increase friendly troop casualties and in this case, could increase casualties among the workers being protected by the troops. Friendly casualties decrease significantly when suppressive fire is effective in reducing the number of aimed sniper rounds. Assuming that high volume suppressive fire against the sniper will cause him to hurry his shots, his fire is considerably less effective. Further, the number of snipers firing will decrease slightly due to the small increase in sniper attrition associated with the increase in suppressive fire.

A second specific problem associated with this scenario is the penetrability of the rounds fired at the snipers in the POL area. Good penetration through existing cover should increase the vulnerability of the snipers. Small arms projectiles should be able to penetrate oil drums, interior walls, ceilings and floors, ammunition containers and other likely sources of ready cover. The scant data available indicate that, at close ranges, small arms penetration is relatively poor as compared to penetrability at medium ranges (100-300 meters). Table 2 shows the results of penetration tests against selected objects for the 5.56 mm and 7.62 mm rounds. Figure 5 shows the number of inches of 1 inch laminated pine boards that can be penetrated by these rounds.

In this situation and in many other tactical situations, one of the major problems is the inflicting of casualties among the civilian population. Such action can cause neutrals to become hostiles, increasing the direct burden in the tactical unit, or they can cause an overload on medical care and evacuation services. Current small arms projectiles can carry and ricochet far beyond the short ranges to unintended targets. In a heavy firefight, damage to buildings can cause costly repair to walls and to utility systems, as well

Table 2: Penetration of Selected Objects at 50 Meters Range
(7.62 and 5.56 mm)

Object Fired At	Penetration			
	M16		M14	
	Yes	No	Yes	No
1. Stacked sandbags One Thickness Horizontally laid		X		X
2. Sandbags One Thickness Vertically standing		X		X
2.a. w/Wet Sand		X	X	
3. Ammo cans (.50 cal) filled with water		X	X	
4. Ammo can (small) filled with sand		X		X
5. Cinder Block filled with sand		X		X
6. Cinder Block empty		X	X	
7. 50 gal Drum Empty	X		X	
8. 50 gal Drum w/water		X		X
9. 2x4 Stud	X		X	

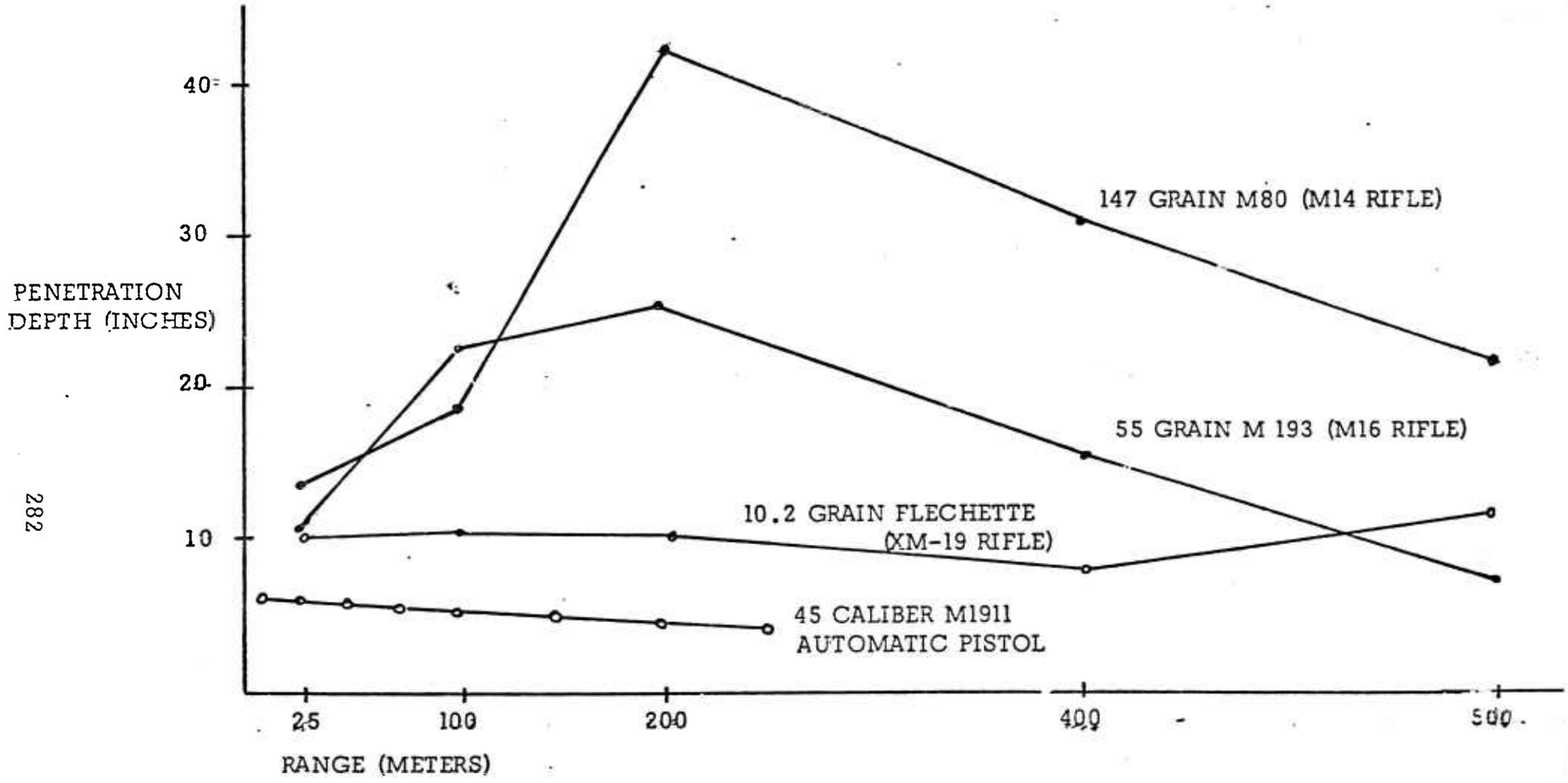


Figure 5: PENETRATION OF LAMINATED 1 INCH PINE BOARDS WITH SMALL ARMS PROJECTILES

as the contents inside. One concept which could reduce the number of civilian casualties and unwanted damage is the development of "self destruct" munitions, projectiles that simply disintegrate after passing a point some distance from the weapon. There is evidence to indicate that technology exists to produce frangible bullets.

Other weapons could have been used effectively against the snipers operating in the area of the POL sheds. The HE round of the grenade launcher would be effective when fired into and along side of the small sheds. Their relatively low velocity would decrease the probability of carrying to the airfield's edge and inflicting casualties on bystanders. The LAW would be effective in this situation, although the possibility of carrying to the outer perimeter exists. Mortars could also be employed in this portion of the firefight although registration could be difficult because of the proximity of POL supplies, friendly troops, and civilians. None of these weapons could be employed against the houses in the perimeter area without destruction of buildings and a number of neutral casualties.

Another possibility is to develop grenades which can be used against snipers behind light partitions. The amount of blast within an enclosure can be severly reduced and still be lethal when compared to the amount of blast to create equal overpressures in open areas. This concept can be varied somewhat with the possibility of using a blast on one side of a light wall to create over pressures in an adjacent room, stunning or killing the sniper and possibly creating a mousehole for immediate entry.

Smoke could be employed several ways, assuming that delivery means were available and wind conditions were not adverse. A screen to cut off the vision of the snipers in the surrounding houses would be an effective means of partitioning the battle. The snipers in the sheds could then be taken care of with minimum harassment from outside the edge of the field. Care would have to be taken to keep the smoke well behind the sheds, since smoke between the sheds and the friendly troops would permit the snipers to escape.

Partitioning may prove to be an important concept in urban combat where interlocking and mutually supporting defensive fires are a problem to attackers. Figure 6 shows estimates of attrition of friendly forces as a function of battle time with the smoke partition and without. Figure 6 is based on the results of a small model which assumes that 10 workmen are attempting to extinguish a fire. They are working in the smoke from the fire and are not directly visible to the snipers. The three snipers simply fire into the smoky area at a rate of 20 rounds per minute each (upper curve). When the nature of the sniper fire changes from high volume fire in the general direction of the workers to aimed fire at specific locations when target is seen even fleetingly, the volume of sniper fire decreases to 5 rounds per minute each and accuracy increases (lower curve). As a result casualties increase significantly. These figures represent subjective estimates based on selected inputs to a Lanchester combat model. The inputs were determined from a review of historical data. In this case, the characteristics of the actual event were generalized to fit a typical scenario event. Two factors combine to make the difference that is observed in the figures. (1) with the partition, the sniper fire from the houses at the edge of the field is changed from aimed fire to area fire, reducing its effectiveness; and (2) the covering fire of the friendly elements is concentrated on the sheds rather than being divided between two areas, the sheds and the nearby houses. Further, the use of smoke negates the need for suppressive fire into the houses, thereby reducing civilian casualties and collateral damage. The disadvantage is that the snipers at the edge of the field are cut off and can easily escape. In this situation this is not a strong disadvantage since their position is such that they can break contact at will anyway and move out of the area.

The use of small quantities of CS gas could be useful in dislodging the snipers in the sheds. 40 mm grenades with CS gas could be fired into the sheds, causing evacuation. Once in the open, the effects of small quantities of gas may be negligible. The 40 mm grenade with its short

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7 X 10 INCHES MADE IN U.S.A.
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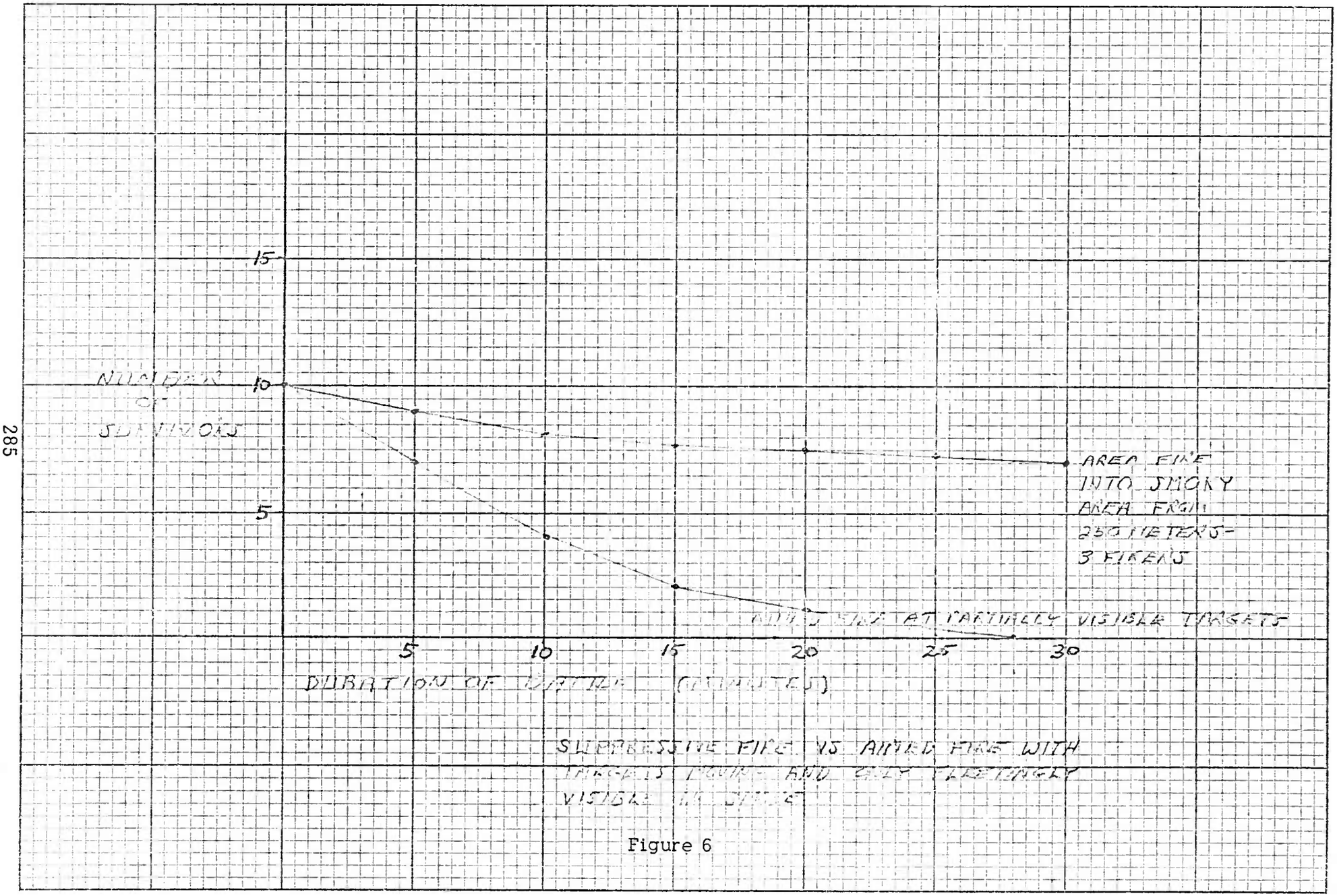


Figure 6

range and low kinetic energy may have many uses in urban combat. The grenade permits excellent control of a good level of chemical energy.

The recent development of smart bombs could lead to the application of the homing concept for tube launched rounds. In this situation and in many other urban operations, it is difficult to set up and register indirect fire weapons quickly, especially when friendly troops or civilians are in the immediate area. The launching of a smart round which could home on an illuminated target could effectively bring firepower onto the enemy in a highly selective manner. An enemy strongpoint near other facilities (e.g., hospital) can be destroyed with a minimum of collateral damage. Smart munitions represent a concept for surgically removing the enemy from the healthy environment that surrounds him.

6. RESULTS OF ANALYSIS

The current doctrine applied in this situation should accomplish this task with available weapons. However, because of the high volume of covering fire and the proximity of civilian housing at the airfield perimeter, some neutral casualties can be expected. In similar situations in built-up areas, some collateral damage to buildings in the surrounding area can be expected. These drawbacks, civilian casualties and collateral damage, which may alienate a heretofore neutral or friendly populace, suggest that alternative responses be considered.

The problem of suppressive fire is more acute in the city. The urban sniper has excellent cover and concealment and is less susceptible to suppressive fire than his rural counterpart. Further, neutrals are likely to be nearby, particularly in ambush or surprise situations. Heavy fire is apt to produce unwanted collateral damage. The problem of the utility value of suppressive fire should be evaluated to help form the basis for establishing guiding doctrine concerning when and under what conditions suppressive fire actually decreases friendly casualties. This proposal analysis will examine alternate firepower means of neutralizing enemy personnel in buildings and behind cover:

Best Available
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for Page 287

concussion grenades of limited lethal areas, wall grenades for creating lethal overpressures in adjacent rooms, and smart munitions for surgically destroying enemy strongpoints. The analysis will encompass a spectrum of actual and feasible system performance characteristics operating against the more important target types and engagement conditions in urban combat. Comparisons of cost-effectiveness and collateral effects will be made among them and against more conventional systems. Particular attention will be given to the response time, comparing direct support systems with other support fire systems and evaluating the effects on combat outcome. It is expected that new system requirements will emerge from these analyses as well as "ratings" [illegible]rrent systems and items in development. Finally, analysis to determine whether frangible projectiles are technically feasible and operationally desirable will be undertaken.

Penetration data for current weapons against various types of structures is lacking. Initial analyses indicate that current munitions may have some characteristics that seriously degrade performance in urban areas. A thorough study to determine current effectiveness in terms of penetration should be undertaken to determine if and where gaps exist so that recommendations for changing characteristics can be made. It is felt that thisstudy has the greatest potential return for resources committed since slight modifications can increase effectiveness of current weapons which represent sunk costs. Practical examples of such modifications would be a change in arming distance of specific munitions. With the close fighting ranges of the cities, many of our current munitions are less effective. These include the 40 mm HE grenade with an arming distance of 79 feet.

Analyze techniques for using smoke effectively in cities to conceal friendly forces, blind the enemy, and partition the battlefield.

A 40 mm grenade with a CS filler for the M203 launcher could be useful in driving defenders from rooms or small buildings. The value of such a munition

should be examined in terms of its ability to reduce the need for direct assault on such a position.

7. ALTERNATIVE RESPONSES

Examine the utility of a 40 mm CS grenade for the M203 launcher.

TECHNICAL PROBLEM RESUME

Problem: Firepower 24	Date: 4 Oct 1972	Sheet 1 of 14
Operational Area: HUNG SHAN		
Title: Relief Column to U.S. Embassy		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 24	Date: 4 Oct 72	Sheet 2 of 14
Operational Area: HUNG SHAN		
Title: Relief Column to U.S. Embassy		

1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, Par. 8.4.a.(5)
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, ST7-157-FY 72, U.S. Army Infantry School, Fort Benning, Ga.
d. U.S. Army FM31-50, Combat in Fortified and Built-Up Areas, March 64.
e. Barclay, Brig C. N. "Countermeasures Against the Urban Guerrilla", Military Review, Jan 70.

2. DESCRIPTION OF PROBLEM

After leaving the Plutang air base at 0815, the relief column of Alpha and Bravo companies proceeded along the main road from Plutang to downtown Hung Shan toward the U.S. Embassy. Movement was very slow because of the extremely heavy foot traffic, animal carts, and bicycles. The convoy was moving at approximately five miles per hour. It was difficult to move around the slower moving animal-drawn vehicles, even though three motorcycles with sirens were provided to lead the way for the convoy. As the convoy began to pass through several Kampungs, at 0835, they began to receive sniper fire from both sides and from the front of the convoy. Four men were wounded, including two of the motorcycle patrolmen leading the convoy. The convoy commander immediately ordered the men to dismount from the trucks and to spread out in the area taking cover. He reported by radio to the battalion commander at the air base what had happened and the battalion commander passed this information on to the brigade command post. The brigade commander reported to the defense attache at the Embassy that the convoy had been held up by sniper fire.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Analyze current convoying tactics to determine if alternate methods exist to move troops and equipment through city streets using ground transportation. Possible tactics include using smaller convoy units and multiple approach routes.

b. Perform a study to determine the value of quick deploying smoke in the case of urban ambush requiring the sniper personnel to switch from aimed fire to area fire during the initial stages of the battles when friendly troops are most vulnerable.

c. Study possible means for dispersing crowds of people moving on needed thoroughfares.

d. Study the tradeoff effect between quickness/mobility and more personal protection (body armor, shields) in the house to house searching role.

4. Situation and Considerations

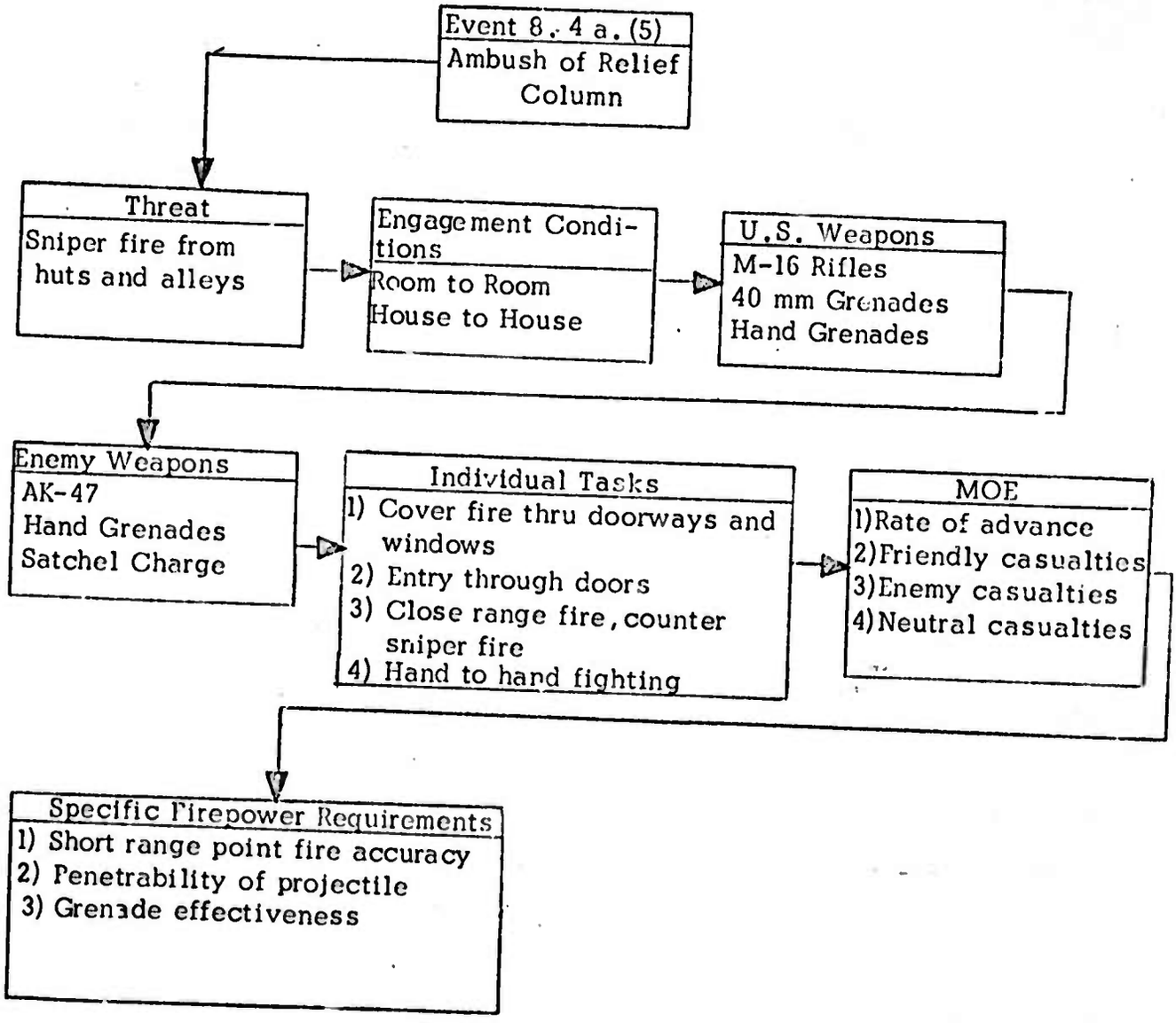
a. Tactical Event for Analysis

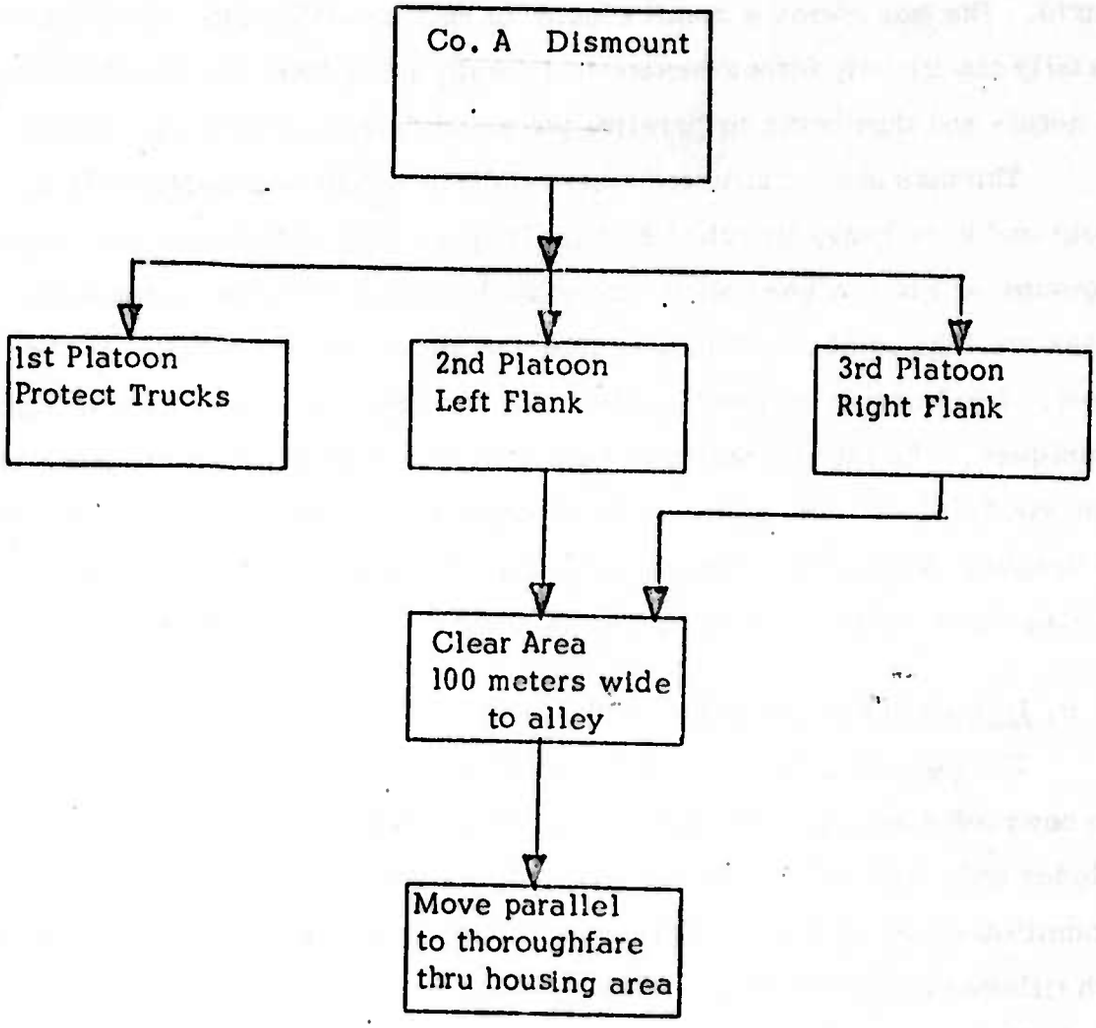
This event depicts a relief column of 2 rifle companies moving in single file on a crowded thoroughfare in 2 1/2 ton trucks with a motorcycle escort. As the convoy passes through a small concentration of houses or huts, it is fired on by 2 cells or squads of guerrilla. The rifle companies immediately dismount, take cover, and begin to clear the area. As the battle progresses, the attackers encounter layers of defenses which escalate the intensity of the conflict. This event analyzes the firefight in the area of the initial contact with the guerrilla forces and is detailed in Figure 1. There are civilians in the area not only along the road but in the houses as well. The street is extremely crowded. Civilians take cover along with the soldiers as the sniper fire increases.

Figure 2 shows the actions of Company A. Company B personnel dismount and take positions near their vehicles to await the clearing action.

Figure 1

Event 2 - Ambush of Relief Column





FLOW CHART - EVENT 2

FIGURE 2

b. Characteristics of the Area of Operations

Figure 3 is a map of the area, approximately to scale (10 feet equals 1 inch). The map shows a small cluster of huts on either side of the street. Initially the friendly forces penetrate laterally away from the street for about 50 meters and then begin to parallel the street moving toward the central city.

The huts are constructed of an adobe type building material (8 in. thick) and have heavy thatched roofs. They are very close together, clustered in groups of 3 to 5 houses with narrow walk ways in between the groups. Alleys are located about 50 meters from the street and are parallel to the street. The friendly soldiers employ house to house and room to room fighting techniques. The interior walls in huts with two or more rooms are made of light wood (1/2 in. pine frames) and rice paper and cardboard. The interior walls are opaque. Most of the houses have one room with a heavy stone/brick fireplace for cooking. The fireplace is about 30 inches high.

c. Description of Own Forces

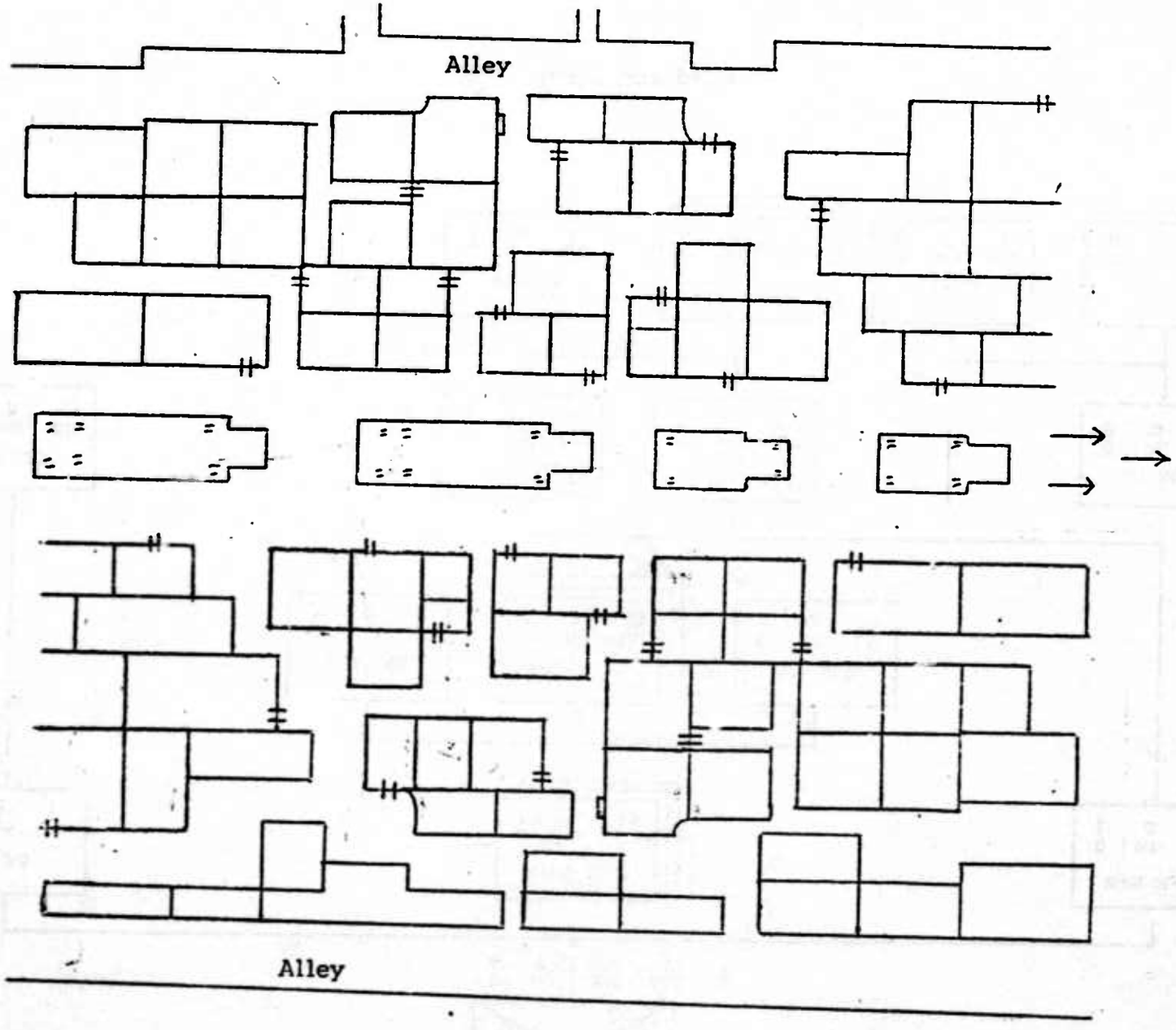
The fighting unit is an airborne infantry company as shown in Figure 4. Two companies and 12 trucks are involved in this firefight. Their equipment includes only their personal gear and weapons with a standard basic load of ammunition which includes 200 rounds of ammunition and 3 hand grenades for each rifleman and 25 40mm grenades for each grenadier.

d. Description of Enemy Forces

Each of the 14 guerrillas is equipped with an AK-47 and 100 rounds of ammunition. Each cell has 4 hand grenades and a satchel charge. Booby traps have not been set.

5. Problem Analysis

As shown in Figure 2, the first platoon is ordered to take up positions to protect the first 6 vehicles in the convoy. These troops are essentially performing an antisniper action similar to event 1. However, since no troops or personnel are working in the open, they have only to protect themselves. The battle simply becomes a one on one duel until the snipers wish to break contact. Consequently, the guerrilla force is able to leave only 3 men to pin down the platoon while the balance of the group (11 men) are used to slow the advance of the search element.



MAP OF THE AMBUSH AREA

FIGURE 3

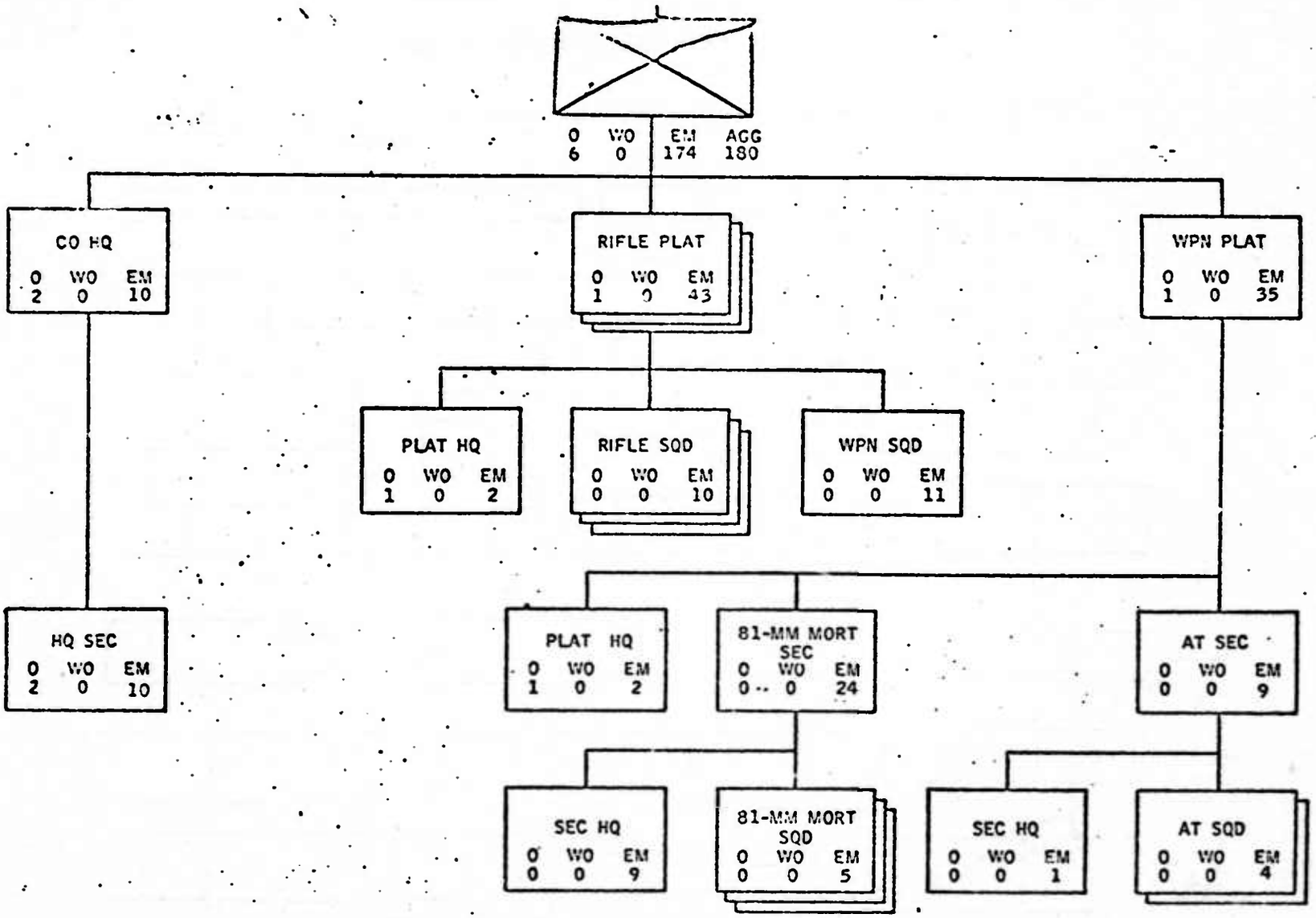


FIGURE 4

Rifle Company

The search elements perform a house to house and room to room search leaving men stationed at key points in the neighborhood, such as alleys and walkways. Since there are civilians in the area, a problem of enemy identification exists. Firing is done at short range (less than 10 meters) using hasty firing techniques. The troops use discretion but often cannot wait to be fired upon after entering a house or a room until they themselves fire.

The clearing action continues in the standard situation until 30% casualties are taken by the clearing platoons. At the 30% level, tactics are changed. Defensive positions are taken up and occupants are ordered from their houses one or two at a time. All civilians are searched and allowed to leave. The houses are then grenaded and bypassed or assaulted singly.

Occasionally, guerrilla personnel hold the occupants prisoners within the houses in an effort to confuse entering troops.

As the clearing action continues to move in the direction of town and when guerrilla strength reaches 50% by attrition six additional cells are committed. Elements of Company B move in to fill in the ranks of Company A as friendly casualties are taken.

When total strength of the two companies reaches 50%, the units attempt to withdraw to the parked vehicles. Some maneuver elements are cut off from the vehicle area and become lost from the main force. The remainder of the friendly forces attempt to move back toward the airfield. Sniper fire, street fighting and close combat is continuous. Eventually only small clusters of men remain and these attempt to escape toward the Embassy.

In all, there are three separate actions in this event: sniper/counter-sniper action, house to house search, and street fighting. In the first two actions, the use of conventional weapons and doctrine cause heavy losses because of exposure to the enemy who in turn is not exposed. In the street-fighting action, the firing is done at very close ranges. The rifle, the

infantryman's usual personal weapon, is at a disadvantage against both the submachine gun and the shotgun, except that it has better penetrating capabilities than shotgun buckshot. Each of the three separate actions are analyzed in the following paragraphs.

a. Countersniper action

The initial volley of fire and the advantage of surprise cause the convoy troops to suffer many casualties. Only rarely can the troops dismount and kill concealed snipers before they escape. Steps are required to reduce the advantages that the ambusher has.

Guidelines for selecting routes of approach should be reviewed. Heavily traveled main thoroughfares may be ideally suited to handle large convoys, but the use of obvious routes permits preparation of unwelcome welcoming committees British security forces in Ulster have had success with posting and concealing men along the route, moving them along the flank into position before the convoy departs. This costs time and forces. Alternate routes should be examined. The attacker has only a single advantage in that he knows which route he is going to take. To cover all possible routes, the defender must have good intelligence and mobility or he must spread his forces thinly across all possible pathways. The attacker further has the advantage of selecting the entry point, which can be several parallel routes using smaller two and three truck convoys rather than a single route for the entire convoy. Finally, military trucks have good cross country capability which could possibly be used in the city. They could drive directly down railroad beds and cross rivers using railroad bridges. Both railroads beds and bridges are apt to have less civilian traffic since they are ill suited for small vehicles, wagons, and carts. In some situations, speed can be used to reduce exposure on city streets.

A city entry model should be developed to study the problems of entering and progressing through urban areas. Several cities should be analyzed in terms of numbers and classifications of entry points and pathways and means of negotiating natural and man-made barriers.

b. House to House Search

Performing this combat action requires maximum exposure to a well hidden enemy. To minimize casualties, current doctrine calls for heavy cover fire and the use of grenades to render the enemy ineffective before an attempt is made to enter the building. Heavy collateral damage is to be expected. If civilians are in the area, a high number of civilian casualties can be expected.

Estimates from past battles including Warsaw indicate that the attacker can expect to take more casualties than the defender. Even complete destruction of the area does not greatly lessen the expected casualties since the remaining rubble provides good cover and concealment.

Output from a street fighting minimodel places the casualty ratio of friendly to enemy at 1 1/2 to 1 (See Figure 5) The model does not account for the large number of neutral casualties that can be expected if civilians are used as hostages during the fighting.

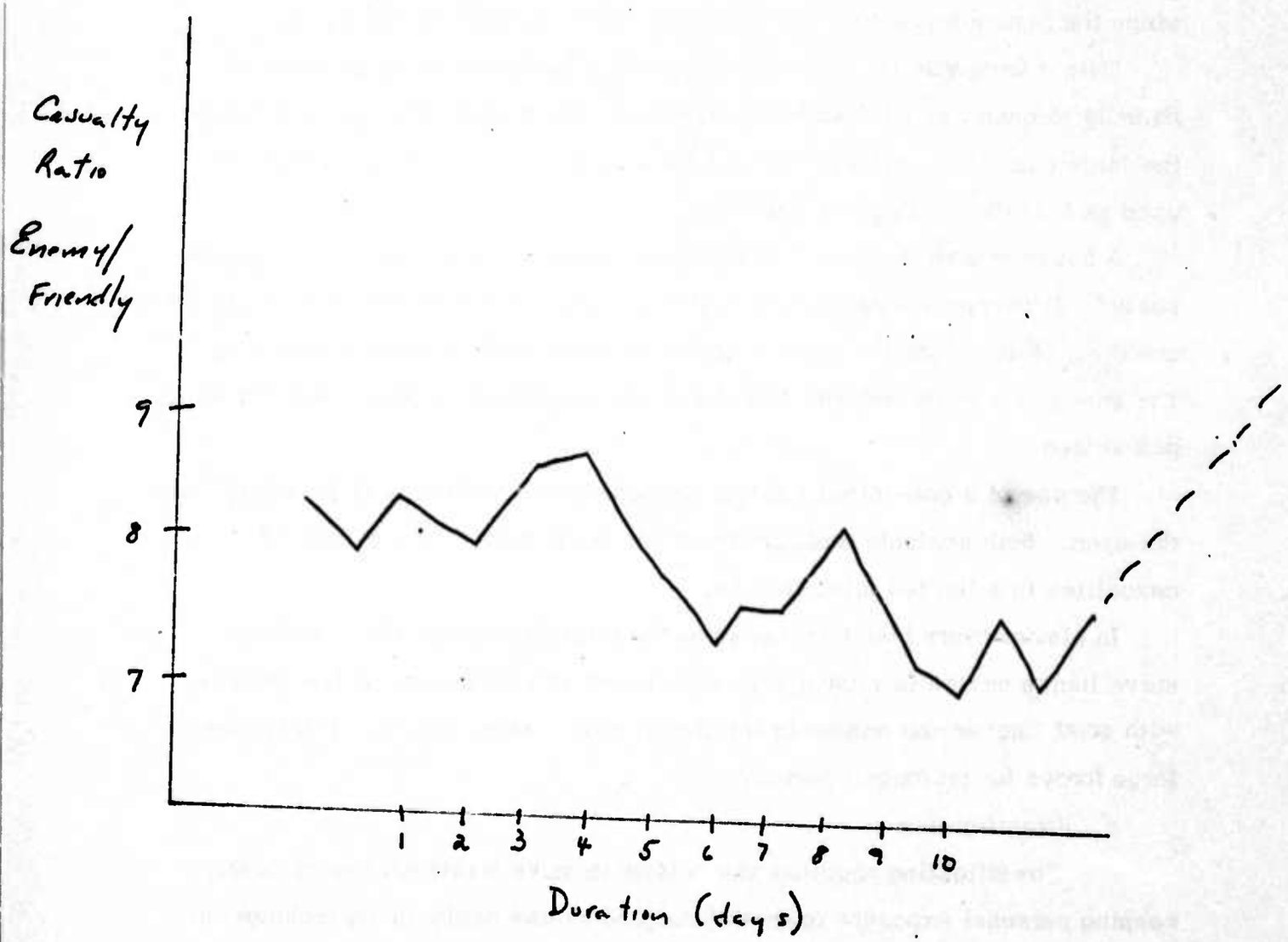
A house or a room ceases to represent cover or concealment if it can be sealed. It becomes a convenient jail or prison. Quick coagulation compounds could possibly be used to seal windows or doors with an opaque substance. The enemy is a much reduced threat and can be picked up later when the action has abated.

The use of a non-lethal CS type grenade could force enemy personnel into the open. Both sealants and non toxic gas could reduce the number of casualties in a limited urban action.

In almost every house to house and antisniper action, the need for a surveillance device to locate sniper positions is paramount. A few snipers, with good cover and concealment almost everywhere, can tie up relatively large forces for prolonged periods.

c. Streetfighting

Streetfighting requires the soldier to make maximum use of cover, keeping personal exposure to a minimum, and to use hasty firing techniques on small or fleeting targets. The use of a personal weapon capable of firing a single projectile with great precision over long distances may not represent the most suitable weapon for this environment. Firing ranges rarely exceed 50 meters and aiming times at visible targets are usually less than 3 seconds.



Ratio of Enemy to Friendly in
Street Fighting

Figure 5

This suggests that alternate weapon designs may improve the combat soldiers effectiveness in streetfighting. Shotgun type rounds for the M203 may be useful. Multiple projectile rounds (salvo) could possibly improve combat effectiveness.

Figure 6 shows expected hit probability of a multiple-projectile squeeze bore rifle hastily fired at a small target compared to hit probability of an M16 fired at the same target under the same conditions.

6. RESULTS OF ANALYSIS

The situation described above is an attrition action designed to dissipate the strength of the friendly unit by causing them to disperse. The initial attempt to clear the area house by house is fruitless until the surrounding area is sealed off. Consequently, initial heavy losses take place until house to house searching is given up in favor of street fighting.

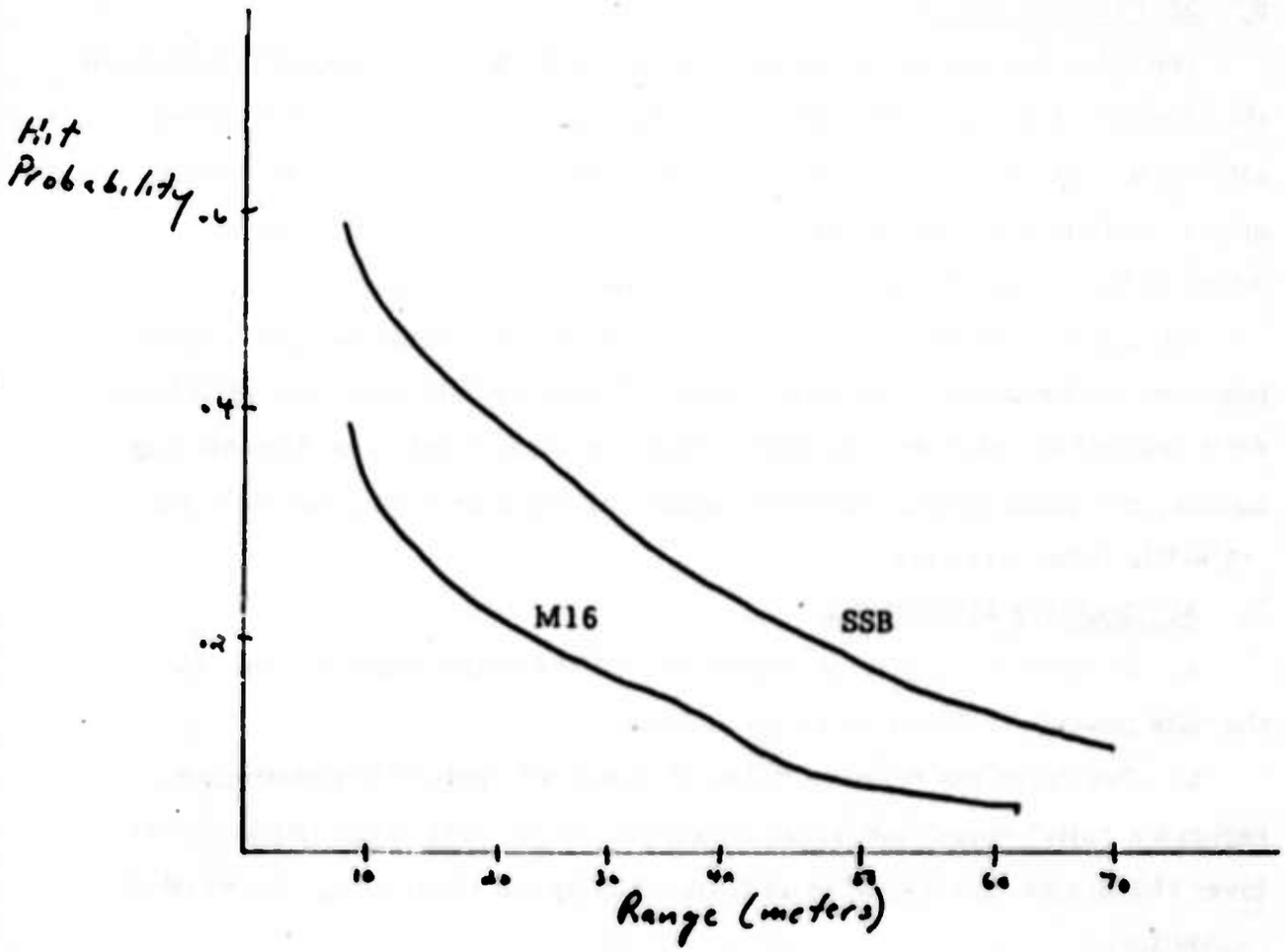
The action indicates several areas where further analysis could lead to improved performance of friendly troops. These include improved guidelines for movement of vehicles into and through the city, window or door sealing agents, nonlethal 10mm projectiles, sniper locating devices, and multiple projectile firing weapons.

7. ALTERNATIVE RESPONSES

a. Conduct a study to determine the utility of the shotgun round for the rifle grenade in house to house fighting.

b. Determine the relative value of increased projectile penetration. Perhaps a "city" round should be developed whose long range characteristics (over 250 meters) are degraded in favor of improved close range penetration capability.

c. Determine the utility value in terms of friendly lives saved of a CS round for the rifle grenade in house to house fighting.



Hit Probability M16 vs SSB (5 miniprojectiles)

Figure 6

TECHNICAL PROBLEM RESUME

Problem: Firepower 25	Date: 14 Sept 72	Sheet 1 of 17
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Title: Combat in High Rise Apartment Buildings		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 25	Date: 14 Sept 72	Sheet 2 of 17

Operational Area: HUNG SHAN

Title: Combat in High Rise Apartment Buildings

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a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972. Par 8.4.a(5)
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Fort Benning, Ga.
d. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, March 1964.

2. DESCRIPTION OF PROBLEM

Upon fighting their way through Podoli, a Hung Shan suburb, U.S. forces have encountered other layers of defenses. This time the high rise apartment buildings were fortified for defenses. All fighting in the problem resume takes place in and around a single building. The population has been evacuated from the buildings. Enemy snipers are placed in well-concealed positions.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. A study should be initiated to determine optimum configuration during the approach and entry phase of an attack on a fortified building. The analysis should examine several likely "enemy" distributions (e.g., primarily horizontal at a given height).

b. An investigation should undertake to determine optimum methods for the coordination of operations inside a building in conjunction with support from forces outside the building. What are the mutually supportive roles, assuming the "geometry" of the problem makes support possible? The importance of communication in this requires coordination with the communications contractor.

c. Initiate an investigation to assess the applicability of hand-placed explosives or direct fire HEP and HEAT rounds in order to increase the vertical and horizontal mobility of friendly forces within a building. A commercially available firefighting device known as jet-axe could possibly be modified for use in urban combat. The pictures in Figure 1 are taken from the jet-axe brochure.

Another possibility is an adaption of the foxhole digging device developed years ago.

d. Conduct a study to determine the utility of small, quick dissipating CS grenades for use within a building for room, hallway, and stairwell clearance. The "soft Ring Airfoil Grenade w/CS" would be a starting point.

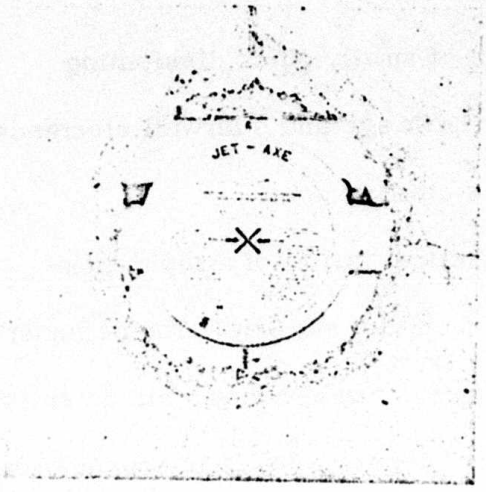
e. Evaluate the technical feasibility and tactical utility of a rapid door-lock device -- in effect, to lock the doors and keep the only key. The defender's concealment, protection, and movement passageways would become his detention cells. The attacker's options would increase for by-pass. Ballistic emplacement of hasps or studs, quick-set adhesives or tapes, "advertised" booby-traps, -- are some of the approaches to be investigated.

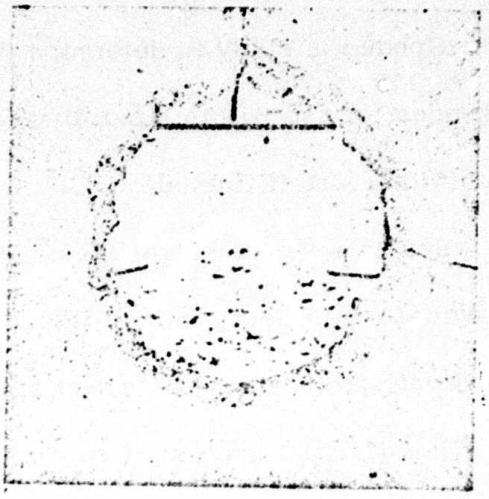
f. Foams for area denial and for visual interruption offer advantages of persistance and localization over smokes. Hardening and non-hardening foams should be evaluated in terms of technical feasibility and operational value. Small amounts of noxious additives will deny the area for use by anyone not properly protected.

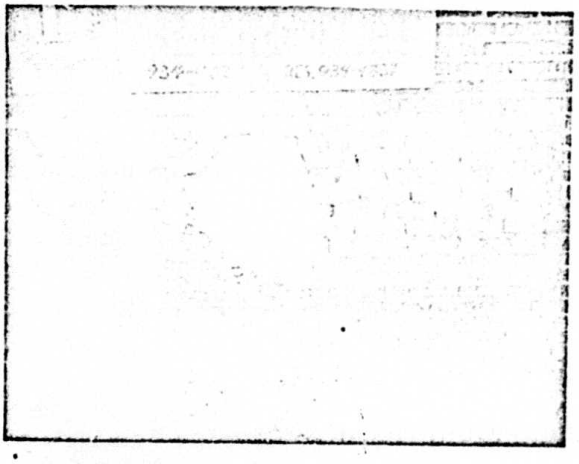
g. Evaluate the technical feasibility and tactical utility of employing "smart" munitions. Target illumination would be by a device operated by the ground troops (to include possibly a "beacon munition" fired onto the target and radiating a homing signal. The study would include hit probabilities, delivery errors, terminal effects, target designation and illumination, communications, and response time.

h. Wall Breacher - High ratios of effects to payload weight for structural cutting can be achieved through the shaped-charge principle. Linear shaped-charge devices are especially efficient and are used commonly in demolition work. Tube-fired or rocket-delivered systems reduce troop exposure time and increase survivability.

Jet-Axe Model JA-V: Same cutting and broaching capabilities as the JA-IV; will also cut reinforcing steel bars up to 5/8-inch in diameter.







Results of Jet-Axe firing: a 26-inch hole through the three-course brick wall.



Hole in 3/8-inch steel deck of ship made by Jet-Axe Model JA-IV during shipboard fire suppression operations by Seattle Fire Dept.

Concrete roof, 2-1/2 inches thick, cut by Seattle Fire Department with JA-111.

-Photo courtesy Seattle FD

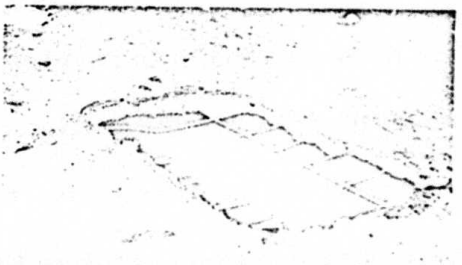


Figure 1

4. SITUATIONS AND CONSIDERATIONS

a. Tactical Event for Analysis

The action in this scenario involves one rifle platoon whose assignment is to clear a high rise apartment building of all enemy personnel. The event is summarized in Figure 2. Entry to the building is gained through the roof after personnel managed to climb the external fire escape under covering fire. Squad assignments are shown in Figure 3.

b. Characteristics of the Area of Operations

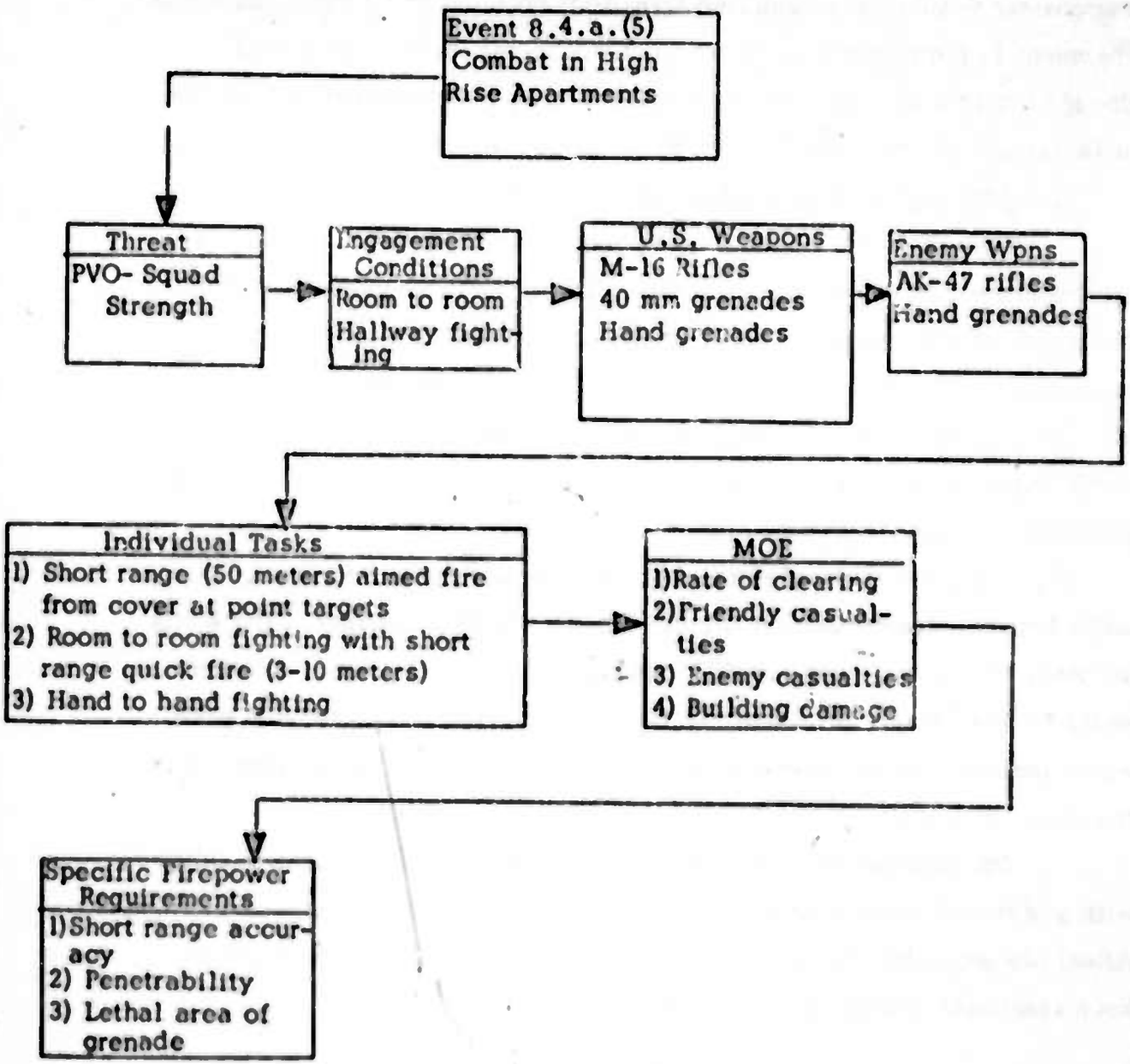
The action centers around an 8 story building which contains 8 apartments per floor, 4 on either side of a long hallway which traverses the length of the building. There is an external fire escape at each end of the building. There are two sets of stairs on opposite sides of the hallways as shown in Figure 4. Entrances to the basement are also at either end of the building and via the internal stairwells. The two elevators are not operational since the building power is cut off.

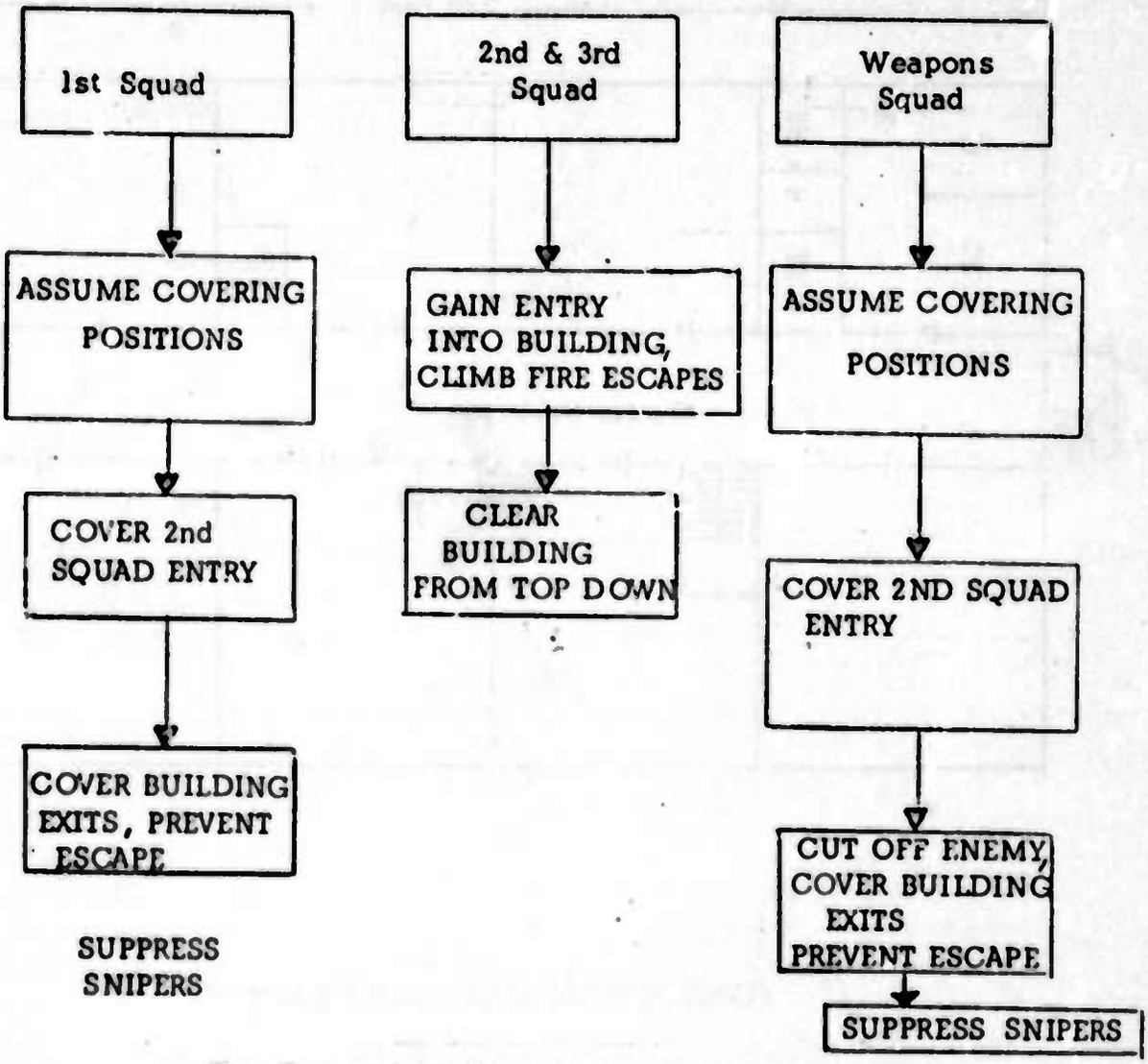
The floors are made of reinforced concrete with a 6" thickness. The walls between apartments are 2 inches thick. Within apartments the walls are made of plaster board and 2x4 framing. The outer doors are made of metal for fire protection. The buildings are located in a congested area which permits friendly troops to approach within street width distance under the cover of nearby smaller buildings.

One infantry platoon is assigned the task of clearing the building with additional support being provided as required. Heavy weapons (recoilless rifles) are available but will not be used unless absolutely necessary to keep apartment damage to a minimum.

Figure 2

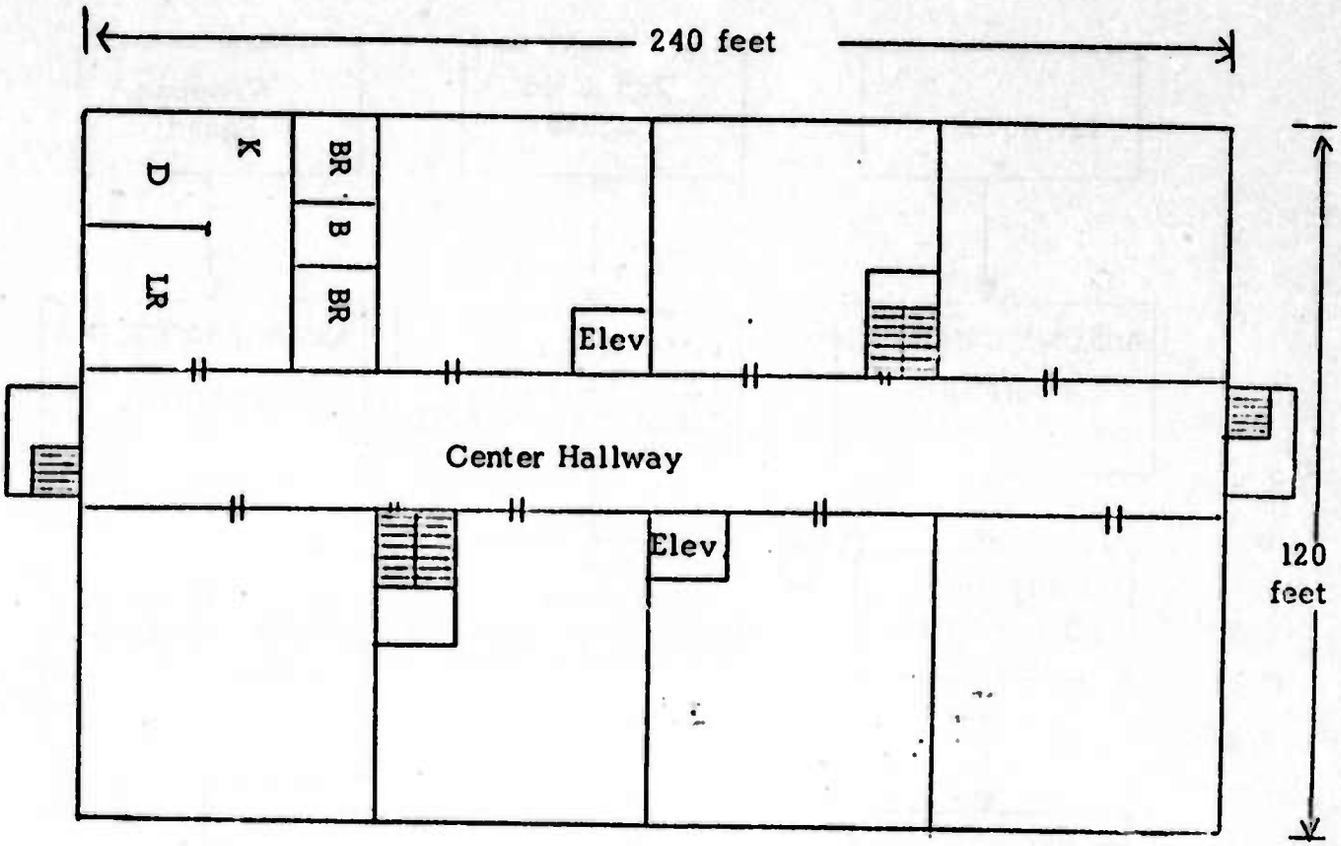
Event 3 - Combat in High Rise Apartments





Flow Diagram of Clearing Platoon Activities

FIGURE - 3



FLOOR PLAN OF HIGH RISE APARTMENT

Figure 4

In clearing the building a squad is assigned to each stairway. One fire team secures stairwell to at least one floor below clearing area and controls hallway. The second fire team clears the floor apartment by apartment by any means at their disposal. The squads plan to work on alternate floors but are ready to assist each other as required.

For building entry, one infantry squad and the weapons squad provide cover while access to the roof is achieved via the external fire escapes.

c. Description of Own Forces

The unit of action is a standard infantry platoon. The elements of the platoon are shown in Figure 5. A list of available equipment is shown in Table 1.

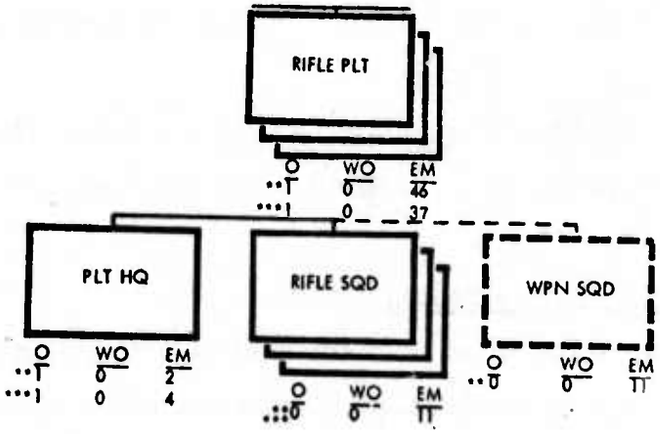
d. Description of Enemy Forces

The building is occupied by a squad or cell of PVO regulars. There are nine men in the squad. Each squad member has an AK-47 rifle, 100 rounds of ammunition and 2 hand grenades.

5. PROBLEM ANALYSIS

a. Description of the Action

The action begins with covering small arms fire to permit assault troops to reach and climb the fire escape. Once on the roof, the action within the building begins. Troops initially take command of internal stairways for two levels and begin the fight for the upper level hallway. Room to room fighting begins after hallway is under control. The only control method available is the use of automatic rifle fire. One man maintains fire from the center stairwell toward the end of the building. Two others working with the covering man work their way toward the first apartment door. Grenades and small arms are used apartment by apartment until the end of the hallway is reached. The troops then proceed to the next level and continue.



*Delete weapon plt when not equipped with 106 RR.
**Total when not equipped with 106 RR.
***Total when equipped with 106 RR.

Infantry Platoon

Figure 5

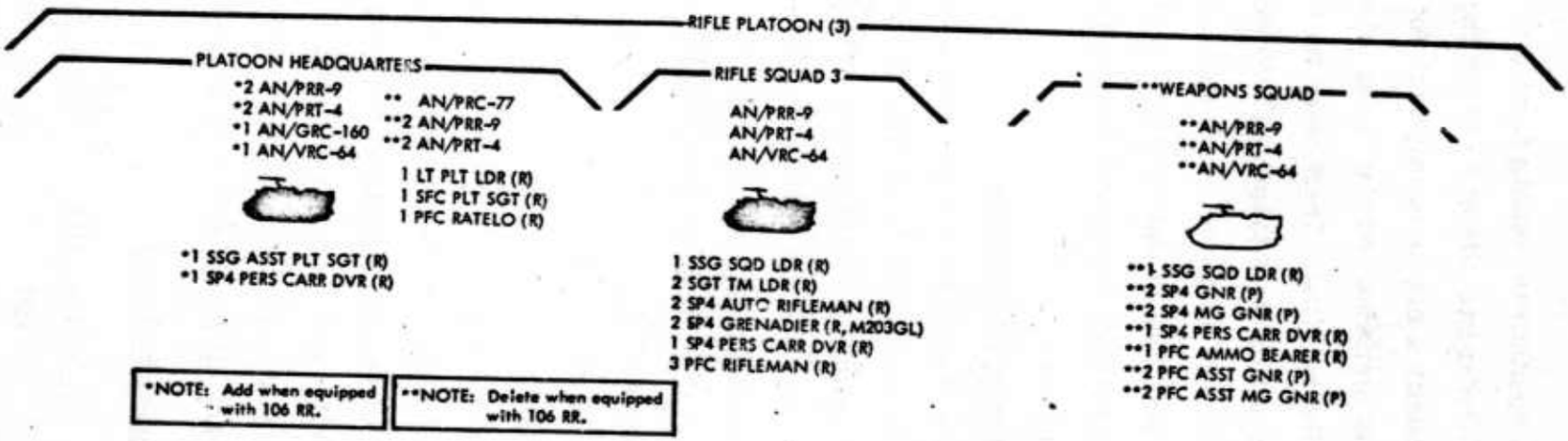


Table 1: Table of Equipment for the Infantry Platoon

Since the apartments contain furniture, snipers are able to barricade themselves within the apartments and reduce the effectiveness of grenades. Consequently, casualties are extremely high for the attackers.

Using only grenades and the basic infantry weapon, the attackers were able to take the building. There were no survivors among the 8 insurgents, and 12 friendly casualties were taken. There were no neutral casualties and building damage, except for glass, was light. In addition to the firefight casualties, there were two friendly casualties from hastily prepared boobytraps. No casualties occurred among units providing covering fire from outside of the building.

b. Basic Estimates of Outcome

With current unaugmented firepower, the friendly forces were able to secure their objective with a loss ratio of 1-1/2 to 1. Even in a small firefight of this magnitude, large numbers of munitions were expended. Estimates below cover 5.56 mm rifle fire and hand grenades only.

To cover climb to roof (time 5 minutes) each squad member of 1st squad and weapons squad fired approximately one round every 3 seconds, or 20 rounds per minute:

14 men x 20 rds x 5 min = 1400 rds, 5.56 mm

For sniper suppression and exit cover, each member of the 1st and weapons squads fired one round every 15 seconds or 4 rounds per minute.

14 men x 4 rds x 25 min = 1400 rds, 5.56 mm

The second and third squads inside the building used an average of 4 grenades per floor (32 grenades) and 8 rounds per room (512 rounds) and 100 rounds per section of hallway control by one man at a time (1600 rounds). 2nd and 3rd squads totals are 2112 rounds and 32 grenades.

Total Expenditure by Squad

	5.56 mm Rifle	Hand Grenade
1st	1400	0
2nd and 3rd	2112	32
Wpns	1400	
Total	4912	32

This is a significant portion of the platoon's basic load of these types of munitions, and indicates that resupply of ammunition would be an important factor in sustained combat in cities.

c. Specific Problems

One of the most difficult tasks for the platoon leader is to get men inside of the building without high casualties. The open area surrounding the building is difficult to cross and represents an area of maximum vulnerability to friendly troops. Figure 5 shows a general base line situation for an individual attempting to cross an open area of 30 meters in view of a 2nd floor sniper. Given that the sniper is able to fire two rounds during the exposed period, the probability of the attacker being hit is . Techniques for crossing and entering buildings should be examined in detail. The development of a small building entry model will permit an estimate of the effects of various types of suppressing fire and the use of smoke cover or irritants. The model will examine the full range of US weapons to determine the most desirable characteristics of covering fire. The aim is to determine the parameters of optimum covering fire in terms of friendly, neutral and enemy casualties. Recommendations will be made, based on the analysis, of the weapon characteristics and tactics required to improve this combat capability. Estimates of comparative expected values of present and projected alternatives will provide a basis for investment decision.

Once inside a building, attackers must operate as an isolated unit unless communications can be established with support units. The ability to utilize such support could lessen the impact of interior fighting. A room known to be occupied could represent a barrier to the troops inside. By calling on support fire from heavy direct fire weapons, that barrier could be neutralized thus permitting the clean up action to continue without exposing troops unnecessarily. This kind of "surgical" action cannot take place without communication channels and without an appropriate grid system or target designating system. The value of fire direction techniques and communication channels should be determined and methods of implementation analyzed.

The types of munitions that would be effective in the role described above should be examined. An effort should be made to determine the effects of current munitions of all types against city structures. These effects should be compared to the types of terminal effects that are needed in city fighting to determine if gaps in our current inventory exist. For example, it appears that penetrating flame weapons and HEP rounds would be particularly useful for "surgically" partitioning enemy units inside a building from mutually supporting each other, and for denying them the use of stairwells and hallways if desired. The ability to drive the enemy away from exterior walls would achieve maximum suppression effect. Another example is the use of "smart" munitions. Since their delivery error is small, they permit the use of relatively large warheads even in the close quarters common to city fighting. This gives a good kill probability against enemy defenses and a low probability of damage to other structures or casualties to friendly troops or to neutrals. Illumination of targets by devices carried by attacking troops would help solve the difficult and time-consuming problem of target designation in the confusing terrain of cities. "Smart" munitions promise rapid destruction of strong points even in close combat.

A study of munitions could be very helpful in defining our present capabilities in the urban environment and identifying gaps in that capability which could be relatively easy to fill utilizing, present delivery means with improved terminal effects.

Other hand deliverable munitions besides the fragmentation grenade may be useful in in-building fighting. Localizing the enemy makes him vulnerable to several types of munitions which can be thrown into rooms or punched through interior walls with small rockets and/or shaped charges. Examples include CS, incendiary, and concussion munitions. These should be examined in detail by means of an interior fighting model in which current methods and equipment can be examined to determine the potential of new methods and equipment. A grenade option limiting lethal radius may be

valuable in such close quarters as well as in other close combat situation.

Covering fire for movement within a long hallway is difficult; personnel within the hallways are very vulnerable. Enemy soldiers can shoot "down the hall" by holding their weapons just far enough out to clear the door frame. In this manner, they expose only their hands. Even though their fire is unaimed, in close quarters it can be deadly. The use of the grenade launcher gives some lateral effectiveness which would tend to keep enemy personnel away from the doorways. However, unless the hallways were more than 20 meters long, there may be some danger to the firers and other friendly personnel in the hallways.

Wall breaching devices would reduce exposure of friendly personnel within the hallways. Such a device would create mouseholes allowing room to room access without using hallways. In this manner area denial fire could be used in the halls with a minimum of exposure of friendlies. It is currently possible to use sledge hammers, axes and wrecking bars to make mouseholes. This telegraphs intentions to the enemy on the other side of the wall who can prepare an unwelcomed reception when the walls are breached. Further, the enemy can fire through the walls at the wrecking sounds with a high probability of hitting friendly troops. The wall breaching device must be usable in close quarters without danger to friendly troops. Possibly the foxhole digger rocket device could be adapted to this role. The device uses a rocket propelled shaped charge. The rocket motor would propell the charge from a holding stand into the wall and hold the charge up against wall during detonation. This device would increase vertical and horizontal mobility of friendly troops within the building, lessening the need to use dangerous hallways. However, rockets and recoilless rifles produce backblasts which may be dangerous inside buildings.

Conversely, systems to counter enemy movement should be examined specifically. It may be possible to turn the defender's cover from an advantage to a disadvantage if a method were found to "lock" the doors.

The cover then becomes a detention device. The "prisoner" can be picked up at the convenience of the attacker. This would permit the bypassing of suspected strong points. Possible devices include adhesives, ballistically emplaced studs or hosps, or quick sealing jets or liquids.

Another possible tactic is to seal off the enemy position from visual contact with the area surrounding him with hardening or nonhardening foam. The foam becomes a curtain. If the curtain is breached, there is a positive indication of enemy presence. Any re-opening should be clearly visible. In addition to the curtain which interrupts visibility, the foam could contain a toxic adititive. An analysis would be useful to determine the technical feasibility of this technique and the tactical utility.

6. RESULTS OF ANALYSIS

The discussion above indicates that troops attacking and clearing high rise buildings are extremely vulnerable during building entry and during room to room searching, especially via hallways. There are several types of studies that could be done which could lead to improved tactics and weapons for accomplishing this task. Briefly, they include developing entry techniques, utilizing new devices to increase or to block vertical and horizontal mobility within the building, developing techniques and munitions for isolating and for attacking enemy strong points, and designing techniques and methods of coordinating themutually supporting actions of interior and outside forces. Specific study recommendations appear under Sections 3 and 7.

7. ALTERNATE RESPONSES

An analysis should be initiated to determine the "wave guide" properties of hallways. This affords the possibility of opening doorways at a distance. Follow this with an analysis of optimum hallway tactics, given: open doors or walls.

The development of a personnel locating device would be extremely helpful to attackers. Such a device would negate the need to assault empty rooms and would provide much more mobility to the attackers. The freedom to approach an occupied room without examination of each intervening or adjoining room would speed the clearing process. Techniques to be examined should include electronic systems and animals. Animals could be trained

to perform a weapons delivery role as well as a target acquisition role.

TECHNICAL PROBLEM RESUME

Problem: Firepower 26	Date: 17 Oct 1972	Sheet 1 of 13
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Title: Assault through a Swampy Urban Area		

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TECHNICAL PROBLEM RESUME

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1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, Par. 8.4.c.(3)
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972
c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Ft. Benning, Ga.
d. U.S. Army FM 31-50, Combat in Fortified and Built-Up Areas, March 1964.

2. DESCRIPTION OF PROBLEM

The defeat of enemy personnel who have taken positions in houses on either side of a broad swampy area.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Conduct a study using an appropriate city fighting model to determine the utility of smoke to isolate enemy units to reduce their mutual support and to allow greater concentration of our firepower.

b. Determine methods for getting heavy armor to enemy strong points for use in direct fire. Examine methods and tactics for entering and moving through urban areas with increased survivability.

c. Examine terminal effects of current munitions against various structural materials to determine if increased effectiveness for urban combat role can be achieved.

d. Determine the tactical utility and technical feasibility of a penetrating fragmenting grenade (30-40 mm) or recoilless rifle (90 mm) round. The round would use kinetic energy to penetrate exterior walls. It would detonate after a delay sufficient to permit the round to pass through the wall.

e. Develop a small penetrating teargas or CS round for use against enemy personnel in buildings. The round could be fired through interior walls at

suspected troops in adjacent rooms.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

At 1045 the 434th Infantry Battalion began its assault through the narrow streets and found many open areas of swamps between groups of houses. Traversing across this open terrain, the troops were exposed to fire from the PVO and became bogged down in the soft, muddy soil. Figure 1 describes the event in terms of engagement conditions and individual tasks which must be performed to accomplish the unit's tactical objectives.

The initial objective was to seize and hold the row of houses to the west of the swampy, open area in order to provide a base of fire from this position.

After the squads achieved their objectives and started to cross the swampy area, they were pinned down by heavy enemy fire. The platoon leaders called for support in suppressing the enemy fire. The major actions to this point in the action are shown in Figure 2.

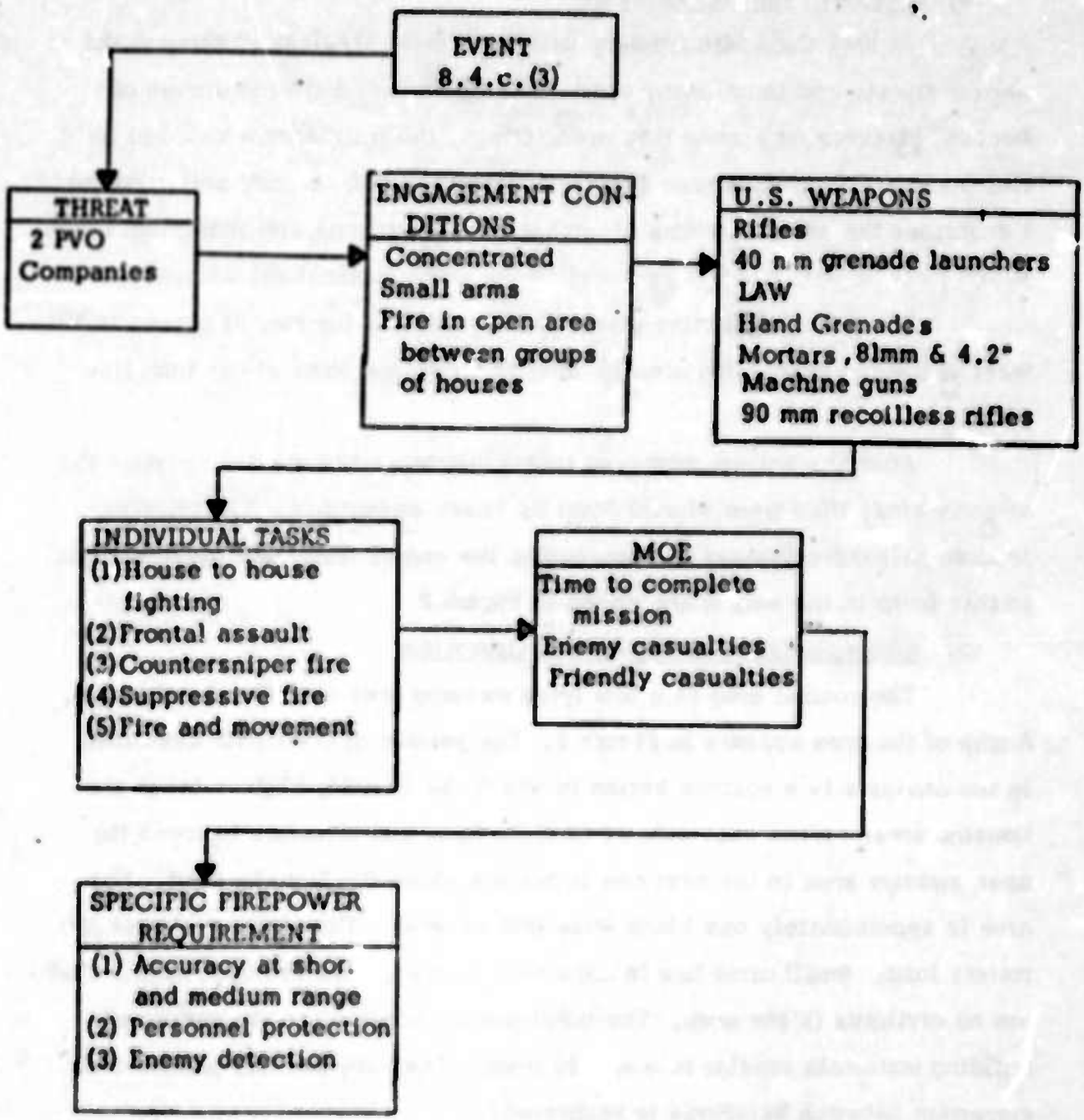
b. Characteristics of the Area of Operation

The combat area is a low lying swampy area near the river's edge. A map of the area appears in Figure 3. The portion of the battle described in the analysis is a platoon action in which the friendly platoon takes the housing areas on the east side of Choi-To Road and attempts to cross the open swampy area to the next row of houses along the Han-To Road. The area is approximately one block wide (100 meters). The platoon front is 150 meters long. Small arms fire is extremely heavy across the open area. There are no civilians in the area. The buildings are made of an assortment of building materials similar to a shanty town. They are densely packed and movement between buildings is restricted.

c. Description of U.S. Forces

A and B Companies of the 434th Infantry Battalion were assigned the mission of attacking and clearing the area. The 2 rifle companies were

Figure 1: Assault Through a Swampy Urban Area



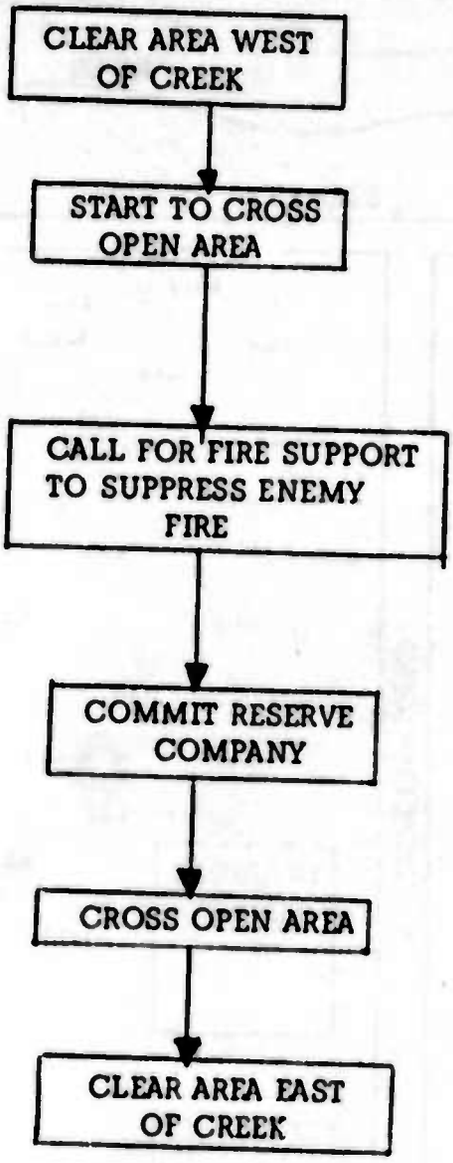
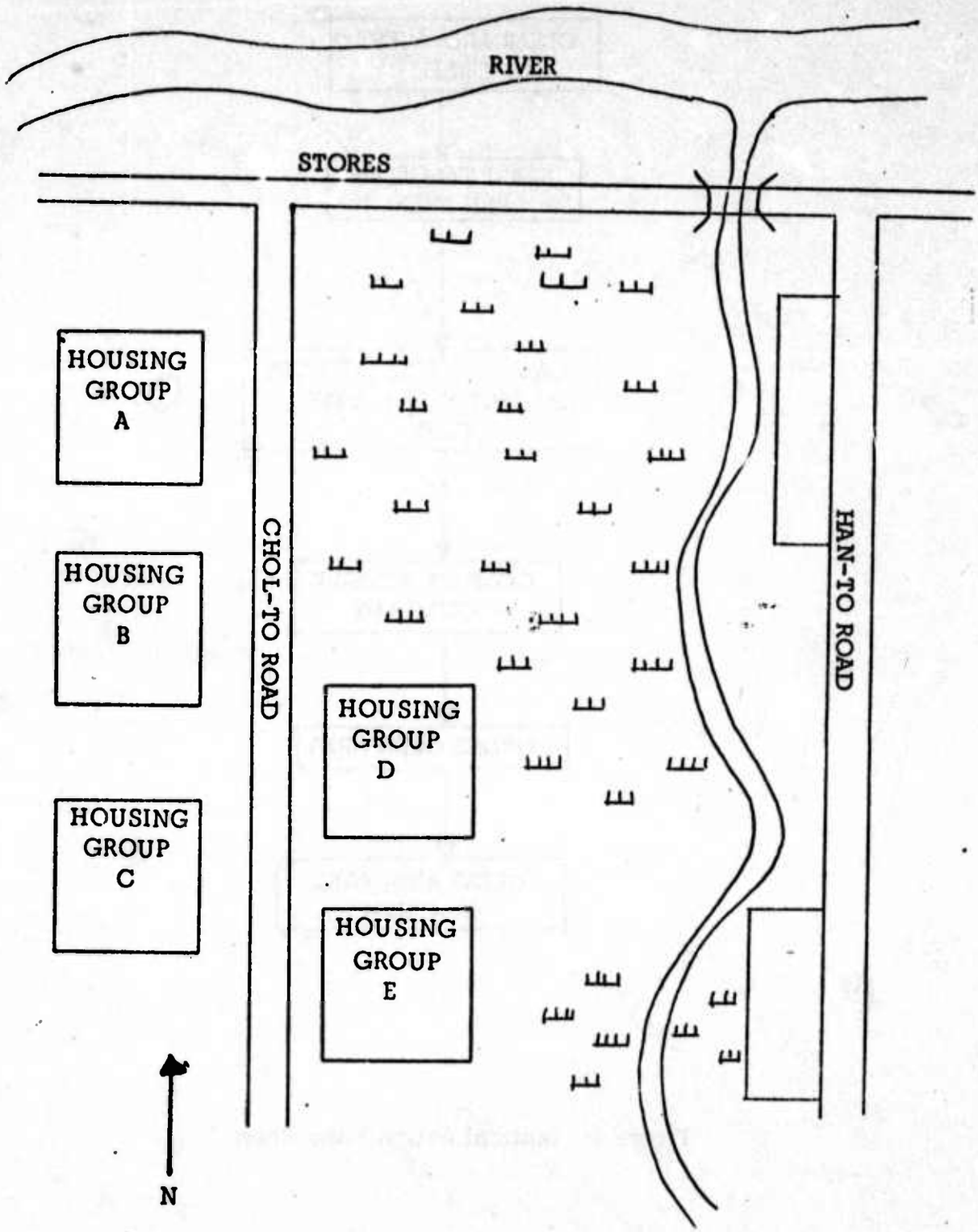


Figure 2: Tactical Action Flow Chart



HOUSES IN SWAMPY AREA

FIGURE 3

supported by the battalion recon platoon with the scout and surveillance section. In addition, one AT squad was attached to each of the 2 attacking Companies. C Company was held in reserve. Figure 4 shows the support elements of the 432 Infantry Battalion.

Of special interest in this event is the Battalion Reconnaissance Platoon. Much of the support fire from vehicles must be provided by the recon platoon because of the area characteristics. The narrow streets and swampy open terrain require mobile vehicles with sufficient armor to withstand small arms fire. The recon equipment is shown in Table 1.

d. Description of Enemy Forces

The enemy units consist of two companies of PVO. The troops are armed with AK-47 rifles, LMG, hand grenades, rifle grenades, and mortars.

5. PROBLEM ANALYSIS

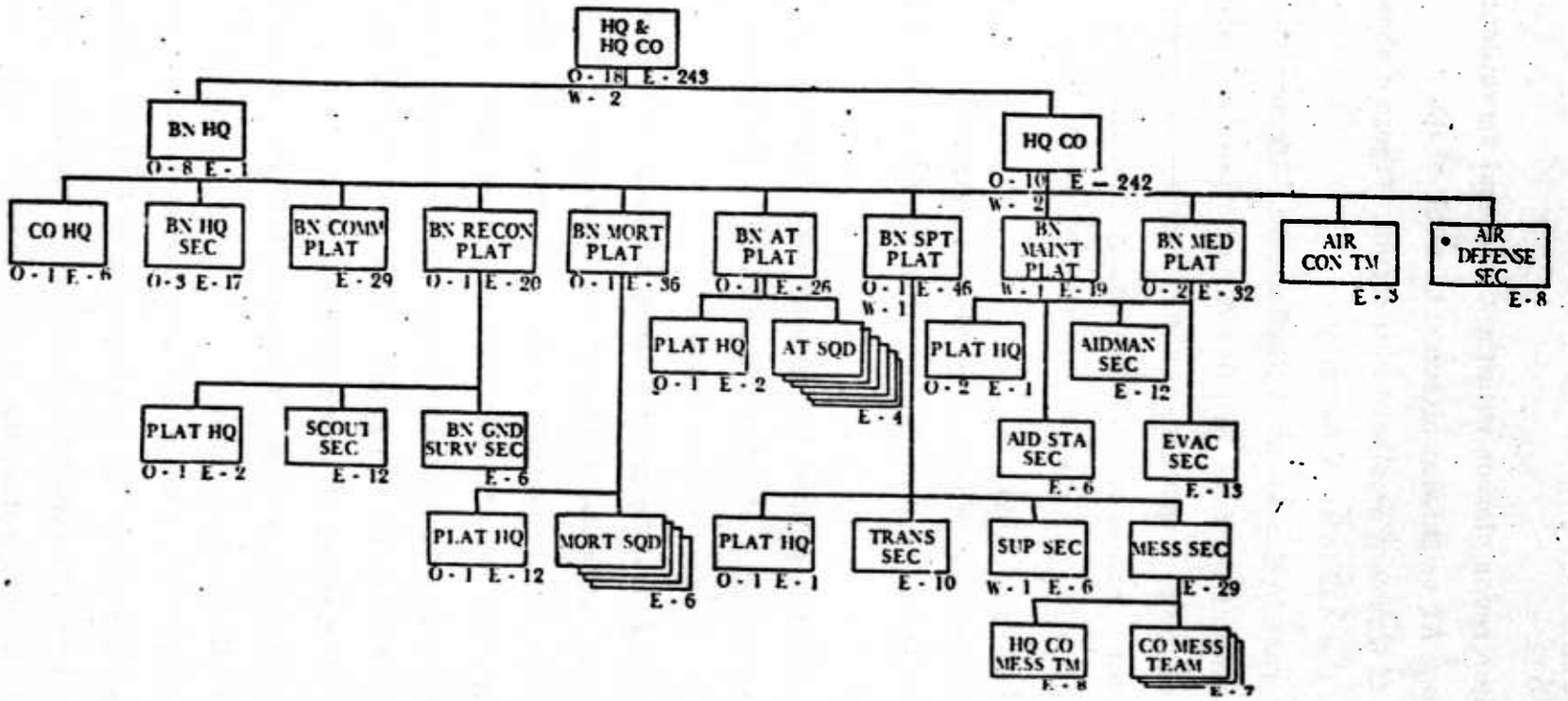
The first squad of the first platoon of Company A has already attacked housing group A, cleared the area of defenders and taken up a position to cover the 2nd Squad's advance to housing group D.

The third squad attacks housing group B using house to house combat, staying in contact with the 1st Squad on the left and elements of the adjacent platoon on the right. After achieving their initial objective of occupying the houses next to the open area, the rifle platoons are pinned down by heavy enemy fire. The Battalion Commander takes charge of the battle, committing his reserve company and calling for fire support from the battalion mortar platoon. At this time, all fighting elements are committed.

The CO, after several minutes of heavy suppressive fire, sends his assaulting elements thru the swampy area.

The PVO forces have destroyed the small bridge crossing the creek on the main road. All vehicles must cross the swampy area or ford the stream.

On order and under heavy covering fire from the mortars, the infantry squads and the recon platoon vehicles, the assault troops attempt to cross the swampy area approximately 100 yards wide. Heavy casualties are taken by the first wave of assault troops, who manage to reach the small creek.



SUPPORT ELEMENTS OF 432nd INFANTRY BATTALION

FIGURE 4



Table 1: Scout Platoon Equipment

From the edge of the creek behind the small protective embankment, the assault troops establish a forward base of fire to cover the advance of the second wave of assault troops who manage to secure a foothold at the objective. Heavy casualties are again taken as the houses are reached. Fierce house to house fighting occurs as more friendly forces cross the swampy area. Two recon vehicles attempting to cross are bogged down and subsequently abandoned for the duration of the firefight.

The current doctrine and weapons applied to this situation were sufficient to accomplish the tactical objective. However, large numbers of casualties were taken in attempting to negotiate the swamp barrier. The use of battalion and company mortars to "soften" the objective had some effect, but accuracy in hitting enemy strong points in specific houses and parts of houses was less than desired. The mortars were not used during the house to house fighting prior to crossing the open area. Smoke from the mortars aided the assault troops by reducing the effectiveness of enemy forces.

It appears that the commander of the friendly forces has few options available to him. He can continue to soften the target for some time, reducing the buildings to rubble. In this situation, this tactic may be effective. Past experience however does not support such a conclusion. In Europe after cities were reduced to rubble, the defenders simply moved in (or emerged from shelters) after the fire was lifted and used the rubble effectively for cover and concealment (Aachen 1944). Damage to the city and life support systems is immense.

Heavier direct fire weapons, if they had been available would be more effective since they do not require penetration of overhead cover which can be several floors thick. Direct fire weapons must contend with cover but usually the cover is a maximum of one wall in thickness. Damage is still a factor with their use but is usually limited to the enemy and the buildings that he is in. Still another problem is bringing the heavier weapons through the city to the strong point. This problem of city entry is discussed in detail

in Hung Shan TPR-2: Ambush of a Moving Column. The analysis of that problem situation indicates the need for and approaches to a study to determine methods of entry and movement in the city and techniques to determine the characteristics of weak points.

For the most part, the only means of limiting collateral damage is to trade machine gun fire with the enemy in an attempt to wear him down and cause his withdrawal. This method only limits damage; it does not eliminate damage. The smaller projectiles continue to inflict some building damage.

The use of smoke could help reduce casualties, but this assumption again is not supported by experience. Experience has shown that its use lacks control both in placement, duration, and distribution. Results have been that too much smoke is used in the wrong places. The consequence is a failure to reduce friendly casualties and in some situations to increase neutral casualties. Smoke munitions characteristics should be studied and compared with the performance required for their use in urban areas.

The short ranges in this and other urban battles seems to indicate there may be problems of fuzing with current munitions. Projectile arming distance may be a factor with current artillery, mortars, M79 grenades and direct fire AT weapons such as the 90 mm and 106 mm RR. Most of the guided AT missiles have capture and control distances which are too great for city use. A small study should be undertaken to determine where such gaps and shortcomings exist with current weapons in urban environments.

In this particular situation, mobility of unarmored wheeled vehicles is a problem. The swamp area along the river is an effective barrier to wheeled vehicles and relegates their weapons to a purely supporting function. Heavier tracked vehicles would also experience difficulty in this situation. It appears that lightly armored air cushion vehicles would be useful in this situation.

A direct fire flame round with sufficient ranges to reach across the stream could be useful in this situation. It appears to be preferable to ignite strong points as a means of defeating them rather than reducing them to rubble. In this same vien, FAX would also be useful. As was discovered in Hung Shan TPR-3 very little is known concerning terminal effects of larger weapons against city structures. FAX and flame weapons should be included in a study to fill this information void.

Finally, the development of a penetrating grenade round could be useful in house to house fighting. If the round could be fired through the exterior wall of a room containing snipers or other enemy personnel with a delayed fuze, the chemical energy in the round could be dissipated inside of the room. Both fragmentation and concussion munitions should be studied for technical feasibility and tactical utility. Further, a tear gas or CS payload in a smaller caliber could be useful within buildings. The round could be fired through interior walls at suspected enemy positions in adjacent rooms. This type of munition could be a definite aid in room to room fighting.

6. RESULTS OF ANALYSIS

The use of smoke in city fighting is somewhat controversial since past experience can be used to support pro or con arguments. The ability to partition a battle area by visually curtaining off selected participants is appealing and represents an effective means of reducing the mutual support that units can provide each other in close quarters. An analysis to determine characteristics of dissipation and means of accurate delivery should be undertaken to determine the utility to the commander of selectively employing smoke as an aid to accomplishing his mission.

The effectiveness of large caliber direct fire weapons against city strong points such as the Citadel in Hue dictates a detailed examination of methods of moving them through cities with low losses.

Technical effects of current weapons including flame and FAX weapons should be examined in detail to determine where firepower gaps exist. Minimum ranges, fuzing and fragment distribution must be examined closely to determine usefulness and safety factors when employing heavier rounds in the city.

Finally, mobility problems within cities must be examined to determine where shortcomings may exist with our current inventory of vehicles.

7. ALTERNATIVE RESPONSES

Determine performance gaps and deficiencies of our current family of combat vehicles and their armaments in the urban combat environment.

TECHNICAL PROBLEM RESUME

Problem: Firepower 27	Date: 26 Oct 72	Sheet 1 of 15
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Title: Ambush of a Relief Column		

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TECHNICAL PROBLEM RESUME

Problem: Firepower 27	Date: 26 Oct 72	Sheet 2 of 15
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1. REFERENCES

a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, Par. 8.4.b.(2) and (3)
b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Ft. Benning, Ga.

2. DESCRIPTION OF PROBLEM

A relief column of tanks on its way to assist troops fighting in the inner city is ambushed by a platoon of PVO regulars.

3. RECOMMENDATIONS FOR FURTHER ANALYSIS

a. Analyze several tactical situations for use by the unit commander to determine the utility of information on friendly vehicle locations as an aid in coordinating unit fire power.

b. Examine various high volume, short range weapons for use in suppressing snipers and AT crews as alternate secondary armaments for vehicles.

c. Examine various tank hull modifications for use in penetrating city structures to take advantage of available cover.

d. Conduct a study to examine doctrines for penetrating city defenses with armor units.

4. SITUATION AND CONSIDERATIONS

a. Tactical Event for Analysis

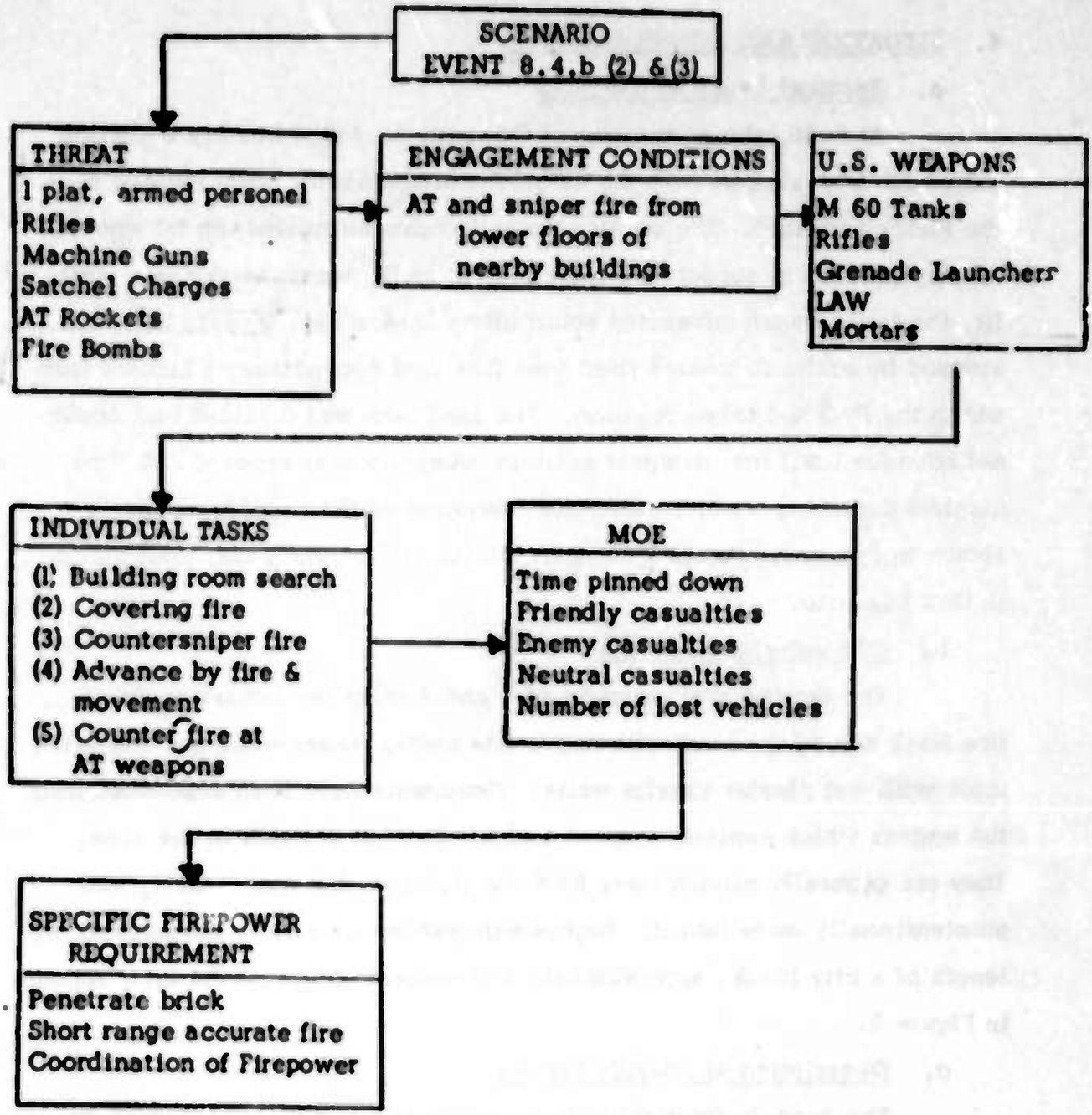
At 0530, the commander of Company A, 432nd Infantry Battalion called for tank support from the 422nd Armored Cavalry Troop located near the Plutang airfield. The cavalry troop commander ordered the 1st armored cavalry platoon to support the infantry. At 0630, when the sky was well lit, the tanks began advancing south along Djalan Raja Kramat, but were stopped by antitank rockets fired from first and second story windows from which the PVO had taken position. The lead tank was disabled and could not advance until the insurgent antitank weapons were removed. A flow diagram depicting major combat tasks required of the friendly troops is shown in Figure 1. Figure 2 summarizes the major events that take place in this scenario.

b. Characteristics of Area

The combat area consists of 2 and 3 story row houses made of fire brick and adobe brick with heavy tile roofs. Outer walls are one brick thick with wet plaster interior walls. Occupants have been evacuated from the houses which contain weapons and troops, but are still in the area. They are generally moving away from the fighting, but occasionally and unintentionally move into it. Engagement ranges usually do not exceed the length of a city block, approximately 200 meters. A map of the area appears in Figure 3.

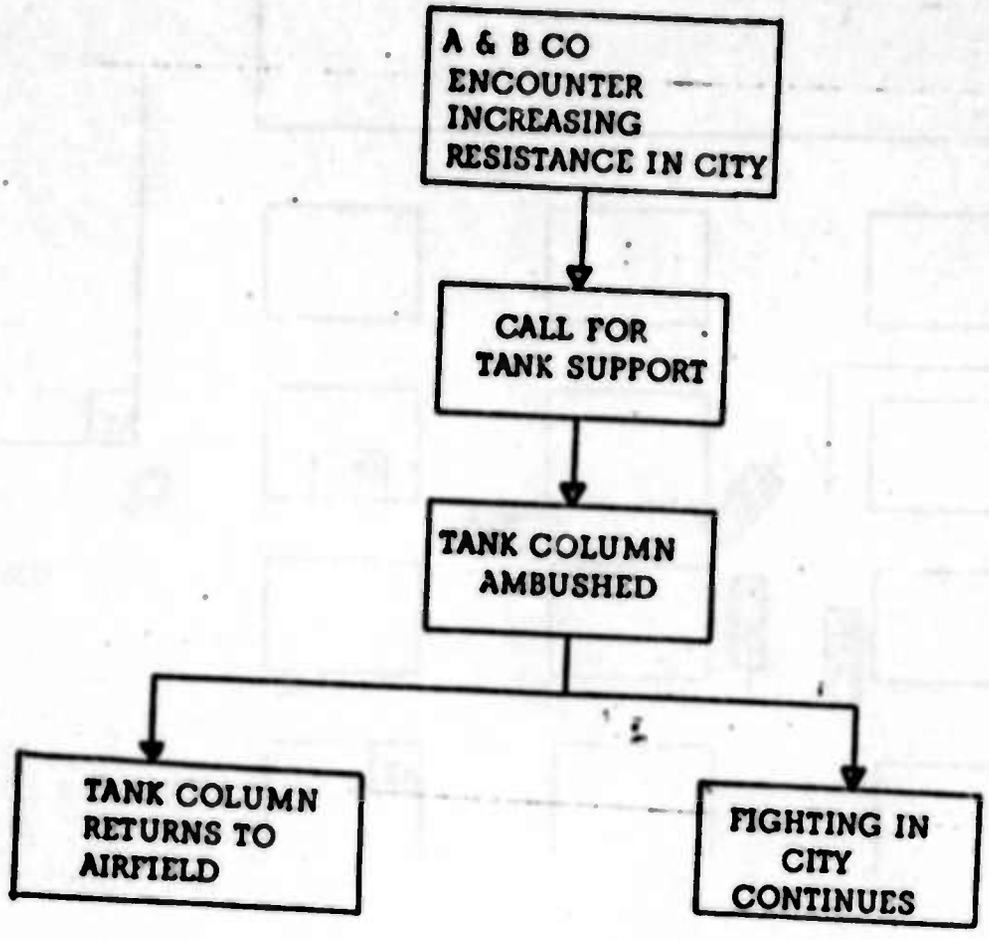
c. Description of Friendly Forces

The friendly force initially consists of A and B companies of the 432nd Inf Bn. This force encouters difficulty in the escalating battle in the inner city as the unit continues toward the embassy. An armored cavalry platoon (Figure 4) is dispatched to assist A and B companies but is ambushed by PVO troops as it moves from the airfield to the battle area.



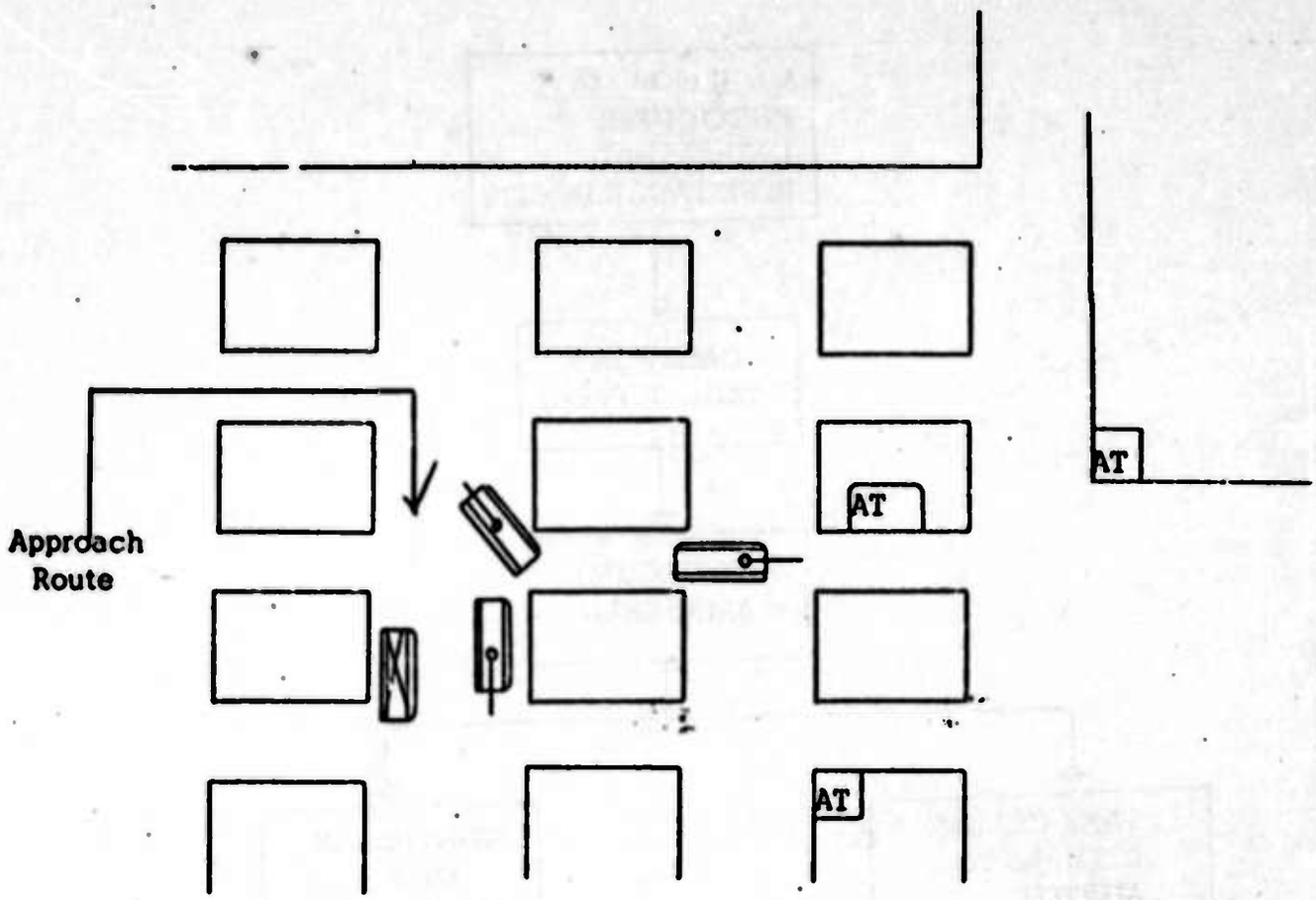
Tank Antitank Operations

Figure 1



Event/Action Chart

Figure 2



IMMOBILIZED TANK

SUSPECTED AT POSITIONS

LIVE TANKS

TANK-ANTITANK BATTLE AREA MAP

Figure 3

d. Description of Enemy Forces

The enemy force consists of 1 platoon of PVO troops armed with rifles, machine guns, satchel charges, fire bombs and AT rocket launchers.

5. PROBLEM ANALYSIS

In moving through the city to reach the embattled troops, the armored column is channelized and vulnerable to enemy antitank weapons. The defender has good cover and concealment and extremely short firing ranges, ideal for the smaller AT weapons such as the LAW.

The standard procedure of disabling the lead tank is used to stop the column. With the buildings providing cover for the defenders and with the tanks in the open, all of the advantages are with the defender. The use of smoke is more of a benefit to the defender since it adds to his concealment; the tanks are difficult to conceal and can only take positions in the streets where little cover is available. Support artillery, although not available here, would be of little help. The friendly tanks in the open are more vulnerable to artillery than the AT crews are in cellars and on the first floors of buildings.

Figure 1 summarizes the event in terms of the forces present and the individual tasks which must be performed by the tank crews and accompanying infantry. The sequence of events is summarized in Figure 2. Figure 3 shows the battle area and the situation after the lead tank has been knocked out.

As the action continues, the accompanying infantry dismount and attempt to clear the area with the remaining armor in support. However, there are too few men to cope with the enemy force. The battle is a standoff with the friendly forces breaking contact in an effort to detour around the strongpoint. In addition to the tank which was destroyed, several infantry personnel were wounded. The column eventually returns to the airfield, unable to penetrate to their objective. In this situation, the relative invulnerability of the enemy defending with the cover available could hold up the column for a considerable length of time. The resulting attrition on both sides would render the relief unit ineffective as a relief force even if it were able to break through.

Current doctrine and current equipment are not highly suited to combat in an urban environment. An armored column moving through the streets of an unfriendly city is very vulnerable. The tactics used in the streets of Budapest, Hungary, were to attack the column and draw the tanks into side streets where they could be attacked from the upper stories of buildings. Isolated tanks made easy targets. The Russian forces lost 80 of 300 tanks that entered the city.

If the alternate doctrine of leading or accompanying the column with dismounted infantry is used, the speed of the armor is compromised and the advance is slowed to a walk.

There are several characteristics of the city environment which should be considered in analyzing current shortcomings of armor in the city. On the rural battlefield, the enemy is normally in front of the attacking armor. Consequently, the least vulnerable part of the tank faces the enemy. The fire power of the tank normally keeps the enemy some distance away and thus renders many of his short range weapons useless. Satchel charges and flame weapons are rarely used. In the city, the tank can be attacked at short ranges from any vertical angle or horizontal direction, including above, below, and behind. This not only exposes lightly armored surfaces to attack, but also may prevent the tank crew from either detecting or engaging the attackers. Furthermore, the differences in bearing surfaces between rural ground and city pavements reduces the advantage of track laying over wheeled vehicles.

Coordination of activities is easier on the open battlefield where intervisibility is generally good. In the city, coordination becomes a definite problem. The platoon leader doesn't have the same fields of view or knowledge of the situation facing each vehicle, especially if vehicles move around corners or behind buildings. It is extremely difficult to keep track of one's own forces, not to mention the disposition of enemy forces. A fighting organization ceases to exist for practical purposes as each component of the organization

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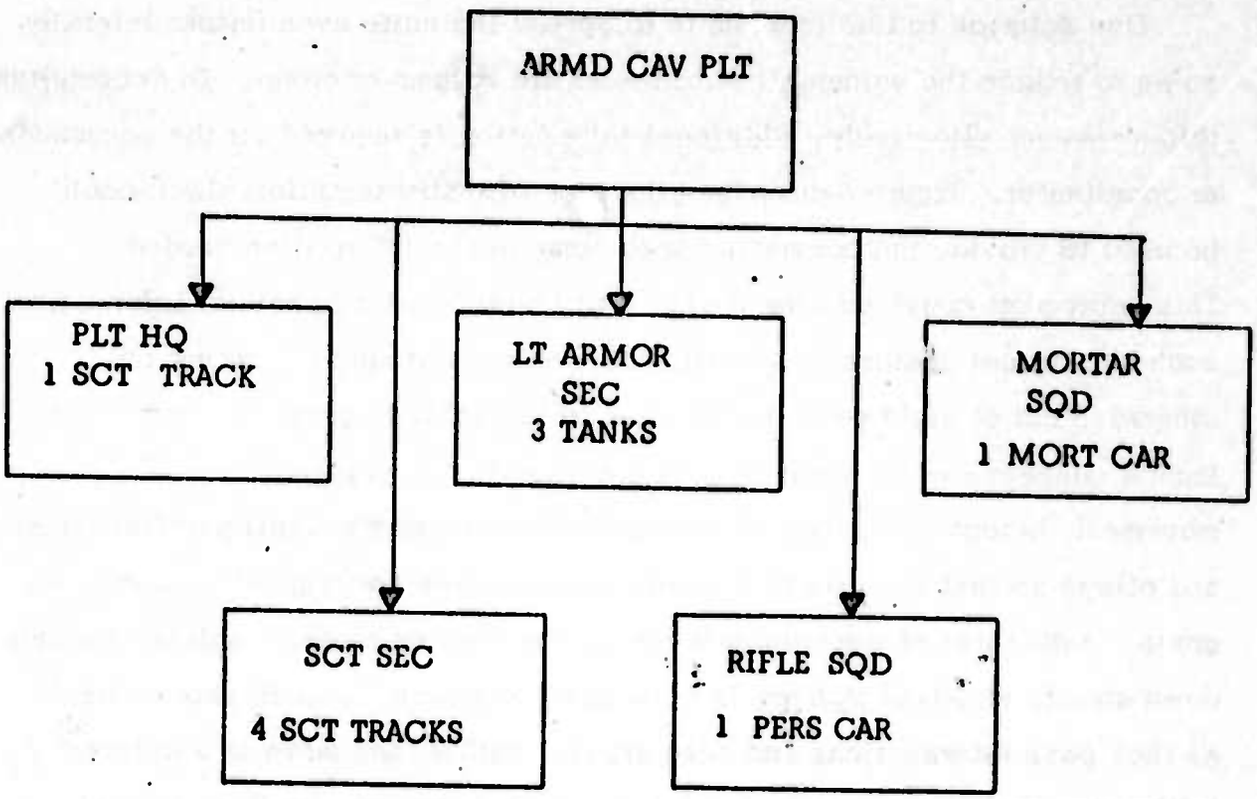
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becomes a separate fighting entity. Generally, the more severe the fighting the more independent each member becomes. The organization simply becomes the sum of its individual parts and loses the innate strengths of group action.

One solution to this problem is to spread the units even farther laterally so as to reduce the vulnerability of the entire column or group. To accomplish this maneuver effectively, additional information is required for the commander or coordinator. Figure 5 describes the type of instrumentation which could be used to provide the commander with some of the information needed. This equipment could also be used to carry additional channels of information such as a target designator so that other weapons around the corner or otherwise out of sight could be directed to potential targets. Such a concept can increase maneuver options. For example, movement through cities can be accomplished by using several parallel streets and alleys so that the loss of a single vehicle does not jeopardize the entire group. Better use of the vehicle's speed can also be made. Vehicles moving down streets at 30-40 mph are in view to AT weapons for much shorter times as they pass intersections and open areas. Rather than move in a column, infiltration techniques can be used such as entering the city from several points and dashing to a predetermined location to establish a strong point from which the firepower can be used. In the case of a relief action, the strong point can be set up almost instantaneously with vehicles moving in rapidly from several directions to an area very near the beleagured position. From the strong point, the relief troops then break through and extract or reinforce the jeopardized position. If extraction were necessary, the group would again disperse for a high speed run out of the city.

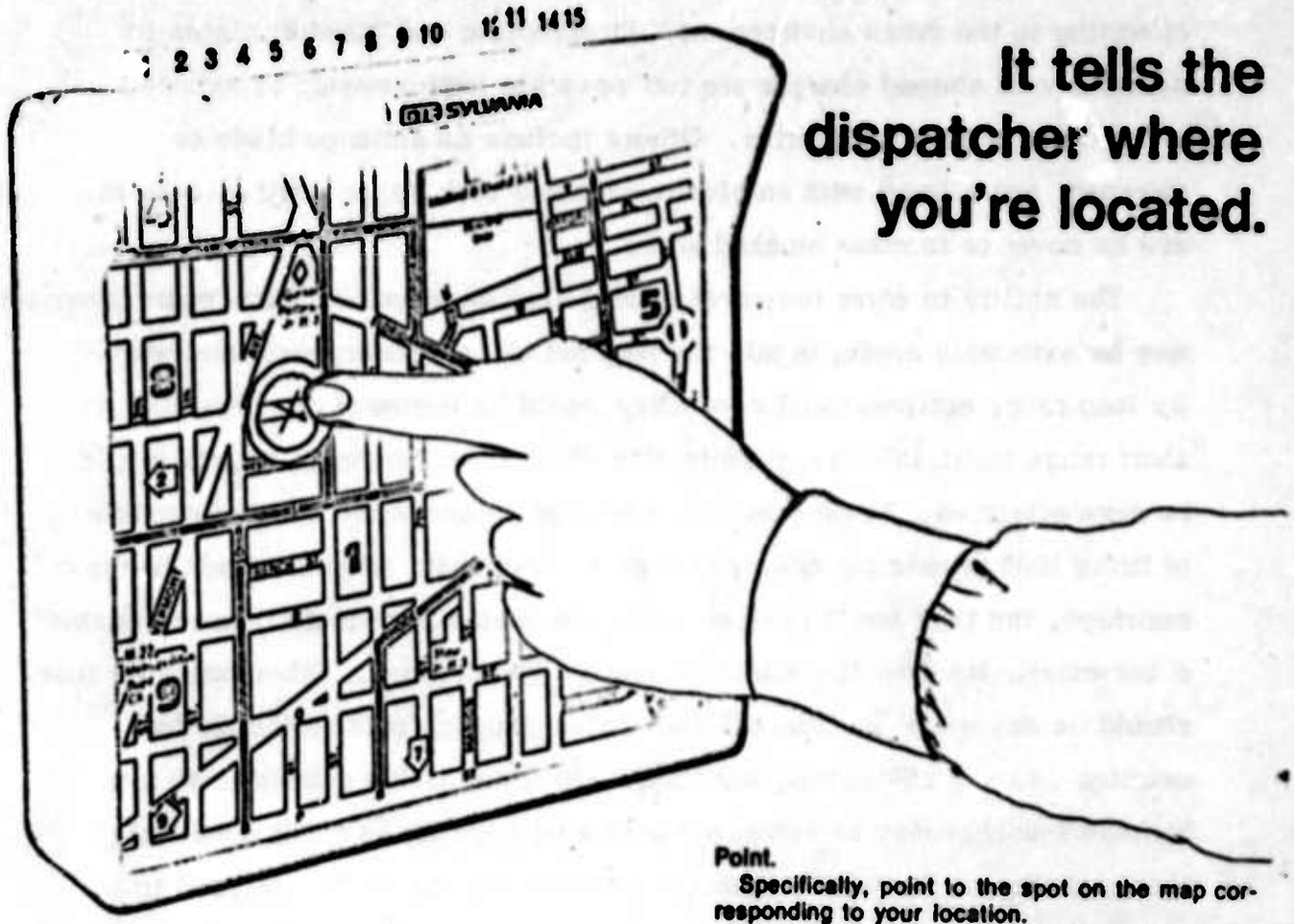
The use of other techniques may improve armor survivability. Tanks equipped with battering devices or explosive wall breaching devices can create cover by using the ground level of buildings. Upon arrival at the predesignated strong point or rendezvous, the vehicles break into buildings so that troops can dismount safely and begin to clear the area.



Armored Cavalry Platoon

Figure 4

digimap 100



It tells the dispatcher where you're located.

Point.

Specifically, point to the spot on the map corresponding to your location.

At the base station, unit identification appears on a map at the dispatcher's console marking the location of your vehicle. The unit identification will be keyed in the appropriate color corresponding to the status of your patrol car.

GTE SYLVANIA digimap is a semi-automatic vehicle location device. It utilizes a pressure sensitive map mounted on a grid-matrix board within easy reach of the driver. The unit is connected directly to a GTE SYLVANIA digicom terminal which transmits coordinate data from the digimap to the base station on the existing mobile radio channel.

Digimap functions especially well in an emergency. The dispatcher can call for all units to report their locations. Almost at once, the map displays all actual locations, making it much easier to work out an effective response strategy.

Each vehicle carries 16 maps of its operating area. Maps can be readily changed, however, as the car moves from one assignment area to another.

Fully automatic location systems may still be years and millions of dollars away. By contrast, inexpensive, semi-automatic vehicle location with digimap is here now. For details contact GTE SYLVANIA, Sociosystems Products Organization, Box 188, Mountain View, California 94040. (415) 966-3373.

Figure 5

GTE SYLVANIA
INCORPORATED

There are changes in vehicle design that would be beneficial to tanks operating in the urban environment. Fireproofing and standoff plates for detonation of shaped charges are two possible improvements to existing armor when operating in cities. Others include an antimine blade or sweeper, and a boom with an electromagnetic pick up for carrying cars to use as cover or to clear blocked areas.

The ability to carry firepower should also be examined. The main armament may be extremely useful in city fighting but the secondary armament with its long range antipersonnel capability could be improved on. Possibly a short range multiple or salvo projectile weapon for personnel targets would be more effective. As an example, consider an automatic shotgun capable of firing 1000 rounds per minute of type 00 buckshot. With 9 rounds to the cartridge, the tank could produce 9000 projectiles per minute, thus increasing substantially its area fire effectiveness at short ranges. Other concepts that should be evaluated include a 5-shot salvo squeeze bore projectile for existing .30 and .50 caliber weapons. The Huey Cobra automatic 40 mm grenade launcher may be extremely useful with either an HE or a multiple shot projectile. The entire spectrum of concepts should be analyzed to determine cost versus benefits in terms of increase survivability and increase casualty producing firepower.

6. RESULTS OF ANALYSIS

There are several gaps or deficiencies to be overcome when using armor in the city. Perhaps the most important is to improve the management capability of the unit commander by providing him with the information he needs to manage efficiently the resources under his control. An initial step in this direction is to net the entire set of vehicles with a position location system so that each unit is aware of all other units, and can exchange target location information. This step will help to emphasize organizational capability, making the unit more than just the sum of its parts.

A second analysis required is to determine what type of vehicular/ firepower modifications could improve urban fighting capability. The use of an integral wall breaching device (either explosive such as that shown in Figure 6 or hull design change or attachment) for plunging through exterior walls to get into temporary cover of buildings is an example. The utility of a mine sweeping or detonating device to facilitate high speed movement throughout the city should be examined. Since implantation of mines is a difficult process, this device could possibly be designed for surface mines only. Several types of multiple projectile short range munitions should be examined with respect to cost and operational effectiveness. These include SSB, automatic shotguns, and 40 mm systems.

7. ALTERNATIVE RESPONSES

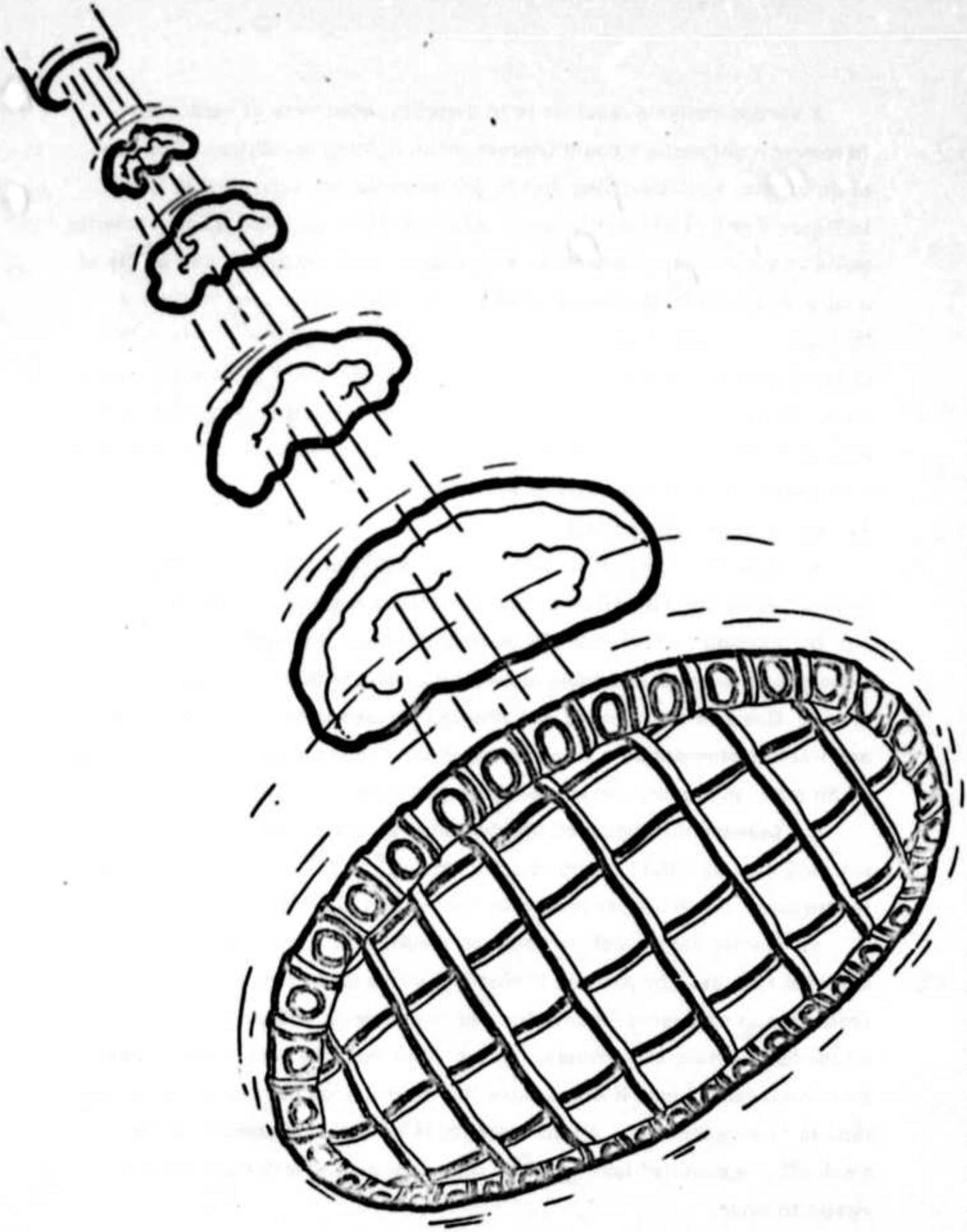
a. Examine various tank hull modifications and concepts for their use in penetrating city structures to take advantage of temporary cover.

b. Examine methods for eliminating AT mines from city streets. Concepts to be evaluated include sweeping devices or detonating devices.

c. Compare track laying and wheeled armored vehicles. The mobility and traction provided by a track laying vehicle in the country may or may not be an asset in the city, where roads are paved and gradients gentle.

d. Examine the angles of fire desirable in city fighting. The turret mounted main armament which can fire from -5° to 45° in elevation may be inadequate. Additional movement in the vertical plane may be required.

e. A grappling capability might be practical to hook onto the rear of a disabled tank and, by pushing it ahead of a live tank, provide additional protection in congested areas. Loss of tracks would not hinder movement on the hard surface city streets. In fact, the loss of a single track could be advantageous since it disengages the transmission placing the disabled tank in "free wheeling". A tank crew could on occasion actually blow a track off of a disabled tank with the main armament to make the vehicle easier to move.



Wall Breaching Munition

Figure 6

f. The only feasible alternate doctrine that could be used in this relief column event would be to use dismounted infantry to lead the column in an attempt to "smell out" the enemy. The number of men in the event above would have been insufficient to cope with the situation and the outcome of the battle would probably not have changed. A larger infantry force would have been required to escort the armor column through the city. This would slow the movement of the column.

g. Tanks are capable of 30-45 mph on hard surface roads. Because of the shadow areas caused by buildings, a tank moving a high speed would not be in view to any one gun position for a long period of time, except when moving directly toward a gun position which is positioned along the street axis. In this situation, the AT gun must fire at the least vulnerable part of the tank possibly giving away his position with the weapon signature. In the case of a guided missile, a round from the tank in the general vicinity of the signature could disturb the gunner's aim. An occasional round fired down the street in the direction of movement,even when no AT weapon has been fired, might discourage an AT crew from firing at all. Using this method of high speed penetration, the force could move along adjacent, parallel streets so that the sound of the moving armor would be difficult to localize. A tank killed in such a movement becomes an independent event, in that the kill does not halt the force and increase the vulnerability of other tanks.

Once the objective area is reached, the armor would take advantage of any available cover until accompanying infantry can dismount from trailing APCs and secure the area. In this manner a strong point can be created which can act as the base of operations.

TECHNICAL PROBLEM RESUME

Problem: Firepower 28	Date: 27 Oct 72	Sheet 1 of 8
Operational Area: HUNG SHAN		
Title: Embassy Defenses Strengthened		

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KETRON/ORA

TECHNICAL PROBLEM RESUME

Problem: Firepower 28	Date: 27 Oct 1972	Sheet 2 of 8
Operational Area: HUNG SHAN		
Title: Embassy Defenses Strengthened		

1. REFERENCES

   a. GTE Sylvania Special Technical Report No. 1, Military Operations in Built Up Areas, July 1972, Par. 8.4.d.(1)
   b. Ketron/ORA Interim Technical Report, Advanced Firepower Concepts for Military Operations in Built-Up Areas, August 25, 1972.
   c. Infantry Reference Data, ST 7-157-FY 72, U.S. Army Infantry School, Fort Benning, Ga.

2. DESCRIPTION OF THE PROBLEM

   Defense of a building complex.

3. RECOMMENDATIONS FOR FURTHER ANALYSES

   a. A gatling shotgun as a show of force and area denial weapon.
   b. Toxic foam barriers.

4. SITUATION AND CONSIDERATIONS

   a. Tactical Event for Analysis

By 1730 the insurgent forces had built up a considerable amount of harassing fire against the Embassy and there were several angry crowds outside the Embassy. The situation was of such magnitude that personnel could not pass windows without being in danger of small arms fire from insurgent snipers. The marines stationed at the Embassy guarded all entrances to the buildings and to the walls. The marines had not been returning the fire of the snipers because it was extremely difficult to identify and locate them, and there were many civilians looking out of the windows of the nearby buildings, so that it would be extremely difficult to return fire without a high probability of wounding persons in addition to the snipers. By 1800, the crowds had become so agitated that they climbed over the walls and began to set fires in the yards around the Embassy building. They also began to damage the windows and the Embassy vehicles that were parked in the rear area of the Embassy. By 0600 the next morning the only points that are being held by U.S. troop units are the main embassy building interior, and the military advisory group area at Tanjuk Priok. Plutang has been captured and all

U.S. troops at the air base have been made prisoner. Of the two C-5A aircraft that had landed one was able to take off prior to the air base capture but the second C-5A is still on the ground. The PVO leaders have arrived at the air base and accepted the surrender of the air base commander and of the U.S. officers. The PVO have captured the broadcast station and the TV station at Hung Shan and have made broadcasts indicating that they are in complete control of the city and of the air base.

The event is described in terms of combat tasks in Figure 1.

b. Characteristics of the Area of Operations

The map of the Embassy area (Figure 2) shows the physical characteristics of the situation. Firing ranges vary from 70 meters to 150 meters. Most of the sniper fire originates from the upper floors of nearby office buildings.

The Embassy is of stone construction with wall thicknesses of about 12 inches. Outer doors are made of heavy steel, the gates are made of rough-cut 12x6 inch wood planking. The exterior wall which limits fields of fire from the lower floor is 12 inches thick and constructed of stone and mortar.

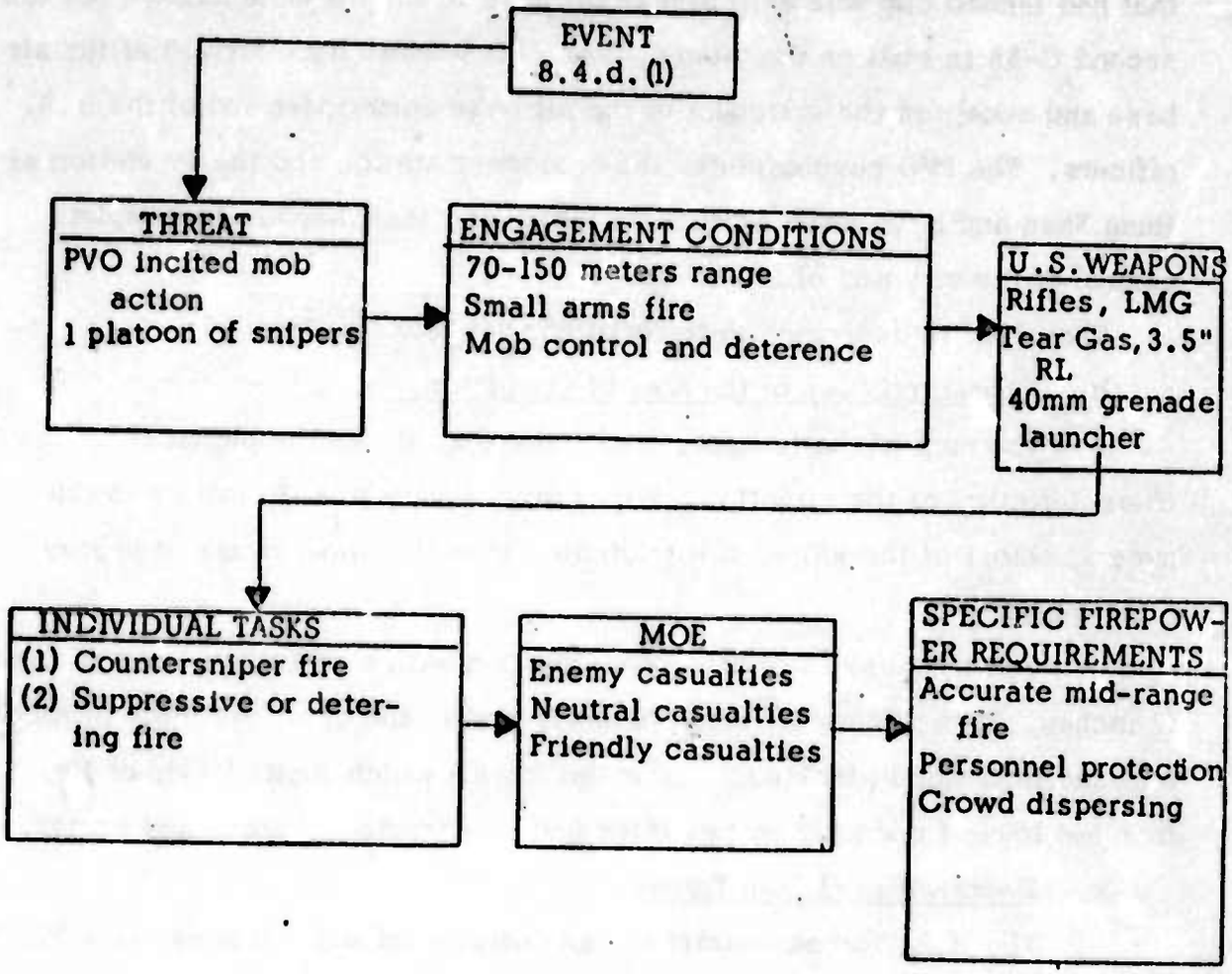
c. Description of Own Forces

The U.S. forces consist of one company of U.S. Marines (see Figure 3), less the mortar platoon.

In the early morning daylight hours 15 stragglers from Alpha and Bravo Companies of the 432nd Infantry Battalion attempt to gain access to the Embassy. Enemy sniper fire increases while the soldiers attempt to enter the Embassy grounds. Approximately one squad of Infantry manage to gain access. All squad members have their rifles but few rounds of ammunition.

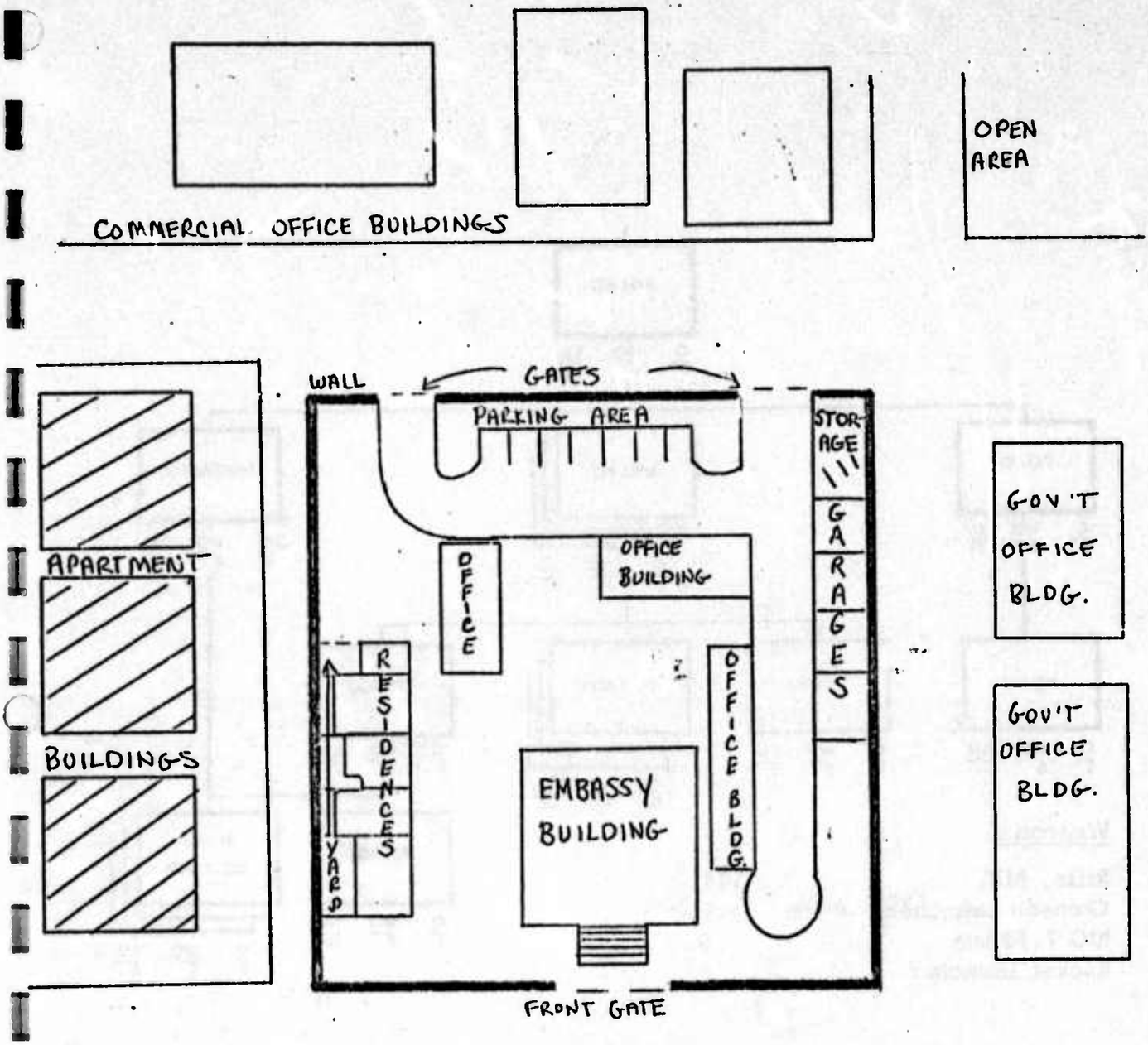
d. Description of Enemy Forces

The enemy force consists initially of 3 platoons of trained PVO forces. One platoon is assigned to sniper duty to harass Embassy personnel. The other two are assigned as agitators to initiate and escalate mob action. With the capture of the airport and other parts of the city, it is expected that the PVO force will be augmented soon. All PVO personnel are equipped with AK-47 rifles.



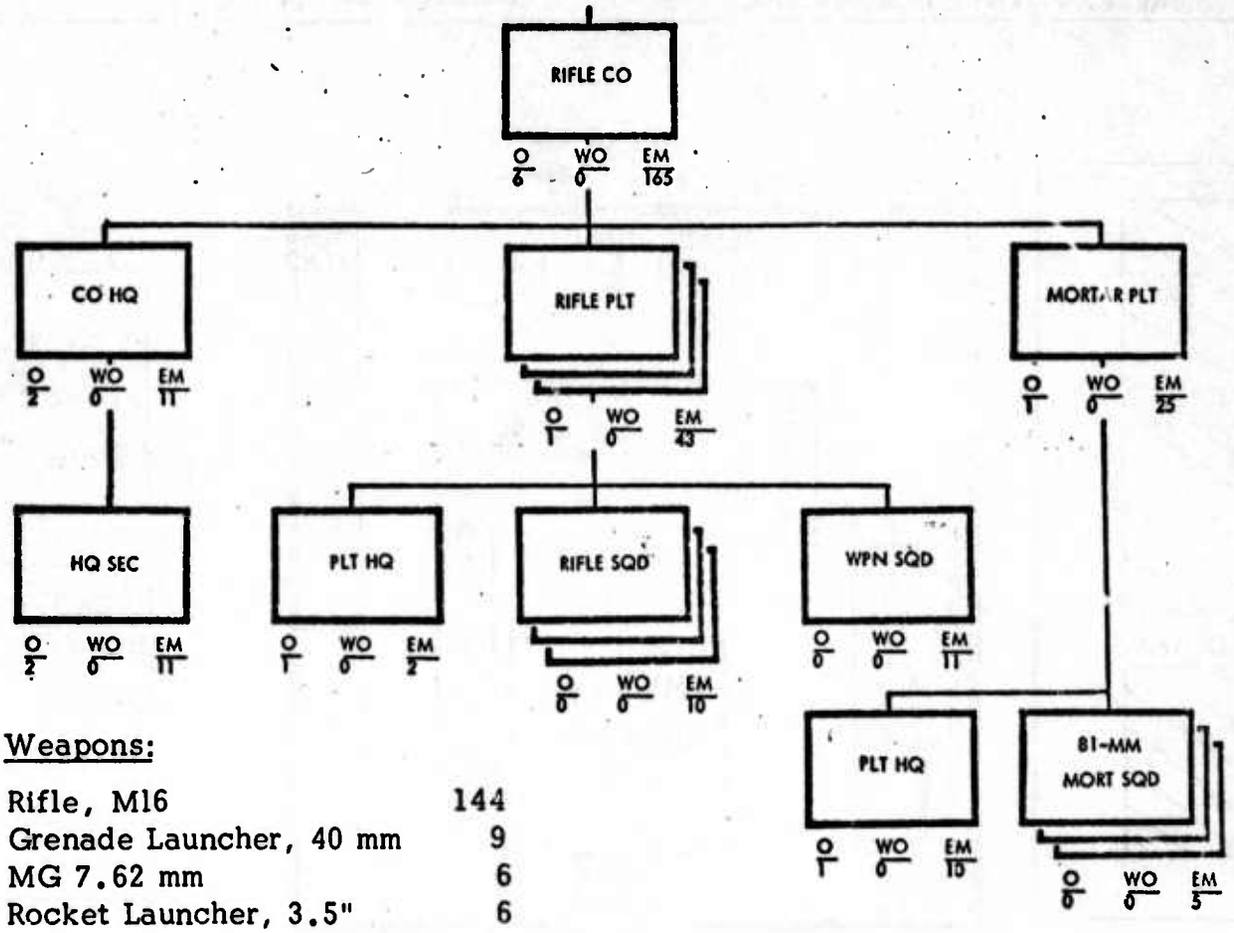
DEFENSE OF A BUILDING COMPLEX

FIGURE 1



MAP OF EMBASSY AREA

FIGURE 2



Weapons:

Rifle, M16	144
Grenade Launcher, 40 mm	9
MG 7.62 mm	6
Rocket Launcher, 3.5"	6

ORGANIZATION OF MARINE COMPANY

FIGURE 3

5. PROBLEM ANALYSIS

This firepower event intensifies gradually over a 12 hour period. Throughout the battle the U.S. forces are purely defenders. Show of force plays an important role initially, since without the Marines the embassy would have been lost very early. The threat of defending with force is very important to the progress of the battle.

By morning the mob action terminates but sniper action continues. U.S. troops return the fire whenever a sniper is located. It is apparent that the PVO force intends to capture the embassy when additional forces arrive. The additional forces will have heavier weapons that will enable them to blow in the exterior doors.

It appears to be only a matter of time before the embassy must fall into PVO hands. However, since U.S. amphibious forces are approaching Hung Shan, each hour of successful defense increases the unit's survival probability. As more PVO forces enter the area around the embassy, the civilians continue to evacuate. U.S. force need be less concerned about shooting noncombatants. This tends to keep PVO troops at maximum ranges consistent with the cover in the area and increasing their difficulty in storming the building.

However, as the enemy take more casualties, they bring in heavier weapons. Satchel charges, AT rockets and mortars are brought into the battle.

In this situation few alternatives are available. Friendly troops are in no position to attack and weapons other than small arms are difficult to employ. Enemy mortars deny access to the roof where rocket launchers and machine guns could be used.

A short range, shotgun type weapon, possibly using the gatling principle could be employed as a show of force weapon thus discouraging enemy personnel from storming the area. Considerable stockages of ammunition would have to be on hand to employ a high rate of fire weapon such as this. A 12 gauge

shotgun firing 9 buckshot per round and 300 rounds per minute would produce 2,700 projectiles per minute, or 45 projectiles per second when firing. This kind of firepower would keep rioters at a distance.

A toxic foam barrier of foam near the wall would also discourage attempts to enter the building if the enemy did not have protective gear.

6. RESULTS OF ANALYSIS

Defense of a reinforced concrete structure which can absorb considerable firepower depends upon keeping the enemy at a distance, assuming that the enemy is not able to bring into battle very heavy weapons. In most escalating mob actions, such heavy weapons are not available. Consequently, there is a need to control the open areas surrounding the defended buildings to keep the enemy from approaching and penetrating the buildings. The ranges of engagement will probably be short, so that a high volume of low velocity projectiles will be effective. The characteristics of the shotgun (low velocity, multiple projectiles, rapid rate of fire) fill the need, especially if the rate of fire can be significantly increased. The ammunition is low in cost and can be stockpiled in quantities if conditions indicate that trouble is apt to occur. Use of the gatling principle will increase the rate of fire significantly over the more conventional blow-back operated weapons. A gas filled shotgun shell dispensing small quantities of CS gas would also be effective.

7. ALTERNATE RESPONSES

The use of liquid foams as a medium for dispensing a persistent, noxious substance should be investigated as an area denial weapon.

KETRON, INC.

Washington Operations
12th Floor, Architect Building
1400 Wilson Boulevard
Arlington, Virginia 22209
(703) 524-5770

MEMORANDUM FOR FILE

5 April 1973

SUBJECT: CITY COMBAT EXPERIENCE: HUE '68

LTC ERNEST C. CHEATHAM, USMC

LTC MARCUS J. GRAVEL, USMC

LTC. Cheatham and Gravel each commanded a Marine Corps battalion at the battle of Hue' in 1968. They consented to come in and confer with us to assist in the ARPA study on "Military Operations in Built-Up Areas" and in the MUCOM "Analysis of Munitions Effectiveness in Built-Up Areas Overseas." The notes of that conference are enclosed.

We are indebted to these officers for their perceptiveness and for their dedication. They provided information and insights valuable to these projects.

George Schecter

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...porate Office Valley Forge Executive Mall 656 East Swedesford Road Wayne, Pennsylvania 19087 (215) 687-6300

VISIT REPORT

1. LTC Ernest C. Cheatham, USMC and LTC Marcus J. Gravel, USMC, visited on 5 April 1973 to discuss the operations of their Marine battalions during the battle of Hue in 1968.

Present were: AMSAA: Dr. Atzinger, MAJ. Coates

MUCOM: Jerry Selman, MAJ Killian

Picatinny Arsenal: Lewis Cole, Joe Dubin

GTE Sylvania: Bob Lambourne

Ketron: Ketelle, Schecter, Bracken, Blacksten, Ball, Collier

2. A rough transcript follows:

Schecter: What did you think was the most important type of building?

Kettelle: How come you could beat three times your number?

Cole: Could you give us a rundown of each of your weapons?

Cheatham: We used the standard battalion equipment. We left a company (+) back. Let's start with a description of the first few days, then we'll answer your questions on weapons and other things.

Gravel: We went into Hue on short notice from a dispersed deployment. My A Company plus some other forces started into Hue. We met some tanks and engineer cherry-pickers who were under fire on the road and they joined us. We crossed the Phu Cam River Bridge (2 small craters in it from VC demolition)

and went into the city. I later realized that if this bridge had been destroyed, we probably never would have gotten into Hue'. This was an area of low buildings and shops, with some open rice paddies and a large Catholic church. Unarmed, confused civilians were in the area, taking casualties. We attacked towards two buildings of 2 or 3 stories which the NVA defended in strength: rifles, small arms. We took it with an infantry assault.

At the next intersection they had sandbagged in .50 caliber MG's in buildings, at ground level, firing down the street. This slowed us down. We took the buildings with foot infantry; the tanks could not get into firing positions because of buildings along the sides of the road. Sgt. Gonzalez cleared the houses with hand grenades, won the CMH. We took losses from the .50 Cal.

What would have helped if you had it?

Gravel: 106 mm RR, mounted on mule or jeep.

We then moved rapidly through light, harrassing fire to the MACV compound. There the fighting was so close that the 81 mm mortars were firing almost vertical. We

fired to support isolated US detachments in the city until Cheatham arrived with his battalion and we could break out. I was ordered to cross the Perfume River on the still-intact bridge. Neither USMC nor ARVN tanks would cross with me, but they supported us by fire. That's when it turned really bad. The NVA were defending in numbers, with automatic weapons. We were ordered to seize ARVN 1st Division Headquarters but were stopped at the first corner. NVA should have let us go down the street, and then destroyed us; but fortunately they didn't. I scrounged and begged for vehicles to evacuate wounded, then we all pulled back across the bridge. This was our first experience with our troops looting. We set up a night perimeter on Route 1 in a building. We found a VN doctor who stayed with us, treating our wounded. The next day we tried to move out to relieve an isolated unit but we were not able to move, so withdrew to our night perimeter. The third day we got to the tropo scatter radio site to relieve them. Cheatham joined us on 3 February and we diverged, attacking in different directions.

Were flak jackets worthwhile?

Cheatham: Yes. It was cool weather, with short distances to move. B40 fragments were plentiful and were stopped by flak

jackets. We also wore helmets all the time in the city.

Weapons:

45 caliber pistol: effective in houses.

M16(M): Fed o.k., using 17-18 round magazine. No malfunctions.

Effective. Penetrated partitions o.k. but not heavy walls. Seemed as good in penetrating as .30 calibre or 7.62 mm. I was satisfied with it.

Gravel: I agree.

Did you use snipers?

Cheatham: Yes. Snipers had Winchester Model 70 rifles with zoom telescopes to 8X.

At what ranges did your battalion fire?

Cheatham: 80% up to 35m; 15% from 35m to 100m; 5% longer than that.

Gravel: I agree. Building to building: 35m; down the street: up to 100m.

Cheatham: 7.62 LMG - 80% of the time we fired it hand-held, without bipod or tripod. Very effective. No problems. Used tripod for night defense. No problems of ammo/resupply, so we used lots of it; the distance from front to ammunition point was short.

Did snipers work with their company, or separately?

Cheatham: With the company, but at night they moved a little way off.

Worked in spotter-sniper pairs, covered by rest of company. They got quite a few people, were satisfied with Model 70. NVA did not often discover snipers. Snipers were nice, but not decisive.

M79: Definitely not effective in city for house-to-house. Inaccurate, had insufficient blast effect. A CS round or illuminating round might have been effective. Basically the troops didn't believe in it, and so wouldn't expose themselves to fire it.

Would an accurate 30mm gun be better?

Cheatham: Yes

Was the lethal radius of M79 enough?

Cheatham: No. B40(RPG2) lethal radius much better.

3.5" RL: so effective that we would clear a room and take the backblast just to use it. Awkward and heavy but worth it. Troops begged for it. I replaced my LAW's with it.

Would a periscope sight be any good?

Cheatham: Yes, or a gun that fires around corner or over a ledge.

106mm RR: We fired it from top floor rooms once in a while. Big mess but workable. No fires, but bad blast; plaster and glass all over. But effective; the 106 penetrated walls.

LAW: couldn't penetrate enough. We turned them in, drew 3.5" RL.

60mm Mortar: Company commanders like it. Used it for illumination, used it to suppress fire from flanking buildings when attacking one building (using HE, with CS).

81mm Mortar: Used in same way: fired in massive concentration, using HE with fuze quick.

Was arming distance too great on any weapons?

Cheatham: No, not really.

Would you want an airburst with 60mm?

Cheatham: Never thought of it. Delay fuze? No.

Where did you emplace mortars?

Cheatham: Baseplates often in courtyards. Night firing (H&I) largely due by artillery; mortars used more for illumination.

Did you need a mortar big as 60/81?

Cheatham: Yes, I would use the biggest available. We later used the 4.2". The best weapon for busting buildings and supporting attacks was the 106mm RR on a mule. It was the key weapon, using HEAT. Didn't have HEP. We used to smoke a street, roll out the 106mmRR, fire it at the enemy when smoke clearing, hoping to see enemy before he saw us. A smaller, lighter gun with the same penetration and accuracy would be ideal for city fighting. The spotter rifle system worked fine.

Could you blow holes with it in the wall of the Province Treasury?

Cheatham: No, but we blew the door down. We never got an air strike on our side of the city, because of low ceilings, political restraints 1st ARVA/, 1st Cav on other side of city got air strikes. It was really too close for air. CEP of bombing was greater than enemy-to-friend distance. We took fire from snipers in the refugee center at New Hue' University. US advisors and ARVN sector people finally convinced the refugees to get rid of the snipers.

Gravel: I had 36 KIA, about 180 WIA

Cheatham: I had 75 KIA, about 550 WIA

Total: 111 KIA, about 730 WIA

Back to weapons:

90mm RR?

Cheatham: We didn't have 90mm RR. Hand grenade: effective but in short supply. We took them off our wounded. Used them to clear rooms - it worked, just like in training films. NVA would sandbag around windows, but did not build interior walls within rooms. The fragments from grenades did not come back through the wall. In some strong buildings, NVA brought in lots of sandbags and fortified.

CS: Very effective; used the E8 launchers, plus 4.2" mortars and hand grenades. Our gas masks were good. E8 launcher

may be too big. Lanyard trigger was no good, so we used hand-held firing device from the Claymore. We never saw the E8 launchers before Hue'; had to learn their foibles. One problem was that they fired the projectiles like a popcorn popper; first one or two, then some more, then all the rest. They should fire all at once.

NVA WEAPONS:

Most effective against us: RPG2(B40). Effective fragmentation - uncanny. Accurate - went in windows. Stopped tanks: didn't destroy them, but wounded crews, made them punchy.

Biggest weapon: 120mm mortar. They also used 12.7 MG, 57 & 75RR; AK47, SKS rifles.

NVA were well clothed, equipped and armed. Their gas masks didn't cover their eyes. They wore helmets and unit insignia.

Command and Control:

90% of our communications was by PRC 25: batallion to company, company to platoon: o.k. no problem.

The problem was at platoon level as the squads dispersed inside buildings. We do not need a radio to each individual. Squad level is good enough. We could have laid phone wire, but radios were good enough so we never used wire. We got extra PRC 25s; gave one to each squad leader.

Engineers: Cheatham had an engineer platoon attached. They fired E8 CS launchers, breached and enlarged holes with C4 charges. We used them once to blow some bridges to improve our defense. On raids across the canal, we would put big demolition charges inside houses. When we pulled back, NVA moved in. We blew them up.

Mines: We used a few Claymores at night.

Artillery: To support our attacks, and for H&I.

Tanks: In city not very effective; drew fantastic fire, so much that crews were groggy. Couldn't maneuver, couldn't traverse and elevate fast enough.

Helicopters: Used for logistics: medical evacuation, resupply. Flew along a safe corridor.

Could you have used helicopter gunships?

Cheatham: NVA 12.7 MG would probably have defeated gunships; NVA firing positions were often impossible to see from air.

FAC: Could not fly over city without being hit.

Scatterable mines: Could have used them. No booby traps were used by either side.

Could you use a small mortar with flat trajectory for direct fire:

Cheatham: Could use them if you make the round as effective as the RPG 2.

Cheatham: Why can't we make B40's?

Killian: Because LAW has been declared better.

Cheatham: LTC Turley, USMC, and Marine Corps Gazette: Information on tanks.

Cheatham: What I want for cities is a short range, heavy-punch weapon, light and small, to hit and breach a wall. Would prefer that to 106RR or 3.5"RL.

Sewers: Used by NVA to resupply, but not to infiltrate into our position.

Tactics: NVA failed to flank and cut us off as we advanced into Hue'. This was especially odd, since they did it all the time out in the jungle.

Kettelle: What were NVA trying to do at Hue'?

Cheatham: Hold the city.

JDK: Why weren't they more mobile?

Cheatham: They were at first.

JDK: What if they had counterattacked you with a couple of battalions?

Cheatham: I think we would have stopped them. Maybe not, but they would have taken huge losses.

Maps: Lacking. Used Shell city map.

Intelligence: Lacking.

Reconnaissance patrolling: Very difficult to move, so little used by either side.

Illumination: Used Spooky. Range too short for starlight scopes.

Dust: Tremendous quantities lying in the streets. We used it as concealment for movement. The backblast from a 3.5"RL would raise a big enough cloud of dust to hide a squad rush.

Noise: Deafening; even rifle fire is deafening in a room. Could you use ear plugs, maybe ones that block out specific frequencies?

Cheatham: Maybe, but there are other sounds you have to hear. Did you try to ricochet rounds into positions?

Cheatham: No.

Helmets: Always wore them in Hue', but couldn't they be lighter?

Assault Squads: Armed with M16's, 2-3 hand grenades each.

Psywar: Tried once to talk an NVA squad out of a bunker; they wouldn't come. They never surrendered; all that we captured were the wounded.

Helicopters: Had to use safe routes in and out. Choppers who didn't follow instruction were shot down by NVA. How did your exchange rate compare with open warfare?

Cheatham: Better.

Flame: Would have been helpful but we couldn't support it. No compressor, no fuel up forward.

Morale: Ours was very high; the sight of the enemy peaked the troops. The battalion had been in a static defense for

several months, and the contrast of attacking an enemy you could see excited 'em. We had good company commanders - 5-7 years service. Men often refused to leave when wounded. Training: The battalion had had none for city fighting. I guess it took us a day and a half to figure out how to operate in the city.

CITY/FIGHT MODEL DESCRIPTION

1. Model Summary

CITY/FIGHT 1 is designed to study the movement of vehicles or personnel through a built-up area and determine the visibility effects as well as the weapon firing degredation which results from loss of visibility. The model uses an input trajectory and develops the range and angular velocity of this trajectory relative to each defender. Defenders are located in buildings, and the geometry of each building as well as the defender location are imput to the program.

If the trajectory cannot be seen by the defender due to an interposing building the visibility factor is 0, if the trajectory is visible the visibility factor is 1. The range and angular rate are converted to a single shot hill probability based on the equation*

$$P_{kss} = \exp - \left(\frac{R}{R_o}\right) \quad \exp - \left(\frac{W}{W_o}\right)^2$$

where R = instantaneous range

R_o = reference range

W = instantaneous angular velocity

W_o = reference angular velocity

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* This function can easily be modified to account for actual weapon data.

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The attacher trajectory is modelled as a set of straight line constant velocity segments. The position of the attacker is computed at each time during the engagement. The number of "viewing" time is input.

Each structure is modelled as a quadrilateral with vertical sides of given height.

Each defender is assigned to a position within a building described by a wall, a fractional distance along the wall, and a fractional height of the wall.

At each time the program determines which defenders have a view of the attacher (and vice versa), the value of P_{kss} and the cumulative P_k. The visibility factor scales P_k by 0 or 1, and P_k is multiplied correspondingly.

The program outputs P_{kss} and P_k for each time as well as all inputs.

2. Inputs

Number of buildings

X, Y, Z coordinator for each building

Height of each building

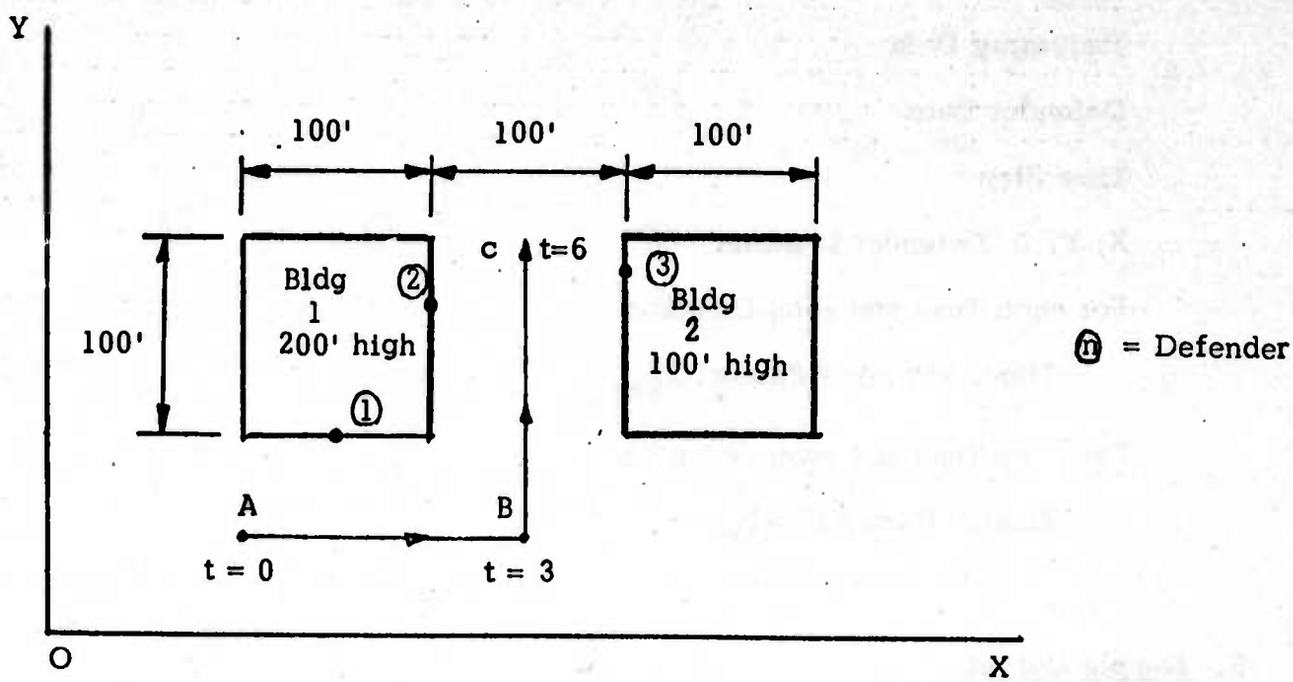
Number of segments in trajectory

X, Y, Z and time at each segment end point

Number of defenders

Location of each defender: building number, wall number, fraction along wall, horizontally, fraction along wall vertically , number of times when output is denied weapon firing rate.

3. Sample Input Problem



This figure represents a plan view of two buildings and three defenders. The trajectory moves along A B C in 6 seconds. The program input data is shown below.

Line No.

```
220 |   2 ..............................  No. of buildings
230 | 100.      100.      0.)
240 | 200.      100.      0.)  Bldg. 1 X, Y, Z
250 | 200.      200.      0.)
260 | 100.      200.      0.)
270 | 200. ..............................  Bldg. 1 height
280 | 300.      100.      0.)
290 | 400.      100.      0.)
300 | 400.      200.      0.)  Bldg.2 X, Y, Z
310 | 300.      200.      0.)
320 | 100. ..............................  Bldg. 2 height
330 |   2  ..............................  No. of trajectory segments
340 | 100.      50.       50.       0.)
350 | 250.      50.       50.       3.)  X, Y, Z. T at each end point
360 | 250.      200.      50.       6.)
370 |   3  ..............................  No. of defenders
380 |   1   1   .5   .8)
390 |   1   2   .6   .2)  Bldg No; wall no; fractions along wall
400 |   2   4   .1  1.)       for each defender
410 |  50   4.  ..............  No. of time steps and firing rate
END OF FILE
```

4. Output

Building Data

Trajectory Data

Defender Data

Time Step

X, Y, Z Defender Location

For each Time and each Defender

Time, Visibility Factor, P_{kss}

For each Time and each Defender

Time, Cumulative P_k.

5. Sample Output

The following Output is obtained from a run of CITY/FIGHT using the Sample Input Problem, section 3.

a. Building Input Data

```
NBLDG=     2
BLDG NO     1
CORNER      1   100.00   100.00      .00
CORNER      2   200.00   100.00      .00
CORNER      3   200.00   200.00      .00
CORNER      4   100.00   200.00      .00
HEIGHT=  200.00
BLDG NO     2
CORNER      1   300.00   100.00      .00
CORNER      2   400.00   100.00      .00
CORNER      3   400.00   200.00      .00
CORNER      4   300.00   200.00      .00
HEIGHT=  100.00
```

b. Trajectory X, Y, Z, Time

```
NO OF SEGMENTS=     2
POINT     1   100.00    50.00    50.00    TIME=      .00
POINT     2   250.00    50.00    50.00    TIME=     3.00
POINT     3   250.00   200.00    50.00    TIME=     6.00
```

c. Defender Locations

Building, Wall, Fraction along wall, Fraction Vertically

```
NO OF DEFENDERS=     3
LOCATIONS
     1     1     1 .500    .300
     2     1     2 .600    .200
     3     2     4 .100   1.000
```

d. Time, Firing Rate Data

Number of Times, Time Increment, Firing Rate (Round/Sec),

Number of rounds per time increment

```
NTIME DT FRATE XN    50     .122    4.000     .490
```

e. View Factors and P_{kss} for each Defender at each time

For each time

View Factor 1 = visible

2 = not visible

VIEW OF DEFENDERS AT EACH TIME
DEFENDERS

	1	2	3
1	TIME=		.00
	1	0	0
	.012	.000	.000
2	TIME=		.12
	1	0	0
	.012	.000	.000
3	TIME=		.24
	1	0	0
	.013	.000	.000
4	TIME=		.37
	1	0	0
	.014	.000	.000
5	TIME=		.49
	1	0	0
	.014	.000	.000
6	TIME=		.61
	1	0	0
	.014	.000	.000
7	TIME=		.73
	1	0	0
	.015	.000	.000
8	TIME=		.86
	1	0	0
	.015	.000	.000
9	TIME=		.98
	1	0	1
	.015	.000	.002
10	TIME=		1.10
	1	0	1
	.015	.000	.002
11	TIME=		1.22
	1	0	1
	.015	.000	.003
12	TIME=		1.35
	1	0	1
	.015	.000	.003
13	TIME=		1.47
	1	0	1
	.014	.000	.004
14	TIME=		1.59
	1	0	1
	.014	.000	.004
15	TIME=		1.71
	1	0	1
	.013	.000	.005
16	TIME=		1.84
	1	0	1
	.013	.000	.006
17	TIME=		1.96
	1	0	1
	.012	.000	.006
18	TIME=		2.08
	1	1	1
	.011	.011	.007
19	TIME=		2.20
	1	1	1
	.010	.011	.008
20	TIME=		2.33
	1	1	1
	.010	.011	.009

```
21   TIME=     2.45
       1     1     1
    .009  .011  .010

22   TIME=     2.57
       1     1     1
    .008  .010  .011

23   TIME=     2.69
       1     1     1
    .007  .010  .012

24   TIME=     2.82
       1     1     1
    .007  .009  .013

25   TIME=     2.94
       1     1     1
    .006  .009  .014

26   TIME=     3.06
       1     1     1
    .017  .014  .017

27   TIME=     3.18
       1     1     1
    .017  .012  .018

28   TIME=     3.31
       1     1     1
    .017  .010  .018

29   TIME=     3.43
       1     1     1
    .018  .008  .018

30   TIME=     3.55
       1     1     1
    .018  .006  .018

31   TIME=     3.67
       1     1     1
    .018  .004  .017

32   TIME=     3.80
       1     1     1
    .018  .002  .016

33   TIME=     3.92
       1     1     1
    .018  .001  .014

34   TIME=     4.04
       0     1     1
    .000  .001  .012

35   TIME=     4.16
       0     1     1
    .000  .000  .010

36   TIME=     4.29
       0     1     1
    .000  .000  .008

37   TIME=     4.41
       0     1     1
    .000  .000  .006

38   TIME=     4.53
       0     1     1
    .000  .000  .005

39   TIME=     4.65
       0     1     1
    .000  .000  .004

40   TIME=     4.78
       0     1     1
    .000  .000  .002

41   TIME=     4.90
       0     1     1
    .000  .000  .002

42   TIME=     5.02
       0     1     1
    .000  .000  .001

43   TIME=     5.14
       0     1     1
    .000  .000  .001

44   TIME=     5.27
       0     1     1
    .000  .000  .001

45   TIME=     5.39
       0     1     1
    .000  .000  .000

46   TIME=     5.51
       0     1     1
    .000  .000  .000

47   TIME=     5.63
       0     1     1
    .000  .000  .000

48   TIME=     5.76
       0     1     1
    .000  .000  .000

49   TIME=     5.88
       0     1     1
    .000  .000  .000

50   TIME=     6.00
       0     1     1
    .000  .000  .000
```

f. Cumulative P_k

For each time and Defender, SSP_k is calculated and multiplied by the View Factor 1 or 0, and then the cumulative P_k is obtained.

CUMULATIVE TOTALS

	TIME	1	2	3
1	.00	.006	-.000	-.000
2	.12	.012	-.000	-.000
3	.24	.018	-.000	-.000
4	.37	.025	-.000	-.000
5	.49	.031	-.000	-.000
6	.61	.038	-.000	-.000
7	.73	.045	-.000	-.000
8	.86	.052	-.000	-.000
9	.98	.059	-.000	.001
10	1.10	.066	-.000	.002
11	1.22	.073	-.000	.003
12	1.35	.080	-.000	.005
13	1.47	.086	-.000	.007
14	1.59	.092	-.000	.009
15	1.71	.098	-.000	.011
16	1.84	.104	-.000	.014
17	1.96	.109	-.000	.017
18	2.08	.114	.005	.020
19	2.20	.118	.011	.024
20	2.33	.123	.016	.028
21	2.45	.126	.021	.033
22	2.57	.130	.026	.038
23	2.69	.133	.031	.044
24	2.82	.136	.035	.050
25	2.94	.138	.040	.056
26	3.06	.145	.046	.064
27	3.18	.153	.052	.072
28	3.31	.160	.057	.081
29	3.43	.167	.060	.089
30	3.55	.175	.063	.097
31	3.67	.182	.064	.104
32	3.80	.189	.065	.111
33	3.92	.196	.066	.117
34	4.04	.196	.066	.122
35	4.16	.196	.066	.127
36	4.29	.196	.067	.130
37	4.41	.196	.067	.133
38	4.53	.196	.067	.135
39	4.65	.196	.067	.137
40	4.78	.196	.067	.138
41	4.90	.196	.067	.138
42	5.02	.196	.067	.139
43	5.14	.196	.067	.139
44	5.27	.196	.067	.139
45	5.39	.196	.067	.140
46	5.51	.196	.067	.140
47	5.63	.196	.067	.140
48	5.76	.196	.067	.140
49	5.88	.196	.067	.140
50	6.00	.196	.067	.140

f. Subroutine and Function Descriptions

Name	Description
DIST (A,B)	Compute distance in feet between points A and B
DOT (X,Y)	Compute scalar product between vectors X, Y
ISEG (T)	Compute trajectory segment number for any time T. (sec).
TANGEN (NBLDG)	Compute tangents of angles made by building walls relative to common coordinate system
UNITV (U,S)	Develop unit vector U along each trajectory segment, J having length, S.
LOCATE (NDEF)	Determine the X. Y, Z coordinates (ft) of all defenders in the common coordinate system.
PKILL (R, W)	Compute SSP_k for aimpoint give the range R, (H) and angular velocity, W, (rad/sec).
ROMEGA (SDT IT, ID)	Compute the angular velocity (rad/sec) and Range (ft) between defender ID and target IT which are separated by ground distance SDT (ft).
VIEW	Main Program - does all calculations, and I/O.

g. CITY/FIGHT 1 Program Listing

```
:18:04    @ XQT CUR
CC CUR.....VERSION 4.0      29 MAY 73
  1.  FSTNEW CITY/FIGHT1
  2.  LIST 1

    @ ELT DIST,1,730221, 63275     , 1

00001                   FUNCTION DIST(A,B)
00002                   DIMENSION A(3),B(3)
00003                   DATA IDEBUG /0/
00004                   DIST=0.
00005                   DO 1 L=1,3
00006                 1 DIST=DIST+(A(L)-B(L))**2
00007                   DIST=SQRT(DIST)
00008                   IF(IDEBUG.EQ.1)PRINT 100,DIST
00009                 100 FORMAT(1X,'DIST=',F8.4)
00010                   RETURN
00011                   END

    @ ELT DOT,1,730221, 63277      , 1

00001                   FUNCTION DOT(X,Y)
00002                   DIMENSION X(3),Y(3)
00003                   DOT=0.
00004                   DO 1 I=1,3
00005                 1 DOT=DOT+X(I)*Y(I)
00006                   RETURN
00007                   END

    @ ELT ISEG,1,730221, 63276     , 1

00001                   FUNCTION ISEG(T)
00002                   COMMON /TRAJEC/ XP(11,3),TP(11),U(10,3)
00003                   DO 1 I=1,10
00004                   IF(T-TP(I)) 2,3,1
00005                 1 CONTINUE
00006                 2 ISEG=I-1
00007                   RETURN
00008                 3 ISEG=I
00009                   RETURN
00010                   END
```

```
@ ELT TANGEN,1,730221, 63276    , 1

0001                  SUBROUTINE TANGEN(NBLDG)
0002                  COMMON /TANG/ TPHI(20,4),IX(20,4),IY(20,4)
0003                  COMMON /BLDG/ XB(20,4),YB(20,4),ZB(20,4),N(20),NB(20)
0004                  DATA IDEBUG /0/
0005                  DO 7 K=1,NBLDG
0006                  DO 8 JW=1,4
0007                  TPHI(K,JW)=0.
0008                  IX(K,JW)=0
0009                  IY(K,JW)=0
0010                  JW2=JW+1
0011                  IF(JW2.GT.4) JW2=1
0012                  Y=YB(K,JW2)-YB(K,JW)
0013                  IF(Y)1,2,1
0014                1 X=XB(K,JW2)-XB(K,JW)
0015                  IF(X) 3,4,3
0016                3 TPHI(K,JW)=Y/X
0017                  GO TO 8
0018                2 IY(K,JW)=1
0019                  GO TO 8
0020                4 IX(K,JW)=1
0021                8 CONTINUE
0022                  IF(IDEBUG.EQ.1) PRINT 100,TPHI(K,JW),IX(K,JW),IY(K,JW)
0023              100 FORMAT(1X,'TPHI IX IY',F8.2,2I5)
0024                7 CONTINUE
0025                  RETURN
0026                  END

@ ELT UNITV,1,730221, 63274     , 1

0001                  SUBROUTINE UNITV(J,S)
0002                  COMMON /TRAJEC/ XP(11,3),TP(11),U(10,3)
0003                  DATA IDEBUG /0/
0004                  DO 1 K=1,3
0005                  U(J,K)=XP(J+1,K)-XP(J,K)
0006                  U(J,K)=U(J,K)/S
0007                1 CONTINUE
0008                  IF(IDEBUG.EQ.1)PRINT 100,J,(U(J,K),K=1,3)
0009              100 FORMAT(1X,'SEGMENT',I5,'U=',3X,3F8.5)
0010                  RETURN
0011                  END

@ ELT LOCATE,1,730221, 63273    , 1

0001                  SUBROUTINE LOCATE(NDEF)
0002                  DATA IDEBUG /0/
0003                  COMMON /TRAJEC/XP(11,3),TP(11),U(10,3)
0004                  COMMON /BLDG/ XB(20,4),YB(20,4),ZB(20,4),N(20),NB(20)
0005                  COMMON /POSIT/ XT(100,3),XD(50,3),TIME(100),V(10),
0006                 +RANGE(50,100),W(50,100)
0007                  COMMON IB(50),IW(50),EW(50),EN(50)
0008                  DO 1 ID=1,NDEF
0009                  J1=IW(ID)
0010                  J2=J1+1
0011                  IF(J2.GT.4) J2=J2-4
0012                  JB=IB(ID)
0013                  XD(ID,1)=XB(JB,J1)+EW(ID)*(XB(JB,J2)-XB(JB,J1))
0014                  XD(ID,2)=YB(JB,J1)+EW(ID)*(YB(JB,J2)-YB(JB,J1))
0015                  Z=ZB(JB,J1)+EW(ID)*(ZB(JB,J2)-ZB(JB,J1))
0016                  XD(ID,3)=Z+EN(ID)*(HB(JB)-Z)
0017                  IF(IDEBUG.EQ.1) PRINT 100,(XD(ID,J),J=1,3)
0018              100 FORMAT(1X,3F10.2)
0019                1 CONTINUE
                      RETURN
                      END
```

```
@ ELT PKILL,1,730221, 63279     , 1

0001                    FUNCTION PKILL(R,W)
0002                    DATA R0,W0 /100.,.25/
0003                    DATA IDEBUG /0/
0004                    PKIL1=EXP(-(R/R0)**2)
0005                    PKIL2=EXP(-(W/W0)**2)
0006                    PKILL=PKIL1*PKIL2
0007                    IF(IDEBUG.EQ.1) PRINT 100,R,W,PKIL1,PKIL2,PKILL
0008                100 FORMAT(1X,'R W P1 P2 PK',2F8.3,3F6.4)
0009                    RETURN
0010                    END

@ ELT ROMEGA,1,730221,. 63278    , 1

0001                    SUBROUTINE ROMEGA(SDT,IT,ID)
0002                    COMMON /POSIT/ XT(100,3),XD(50,3),TIME(100),V(10),
0003                   +RANGE(50,100),W(50,100)
0004                    COMMON /TRAJEC/ XP(11,3),TP(11),U(10,3)
0005                    DIMENSION A(3),B(3)
0006                    DATA IDEBUG /0/
0007                    RDT=SDT*SDT+(XT(IT,3)-XD(ID,3))**2
0008                    RANGE(ID,IT)=SQRT(RDT)
0009                    IS=ISEG(TIME(IT))
0010                    DO 1 I=1,3
0011                    A(I)=XT(IT,I)-XD(ID,I)
0012                    B(I)=U(IS,I)
0013                  1 CONTINUE
0014                    CAB=DOT(A,B)
0015                    CAB=CAB/SQRT(DOT(A,A)*DOT(B*B))
0016                    SAB=SQRT(1.-CAB*CAB)
0017                    W(ID,IT)=V(IS)/(RANGE(ID,IT)*SAB)
0018                    IF (IDEBUG.EQ.1) PRINT 100,IT,ID,IS,W(ID,IT),
0019                   +RANGE(ID,IT),CAB,SAB,V(IS)
0020                100 FORMAT(1X,'IT ID IS W R CAB SAB V',3I5,5F8.3)
0021                    END

@ ELT VIEW,1,730529, 33482      , 1

0001                    COMMON /TRAJEC/ XP(11,3),TP(11),U(10,3)
0002                    COMMON /TANG/ TPHI(20,4),TX(20,4),TY(20,4)
0003                    COMMON /BLDG/ XB(20,4),YB(20,4),ZB(20,4),HB(20),HB(20)
0004                    COMMON /POSIT/ XT(100,3),XD(50,3),TIME(100),V(10),
0005                   +RANGE(50,100),W(50,100)
0006                    COMMON IB(50),IW(50),FW(50),FH(50)
0007                    DIMENSION AA(3),BB(3),PK(50),PS(50)
0008                    DIMENSION SS(10),DS(10),VT(50),IVIEW(50,100)
0009                    DATA IDEBUG /0/
0010                    READ(5,200) NBLDG
0011                    PRINT 210,NBLDG
0012                210 FORMAT(1X,'NBLDG=',I5)
0013                    DO 30 I=1,NBLDG
0014                    PRINT 212,I
0015                212 FORMAT(1X,'BLDG NO',I5)
0016                    DO 33 J=1,4
0017                    READ(5,201) XB(I,J),YB(I,J),ZB(I,J)
0018                    PRINT 211,J,XB(I,J),YB(I,J),ZB(I,J)
0019                211 FORMAT(1X,'CORNER',I5,3F8.2)
0020                 33 CONTINUE
0021                    READ(5,202) H(I)
0022                    HB(I)=ZB(I,1)+H(I)
0023                    PRINT 218,H(I)
0024                218 FORMAT(1X,'HEIGHT=',F8.2)
0025                 30 CONTINUE
```

```
00026              208 FORMAT(F10.2)
00027              200 FORMAT(I5)
00028              201 FORMAT(3F10.2)
00029                  READ(5,200) NSEG
00030                  PRINT 213,NSEG
00031              213 FORMAT(1X,'NO OF SEGMENTS=',I5)
00032                  NS=NSEG+1
00033                  DO 31 I=1,NS
00034                  READ(5,204) (XP(I,J),J=1,3),TP(I)
00035                  PRINT 214,I,(XP(I,J),J=1,3),TP(I)
00036              214 FORMAT(1X,'POINT',I5,3F8.2,3X,'TIME=',F8.2)
00037               31 CONTINUE
00038              204 FORMAT(4F10.2)
00039                  READ(5,200) NDEF
00040                  PRINT 215,NDEF
00041              215 FORMAT(1X,'NO OF DEFENDERS=',I5)
00042                  PRINT 217
00043                  DO 32 I=1,NDEF
00044                  READ(5,206) IB(I),IW(I),FW(I),FH(I)
00045              217 FORMAT(1X,'LOCATIONS')
00046                  PRINT 216,I,IB(I),IW(I),FW(I),FH(I)
00047              216 FORMAT(1X,3I5,F5.3,F7.3)
00048               32 CONTINUE
00049              206 FORMAT(2I5,2F5.2)
00050                  READ(5,207) NTIME,FRATE
00051              207 FORMAT(I5,F10.2)
00052                  DT=TP(NSEG+1)/(NTIME-1)
00053                  XN=FRATE*DT
00054                  PRINT 219,NTIME,DT,FRATE,XN
00055              219 FORMAT(1X,'NTIME DT FRATE XN',I5,3F8.3)
00056                  CALL LOCATE(NDEF)
00057                  DO 5 I=1,NSEG
00058                  TL=TP(I+1)-TP(I)
00059                  IF(TL.LT.0.)GO TO 99
00060                  DO 17 J=1,3
00061                  AA(J)=XP(I,J)
00062               17 BB(J)=XP(I+1,J)
00063                  SS(I)=DIST(AA,BB)
00064                  CALL UNITV(I,SS(I))
00065                  V(I)=SS(I)/TL
00066                  DS(I)=V(I)*DT
00067                  IF(IDEBUG.EQ.1)PRINT 220,I,DS(I)
00068              220 FORMAT(1X,'SEGMENT',I5,2X,'DS=',F8.4)
00069                5 CONTINUE
00070                  V(NSEG+1)=V(NSEG)
00071                  GO TO 15
00072               99 PRINT 999
00073              999 FORMAT(1X,'NEGATIVE TIME IN SEGMENT',I5)
00074                  STOP
00075               15 ITIME=0
00076                  T=-DT
00077                  S=-DS(1)
00078                  DO 1 I=1,NSEG
00079                6 S=S+DS(I)
00080                  IF(S.GT.SS(I)) GO TO 2
00081                  T=T+DT
00082                  ITIME=ITIME+1
00083                  TIME(ITIME)=T
00084                  DO 3 J=1,3
00085                  XT(ITIME,J)=XP(I,J)+S*U(I,J)
00086                3 CONTINUE
00087                  IF(IDEBUG.EQ.1) PRINT 223,ITIME,T,(XT(ITIME,K),K=1,3)
00088              223 FORMAT(1X,'TIME=',I5,3X,'T=',4F8.3)
                       GO TO 6
```

```
0090            2 S=S-DS(I)
0091              D1=SS(I)-S
0092              TL=TP(I+1)-TP(I)
0093              T1=D1*TL/SS(I)
0094              T2=DT-T1
0095              S2=T2*SS(I+1)/(TP(I+2)-TP(I+1))
0096              S=S2-DS(I+1)
0097              IF(IDEBUG.EQ.1) PRINT 221,I,D1,T1,S2,S
0098          221 FORMAT(1X,'I,D1,T1,S2,S',I3,4F8.4)
0099            1 CONTINUE
0100              DO 11 II=1,NDEF
0101              DO 11 IT=1,NTIME
0102           11 IVIEW(II,IT)=1
0103              CALL TANGEN(NBLDG)
0104              DO 4 ITIME=1,NTIME
0105              DO 4 J=1,NDEF
0106              XDT=XT(ITIME,1)-XD(J,1)
0107              YDT=XT(ITIME,2)-XD(J,2)
0108              SDT=SQRT(XDT*XDT+YDT*YDT)
0109              CALL ROMEGA(SDT,ITIME,J)
0110              TG=(XD(J,3)-XT(ITIME,3))/SDT
0111              TTHE=YDT/XDT
0112              CTHE=-XDT/SDT
0113              STHE=-YDT/SDT
0114              IF(IDEBUG.EQ.1) PRINT 230,SDT,TG,TTHE,STHE,CTHE
0115          230 FORMAT(1X,'SDT TG TTHE STHE CTHE',5F8.3)
0116              DO 7 K=1,NBLDG
0117              DO 8 JW=1,4
0118              IF(JW.EQ.IW(J).AND.K.EQ.IB(J)) GO TO 8
0119              JW2=JW+1
0120              IF(JW2.GT.4) JW2=1
0121              IF(IY(K,JW).EQ.1) GO TO 28
0122              IF(IX(K,JW).EQ.1) GO TO 29
0123              XC=XT(ITIME,2)-YB(K,JW)
0124              XC=XC+XB(K,JW)*TPHI(K,JW)
0125              XC=XC-XT(ITIME,1)*TTHE
0126              XC=XC/(TPHI(K,JW)-TTHE)
0127              YC=(XC-XB(K,JW))*TPHI(K,JW)+YB(K,JW)
0128              XDW=XC-XD(J,1)
0129              YDW=YC-XD(J,2)
0130              GO TO 26
0131           28 YC=YB(K,JW)
0132              YDW=YC-XD(J,2)
0133              XC=YDW/TTHE
0134              XC=XC+XD(J,1)
0135              XDW=XC-XD(J,1)
0136              GO TO 26
0137           29 XC=XB(K,JW)
0138              XDW=XC-XD(J,1)
0139              YC=XDW*TTHE
0140              YC=YC+XD(J,2)
0141              YDW=YC-XD(J,2)
0142           26 CONTINUE
0143              IF(IDEBUG.EQ.1) PRINT 231,XC,YC
0144          231 FORMAT(1X,'XC YC',2F8.3)
0145              IFILT=0
0146              IF(XC-XB(K,JW)) 40,9,41
0147           41 IFILT=1
0148           40 IF(XC.LT.XB(K,JW2).AND.IFILT.EQ.1) GO TO 9
0149              IF(XC.GT.XB(K,JW2).AND.IFILT.EQ.0) GO TO 9
0150              IF(IDEBUG.EQ.1) PRINT 400
0151          400 FORMAT(1X,'FAILED X FILTER')
0152              GO TO 8
```

```
                    CONTINUE
                    IFILT=0
                    IF(YC-YB(K,JW)) 42,19,43
                43  IFILT=1
                42  IF(YC.LT.YB(K,JW2).AND.IFILT.EQ.1) GO TO 19
                    IF(YC.GT.YB(K,JW2).AND.IFILT.EQ.0) GO TO 19
                    IF(IDEBUG.EQ.1) PRINT 401
               401  FORMAT(1X,'FAILED Y FILTER')
                    GO TO 8
                19  CONTINUE
                    ZC=(XC-XT(ITIME,1))*CTHE
                    ZC=ZC+(YC-XT(ITIME,2))*STHE
                    ZC=ZC*TG
                    IF(ZC.GT.HB(K)) GO TO 8
                    DP=XDW*XDT+YDW*YDT
                    IF(IDEBUG.EQ.1) PRINT 404,XDW,YDW,XDT,YDT,DP
               404  FORMAT(1X,'XDW YDW XDT YDT DP',5F10.3)
                    IF(DP.LT.0.) GO TO 8
                    SDW=SQRT(XDW*XDW+YDW*YDW)
                    IF(SDW.GT.SDT) GO TO 8
                    IVIEW(J,ITIME)=0
                    IF(IDEBUG.EQ.1) PRINT 232,ITIME,J,K,JW
               232  FORMAT(1X,'TIME NO',I5,3X,'DEF',I5,3X,'BLDG',I5,3X,'WALL',I5)
                    GO TO 4
                  8 CONTINUE
                  7 CONTINUE
                  4 CONTINUE
                    DO 14 J=1,NDEF
                 14 VT(J)=0
                    PRINT 104
               104  FORMAT(1X,/,1X,'VIEW OF DEFENDERS AT EACH TIME')
                    PRINT 105
               105  FORMAT(1X,'DEFENDERS')
                    PRINT 106,(I,I=1,NDEF)
                    DO 39 K=1,NDEF
                 39 PS(K)=1.
                    DO 12 I=1,NTIME
               106  FORMAT(6X,2515)
                    PRINT 120,I,TIME(I)
               120  FORMAT(1X,/,I5,3X,'TIME=',F8.2)
                    PRINT 119,(IVIEW(K,I),K=1,NDEF)
               119  FORMAT(6X,2515)
                    DO 38 K=1,NDEF
                    PK(K)=PKILL(RANGE(K,I),W(K,I))*IVIEW(K,I)
                    PSK=(1.-PK(K))**XN
                    PS(K)=PSK*PS(K)
                    W(K,I)=(1.-PS(K))
                 38 CONTINUE
                    PRINT 101,(PK(K),K=1,NDEF)
               101  FORMAT(6X,25F5.3)
                 12 CONTINUE
                    PRINT 100
               100  FORMAT(1X,//,1X,'CUMULATIVE TOTALS',/)
                    PRINT 102,(N,N=1,NDEF)
               102  FORMAT(4X,'TIME',2016)
                    DO 16 I=1,NTIME
                    PRINT 103,I,TIME(I),(W(J,I),J=1,NDEF)
                 16 CONTINUE
               103  FORMAT(1X,I3,F5.2,20F6.3)
                    PRINT 113
               113  FORMAT(1X,///)
                    END
591 CARDS WRITTEN IN  CITY  /FIGHT1  (    361 COMPRESSED CARD IMAGES)
  1 BLOCKS ACQUIRED (KEY = 0101)
CUR
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APPENDIX D

BIBLIOGRAPHY

BIBLIOGRAPHY

This is a bibliography on combat in cities selected from the readings done in support of a contract on Munitions Effectiveness No. DAA21-72-C-0784. It is included in this report because it represents the most concise and up-to-date references for combat in urban areas. Although many of the entries are incomplete, they are included anyway in the hope that they will be of assistance to those interested in further reading.

The bibliography is classified into four sections: Bibliographies, General and Limited Warfare, Revolutionary Warfare, and Weapons and Weapons Effects. Within each section, the entries are listed by the preparing agency in the case of reports and monographs and by the title for articles from periodicals.

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