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Pentagon withholds data on troop vehicle trouble

By Fred Kaplan
Globe Staff

WASHINGTON — High-ranking Pentagon officials are suppressing an internal report that concludes that recent test results of the Bradley Fighting Vehicle, the Army's new armored personnel vehicle, were far gloomier than has publicly been revealed.

The Globe has also been told that an earlier set of Bradley tests, which had been widely criticized as "rigged," was even more unrealistic than previously reported.

Army spokesman Maj. Phillip Soucy denies that tests have shown serious problems with the vehicle and says of the Bradley, "It is performing exactly as it was designed to perform . . . and any supposition to the contrary is either malintended or misinformed."

The report in question was written by the man who ordered and designed the weapons tests, James G. Burton, an Air Force colonel assigned to the office of the undersecretary of defense for research and engineering.

The Globe reported two weeks ago that the Army's official test report, which had recently been sent to Congress and has since been endorsed by Burton's civilian

superiors, substantially differed from conclusions reached by Burton in his own independent report.

The tests were conducted to determine the vulnerability of a Bradley vehicle fully loaded with fuel, ammunition and uniformed dummies, when fired upon by real antitank rounds. Before this, vulnerability was estimated by computer models extrapolating results of very limited testing.

The Army has bought more than 2,000 Bradley vehicles, manufactured by the FMC Corp. at a cost of \$1.5 million each, and plans to build 6,882 in all.

Technologists, including many in Army labs, have long warned that the Bradley's aluminum armor, if penetrated by a high-explosive antitank round, would vaporize and act as a chemical fuel that intensifies the explosion and sets off a fire. Burton's intent was to test this hypothesis.

Army officials have said there is no Burton report, but merely "a rough draft." Pentagon spokeswoman Jan Bodony this week said the same thing, and added, "The judgment . . . was that the Army test report and the [Burton] observations coincided." Therefore, only the Army report was sent to Congress.

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Pentagon withholds data on troop vehicle trouble

■ BRADLEY

Continued from Page 1

However, a copy of Burton's document, obtained from a Pentagon source (not Burton) by the *Globe*, indicates that it is not a rough draft. Burton's cover letter, to which his report is attached, dated Dec. 17, reads as follows:

"As part of my oversight responsibilities, I was asked [by his superiors] to prepare an independent report on the results of the Bradley Vulnerability Tests. I began this effort when it appeared that the Army's report was going to be incomplete and unacceptable. I prepared two separate drafts and staffed them with OSD [office of the secretary of defense] staff, the Army Secretariat and Army staff. I received comments from the Army and [OSD]; comments which I incorporated for the most part. I hereby submit my finished product."

New revelations

Congressional officials yesterday said the Pentagon has refused

to give a copy of Burton's report to the General Accounting Office, the investigative arm of Congress, which has been asked by several legislators to compare the two studies.

Burton's superiors did give a copy of his report, upon request, to Rep. Samuel Stratton (D-N.Y.), chairman of the House armed services procurement subcommittee. However, Stratton too has refused to give a copy to the GAO. Stratton's staff did not return repeated phone calls.

The new revelations about earlier tests of the Bradley, conducted in 1984 but also at Burton's orders and also intended to measure the vehicle's vulnerability, provide further evidence that the weapon may not have been thoroughly tested. The information comes from a detailed report on the tests commissioned by the Pentagon and written for the Institute for Defense Analysis, a major think tank, and from conversations with one of the test analysts present at the scene.

In this series of 19 test shots, a

charge was placed on the left side of the Bradley and exploded into the vehicle, simulating the speed and force with which a round might hit if fired in battle. The Bradley was loaded with ammunition (not live) and dummies in Army combat fatigues.

In the first shot, the weapon hit one of the dummies, which, in the words of the test analyst at the scene, "lit off like a damned Christmas torch."

Moreover, said the analyst, "The toxicity [caused by the burning fatigues] was so high that for minutes afterward, nobody could get in to open up the hatch."

Test questioned

To prevent this from happening again, the Army testers took off the dummy's uniform. However, the second shot burned the uniform of the dummy just behind it, with the same effect. The Army testers took its clothes off too.

The tests were supposed to evaluate the effects of heat, blast, overpressures, flash and toxic gases. With the uniforms removed, however, the evaluation was inevitably distorted.

Moreover, diagrams in the Institute for Defense Analysis report indicate that all the shots were fired in such a way as to miss, often just by inches, several 25mm ammunition cases and a fuel tank inside the Bradley.

Army spokesman Soucy said this shot-line was "fully approved by everybody participating" in the test, and was selected to gauge certain effects of certain kinds of shots.

However, the Institute's report noted that as a result, not much could be concluded from these shots. They were fired in "a rather benign shot-line," it stated. "A large percentage of the internal area of the [Bradley] is occupied by fuel, missiles or stowed munitions . . . The resulting conflagration even with a single 25mm ammunition container, within the confined quarters of the vehicle interior, would have ended the vehicle and crew's combat effectiveness."

Burton's report made a similar observation of the 10 shots fired in the most recent tests, conducted last fall. Each shot, he wrote, "was aimed so as to avoid intentionally striking the explosive elements of internally stowed ammunition."

Burton's report said two shots hit explosive elements of ammunition accidentally. One caused less damage than critics might have predicted. However, the other caused major damage, and in war would have put the Bradley out of action and injured or killed nearly everyone aboard.

FMC QUESTIONS \$75,000 ARMY PRICE FOR BRADLEY SURVIVABILITY MODIFICATIONS

FMC Corp. officials reportedly are questioning an Army estimate that modifying the Bradley fighting vehicle to increase survivability will cost about \$75,000 per copy, according to informed sources, raising the possibility that the product improvements eventually requested by the Army may exceed the \$75,000 figure. "We don't know where they got that figure," said one key source familiar with FMC thinking. "No one has ever figured it out before and the Army has not asked FMC to make an estimate."

The actual cost of improving the Bradley is considered the next major battleground between military reformers and the Army on the future of the controversial vehicle. Some reformers are claiming that the Bradley is so flawed that needed retrofits will push the \$1.5-million price tag of the vehicle to well over \$2-million per copy — a prospect that would likely cause Congress to kill the program. Army officials are arguing, however, that Bradley retrofit costs will be no higher than \$75,000. Informed observers speculate that the \$75,000 figure represents the average amount of money the Army plans to spend on product improvement for the Bradley in the out years of the program. Said one: "It may just be \$300-500-million the Army has set aside for improvements as part of their five year plan."

FMC Corp., the prime contractor for the Bradley, reportedly does not endorse the Army's estimate, asserting that much more analysis needs to be done of Army survivability improvement plans before a realistic cost estimate can be determined. For instance, according to one source, the highest cost item in Army plans, retrofitting applique armor, could be accomplished using any of three developing technologies. Two of the technologies are in the prototype stage, and the third — and most promising — option, so-called "reactive" armor, is still in r&d. "There are no realistic production price estimates for any of these armors," said this source, noting that the armor applique production contracts have not yet been signed by the Army.

In addition, the Army is considering adding spall liners to the Bradley, a technology that is well developed and almost available for the M113 personnel carrier but in need of design development for the Bradley. The cost estimate for Bradley liners is also unclear, said another source. Moreover, FMC sources

reportedly need to know more about Army plans to move internal ammo storage compartments. If the moves are extensive to require substantial redesigning, then costs could be high, one source said. Two other planned changes — rewiring electrical cables with light armor and switching the flow of fuel tanks — are not considered major problems, by either FMC Corp. or the Army.

The whole retrofit procedure is considered a major problem by Rep. Denny Smith (D-OR), co-chairman of the Military Reform Caucus, and leading critic of the Bradley. Smith wrote Defense Secretary Caspar Weinberger in late November, claiming that the Army and FMC Corp. "are already considering a lengthy list of actions to make the M-2 vehicle less vulnerable and more effective," asserting in another place in the letter that the list of "extensive and expensive modifications implies a nearly new vehicle." Smith, who sent a copy of the list to the Secretary, demanded that Weinberger provide a realistic estimate of Bradley retrofits based on the 25-item list.

Army officials claim the list is "just somebody's wish list that contains every electronic gadget you could think of," asserting that "there are no plans to move on such extensive improvements." Most of the items on the list "have nothing to do with vulnerability," according to one Army source, "which is what the reformers are concerned about." The ability of the Bradley to survive anti-tank fire is considered crucial to the future of the project, with observers saying that military reformers may be able to convince the Congress to cancel the program if the Bradley tests poorly on survivability.



OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

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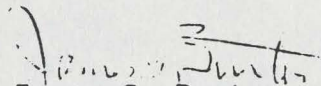
17 DEC 1985

MEMORANDUM FOR MR. WATT

THROUGH: GENERAL JONES

SUBJECT: Bradley Fighting Vehicle Vulnerability Tests Report

As part of my oversight responsibilities I was tasked by you and General Jones to prepare an independent report on the results of the Bradley Vulnerability Tests. I began this effort when it appeared that the Army's report was going to be incomplete and unacceptable. I prepared two separate drafts and staffed them with the OSD staff, the Army Secretariat, and Army staff. I received comments from the Army and PA&E; comments which I incorporated for the most part. I hereby submit my finished product.


James G. Burton
Colonel, USAF
Military Staff Assistant
for Tactical Air and
Land Warfare Systems

Attachment

REPORT TO CONGRESS ON PHASE I-RESULTS
OF THE LIVE-FIRE SURVIVABILITY TESTING FOR
THE BRADLEY FIGHTING VEHICLE SYSTEM

(U) The 1986 Authorization Act requires the Secretary of Defense to report to Congress by December 1, 1985, the results of survivability testing of the Bradley Fighting Vehicle System. Phase I of the Bradley FVS tests was conducted from March through October 1985 and pertained to currently configured Bradleys. Phase II involves testing candidate survivability enhancements based upon lessons learned during Phase I. Phase II testing must be complete by April 1986 and results reported to Congress by June 1986. This report is the Secretary of Defense report required by the 1986 Act. There is a separate U.S. Army report. Each major point of disagreement between the two is identified and discussed in this report.

(U) System Description

(U) The Bradley Fighting Vehicle System is comprised of two configurations; the M-2 Infantry Fighting Vehicle (IFV) and the M-3 Cavalry Fighting Vehicle (CFV). A total of 2,043 vehicles have been produced, 1,203 M-2's, 840 M-3's. The Army plans to procure a total of 6,882 Bradleys. The M-2 provides the Army the infantry-carrying part of the combined arms team employing armor, infantry, artillery, and attack helicopters operating in concert. The M-3 provides the armored cavalry units a vehicle for their screening, reconnaissance and security missions. Annex A depicts the M-2 and M-3 configurations showing positions of the crew relative to the internal fuel and internal ammunition. Both the M-2 and the M-3 have a two-man turret which mounts the 25mm automatic stabilized cannon, its primary armament, supported by a TOW launcher outside the turret, and the 7.62mm coaxial machine gun. The M-2 has, in addition, six firing ports for infantry 5.56mm rifles positioned along the side and rear of the vehicle. The overall mobility of M-2/3 is comparable to the M-1 tank. The M-2 carries a nine man team; commander, gunner, driver and six squad members. The M-3 carries a five man team; commander, gunner, driver and two scouts. The vulnerability tests were conducted on the M-3 configuration with results extrapolated to the M-2 configuration.

(U) Threats to the Bradley Fighting Vehicle

(U) Table 1 lists the spectrum of threat weapons the M-2/3 can expect to encounter on the battlefield. The threat weapons most frequently encountered will be the weapons found in each enemy infantry squad, platoon and company, which are principally small arms (rifles, machine guns, etc.) and shoulder-fired High Explosive Anti-Tank (HEAT) infantry weapons. Larger weapons, primarily tank fired and artillery

rounds, plus anti-tank guided missiles will also be widely encountered. The Bradley design specification did not require protection against battlefield threats other than small arms, artillery fragments or antipersonnel mines.

(U) First prototype of the Bradley was delivered in June 1979. The first production vehicle was delivered in December 1980. In 1981, ballistic tests of small arms bullets and artillery fragments were conducted against a Ballistic Hull and Turret (BH&T) vehicle which is essentially an armor shell with no working subsystems. While some rounds as well as artillery fragments penetrated the armor shell under certain conditions, there were no interior effects available since the BH&T was not loaded with fuel or ammunition. Until 1984, there was no further vulnerability testing of the Bradley and none planned. In June 1984, the Joint Live Fire Test Program of the USD(R&E) drew up plans for testing the vulnerability of combat loaded Bradleys. In September 1984, the U.S. Army offered to conduct the tests themselves and a test plan was jointly agreed to by USDR&E and the Army.

(U) The 1985 vulnerability tests concentrated on the most common anti-armor threat weapons (beyond small arms). Tank fired kinetic energy penetrators, anti-tank field guns and direct fire artillery were not included in this high-urgency first round of tests because it was felt that vulnerability reduction measures would have less chance of helping against those more destructive rounds.

(U) Test Conditions

(U) The tests were conducted in a building block approach. Testing began with eight limited realism firings at a BH&T armored shell and thirty-six firings at operating M-3 vehicles containing inert ammunition. To understand the critical area of ammunition fires and explosions better, fourteen additional limited-realism firings, referred to as "off-line" tests, were conducted at a BH&T which contained various amounts of live 25mm ammunition in the crew compartment. For these limited-realism 14 shots, the internally stowed ammunition was intentionally struck so that the violence of the reaction could be measured directly.

(U) The test program culminated with 10 full live fire shots at an M-3 realistically combat loaded with a full complement of fuel, uniformed mannequins and live ammunition. For these 10 live fire shots, the impact points and attack directions were not random nor representative of the locations of combat impacts. Instead, they were carefully selected to resolve vulnerability uncertainties. Shots for which there was a high probability of a catastrophic fire or explosion on the one hand, or trivial mechanical damage on the other hand, were

deemed unnecessary and therefore avoided. For example, each of the 10 live fire shots was aimed so as to avoid intentionally striking the explosive elements of internally stowed ammunition--even though there are likely to be a fair number of direct hits on ammunition in real combat. During the live fire tests, there were two accidental impacts on internal ammunition; the results are discussed in a later section. Additional "off-line" firings were conducted at individual potentially explosive components such as TOW missile launch motors, flight motors and warheads.

(U) The operating M-3 vehicles were loaded with fuel heated to operational temperatures and the majority of equipment and supplies normally carried in combat. Plywood mannequins in battledress uniforms were placed in all crew positions. All combustible and explosive materials normally carried inside the Bradley were also stowed in the vehicle. All ammunition (either inert or live) was loaded in normal stowage containers and stowed in accordance with the M-3 stowage plan. All ammunition for the ten live fire shots as well as the fourteen limited-realism BH&T shots, contained inert fuzes for the safety of the test crews when they entered the vehicle following a shot. There is a possibility that the presence of live fuzes would have increased the violence of the reactions when ammunition was struck directly. Tests of this possibility are scheduled for January.

(U) After each firing, an assessment team inspected the vehicle to determine the nature and extent of damage which occurred on that firing. All damage to the vehicle, individual components, and soldier mannequins was photographed and recorded; videotapes of each firing were also made. Functional checks were made of the engine, transmission, turret, TOW launcher, 25mm gun, and automatic fire suppression system. The detailed assessment data is available in BRL Report SP-49.

(U) The Soviet RPG-7G grenades, the West German 120mm HEAT projectiles, and the U.K. 30mm APDS projectiles were fired at the Bradley target vehicle from actual launchers or gun barrels. The U.S. ROCKEYE II bomblets and the U.S. M718 mines were placed above and below the vehicle and statically detonated. Nine TOW missiles were dynamically launched from a rail to ensure sufficient accuracy of impact. The remaining TOWs and the 3.2 inch laboratory shaped charge were attached to the vehicle and statically detonated to ensure that the jet impacted the desired item. Statically detonated rounds do not represent combat conditions and may have much-reduced effects relative to dynamic impacts. This was observed to be particularly true for the larger TOW missile impacts in which the kinetic energy of the missile added to the damage mechanisms of the warhead. Structural failures of the armor

near the impact point occurred; additional debris including the attacking missile body itself entered the vehicle and caused additional damage. The striking velocities of all dynamically fired munitions were representative of combat conditions.

(U) The 10 full live fire shots against the Bradley consisted of 3 U.S. TOWs, 6 Soviet RPG-7G's, and one West German 120mm HEAT round. We would have preferred to use all Soviet rounds, but Soviet ammunition was not available in time for the tests. Eight of the firings were dynamically fired, two statically. In addition, live fire testing of the Soviet BMP and US 901 Improved TOW Vehicle (ITV) was conducted to provide comparative data for vehicles with similar missions. Live fire testing of the M113 is currently in progress. Annexes B and C contains a shot by shot summary of all test results.

(U) Live Fire Test Results

(U) In this report, the results of the 10 live fire shots* are assessed in two ways, one primary and one secondary:

1. Troop casualties per hit--this is clearly the single most important measure of vulnerability for the Bradley (or any other armored vehicle). In fact, it is the principal purpose of combat-loaded live fire testing, that is, to determine whether there are excessive U.S. troop casualties in first-line U.S. vehicles and, if so, whether there are any feasible modifications or measures that can reduce these casualties.

2. Vehicle damage per hit--this measure of vulnerability is clearly secondary. It is assessed in terms of a) whether or not the vehicle can move after being hit; b) whether or not it can shoot; c) whether or not the vehicle is catastrophically destroyed; and d) whether the vehicle has to be evacuated by the troops after being hit.

* Where appropriate, some additional insights are drawn from the "off-line" ammunition tests, even though they were statically detonated. No conclusions in this report are based on any of the remaining firings against non-fully combat loaded vehicles due to their limited realism.

(U) Casualties

(U) There is a large degree of uncertainty in the medical community on what constitutes a casualty. For this report, casualties are defined to include only (1) puncture wounds from the penetrating round and or spall fragments, (2) burns, and (3) ruptured eardrums, lung hemorrhage or death as a result of blast overpressures. The Army uses the same

casualty criteria for punctures and burns, but chooses to use incapacitation criteria for blast over-pressure effects; they do not consider ruptured eardrums as casualties.

(U) Shots into actual fuel produced more casualties than shots into the vapor space above the fuel. Five shots into actual fuel produced additional burn casualties in the BMP and the ITV (none in the two Bradley fuel shots). Three shots through vapor space produced no additional casualties since no fire or explosion occurred.

(U) Table 3 indicates that as expected, the larger, more energetic weapons produce significantly higher average casualties. The 120mm HEAT shots were limited to engine compartments so no results are available concerning their casualty-producing effects.

(U) Vehicle Damage

(U) Other Major Findings

(U) Aluminum Vaporifics Effects

(U) The tests do not answer the questions of whether aluminum armor creates higher overpressures (i.e., vaporifics) than steel armor, particularly for the important case of TOW-size warheads. This is because the steel-armored BMP had ammunition explosions during the one effective TOW impact and thus cannot be compared to TOW impacts on aluminum armor where no ammunition was set off.

(U) Vulnerability Models

(U) Computer based vulnerability models were used to generate pre-test predictions for all Bradley and BMP shots. During the diagnostic tests prior to the live fire shots, anomalies in the models were discovered which led to three major model revisions. Annexes B and C contain a shot by shot summary of all firings including pre-test predictions and assessed results. The pre-test predictions were based on the third model revision. For the live fire series of 10 shots on the Bradley and BMP, the model predictions were reasonably accurate for 40 and 62 percent of the shots respectively, and

grossly incorrect for the remainder of the shots. After three major revisions, the models clearly have no predictive value for individual outcomes. The Army position is that, while the models are inaccurate in predicting the outcome of any particular shot, they are accurate in general when all of the outcomes are averaged. In addition, the models failed to predict the vulnerability of electric wiring, the fact that some direct hit impacts on ammunition do not lead to catastrophic explosions or sustained fires, failed to predict the structural failures resulting from dynamic warhead blasts on the outside of the vehicle, etc.

(U) Value of Live Fire Testing

(U) All major problems and results which surfaced during the diagnostic tests involving inert ammunition also surfaced during the 10 live fire shots. On the otherhand, significant surprises (with important design lessons) occurred during the live fire shots which could not have occurred when inert ammunition was used. For example, when inert ammunition was struck, catastrophic kills were automatically assessed. Live fire shots demonstrated clearly that some ammunition hits are survivable and that there are likely to be techniques for improving this survivability. The value of live fire testing in revealing actual vulnerabilities and lethalties was clearly demonstrated and in the way to significantly reducing vulnerability.

(U) Major Problems and Possible Vulnerability-Reduction Measures

(U) Several candidate solutions are being developed and tested in Phase II which will either reduce the probability of the ammunition being hit, or reduce the violence of the reaction when it is hit. The simplest solution, removing the TOW missiles and 25mm ammunition from the troop compartment, is not being considered. External stowage of some small arms ammunition and antipersonnel mines is being considered.

(U) The above candidate survivability enhancements are currently being tested in Phase II. The most promising enhancements will be incorporated in prototype Bradley vehicles and subjected to a 10 shot live fire test series starting in March 1986. The results will be reported to Congress in June.

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TABLE 1

THREATS TO THE BRADLEY FIGHTING VEHICLE

Weapon Class	Fielded Soviet Equipment	Tested vs. M-2/3 In 1981 (DT-II)	Tested vs. M2/M3 In 1985
<u>Weapons in every Infantry Squad, Platoon, and Company</u>			
Rifle	AK-74	None	None
Anti-Tank Grenades	RPG-7, 16 and 18	None	3.2in Device, RPG-7G
Recoilless Rifle	SPG-9	None	None
<u>Guns On Vehicles</u>			
Machine Guns on Trucks, APCs etc.	12.7mm, 14.5mm	30cal, 50cal, 14.5mm	None
Automatic Cannons	30mm, 73mm	None	UK 30mm(APDS)
Tank Cannons	100mm, 115mm, 125mm	None	FRG 120mm(HEAT)
<u>Anti-Tank Guided Missiles</u>			
Missiles in Infantry Units and Helicopters	AT-3,4,5,6,7, and 8	None	US TOW-I
<u>Artillery</u>			
Howitzer	122mm, 152mm	US 155mm(VT)	None
Field Guns	85mm, 100mm, 130mm	None	None
<u>Mines</u>			
Blast/Frag	Multiple	US M16A1	None
Anti-Tank	Multiple	None	US M718
<u>Air Delivered Weapons</u>			
Guns, Bombs and Bomblets	Multiple	None	US ROCKEYE II

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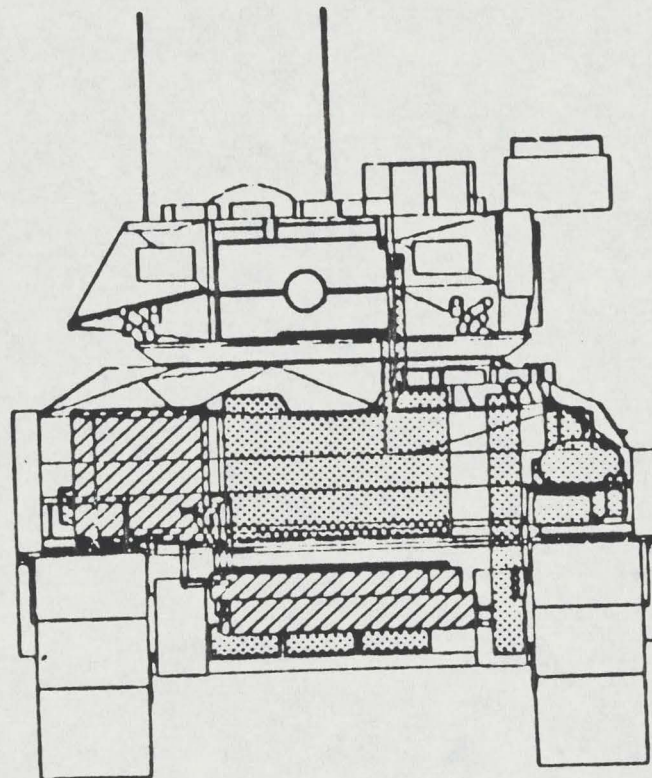
ANNEX A

CREW, FUEL & AMMUNITION CONFIGURATION

FOR M-2, M-3, BMP-1, BMP-2, ITV

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

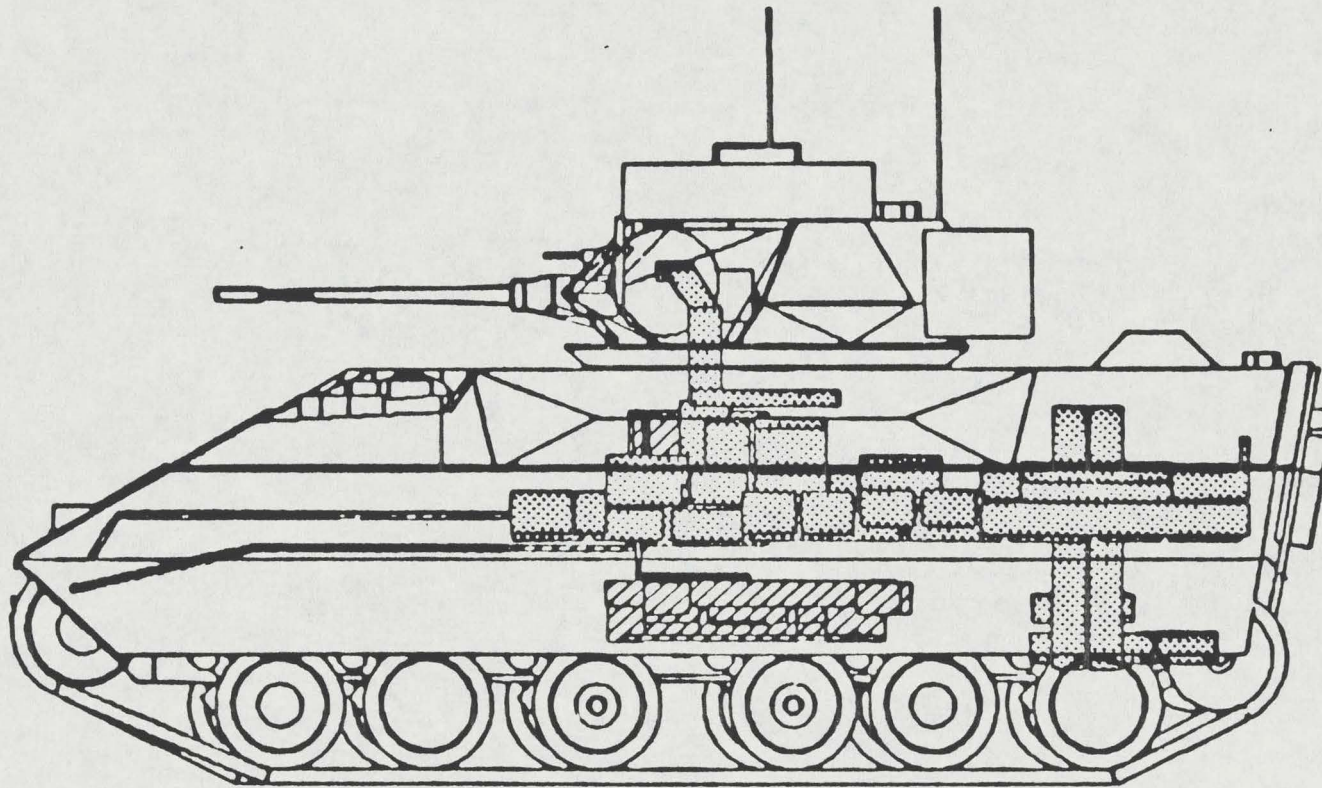
0° AZIMUTH
0° ELEVATION



KEY:  TOW/DRAGON MISSILES
 AMMO
 DIESEL FUEL

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

90° AZIMUTH
0° ELEVATION

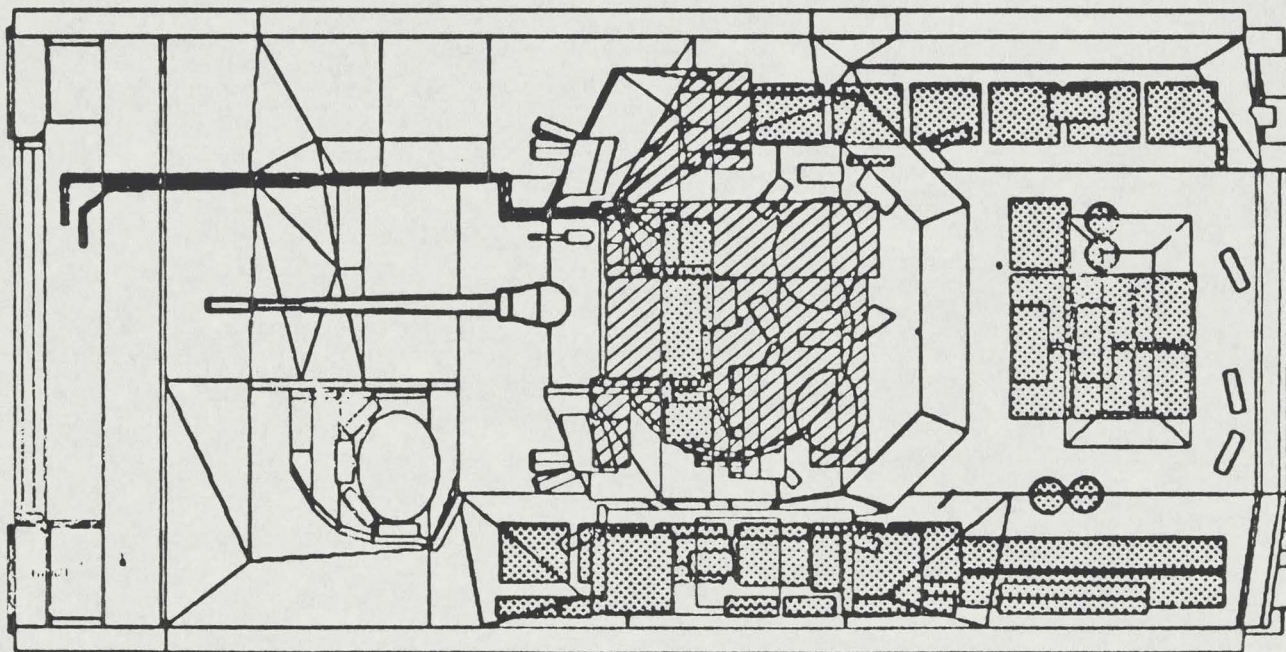


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	AMMO
	DIESEL FUEL

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

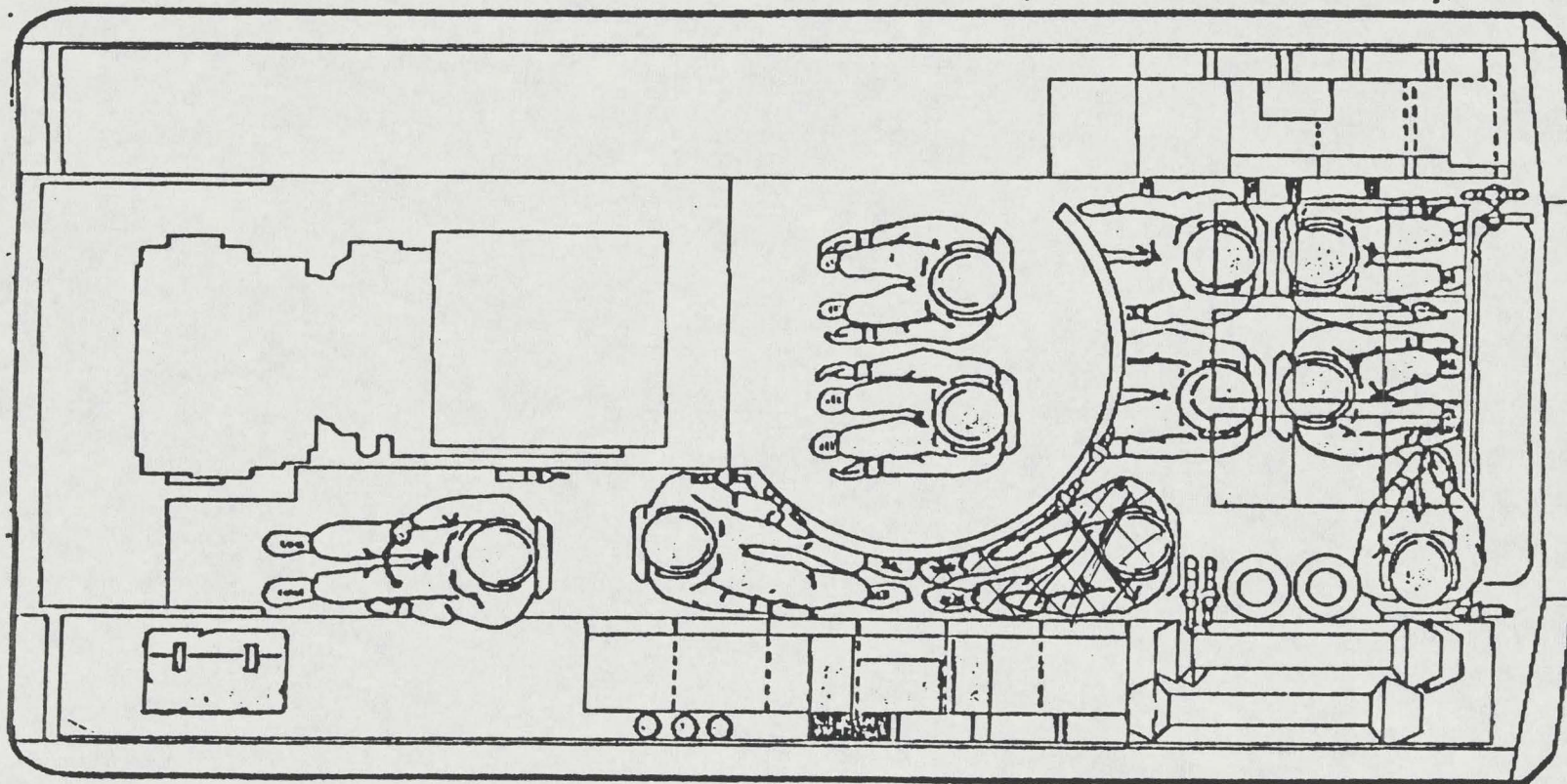
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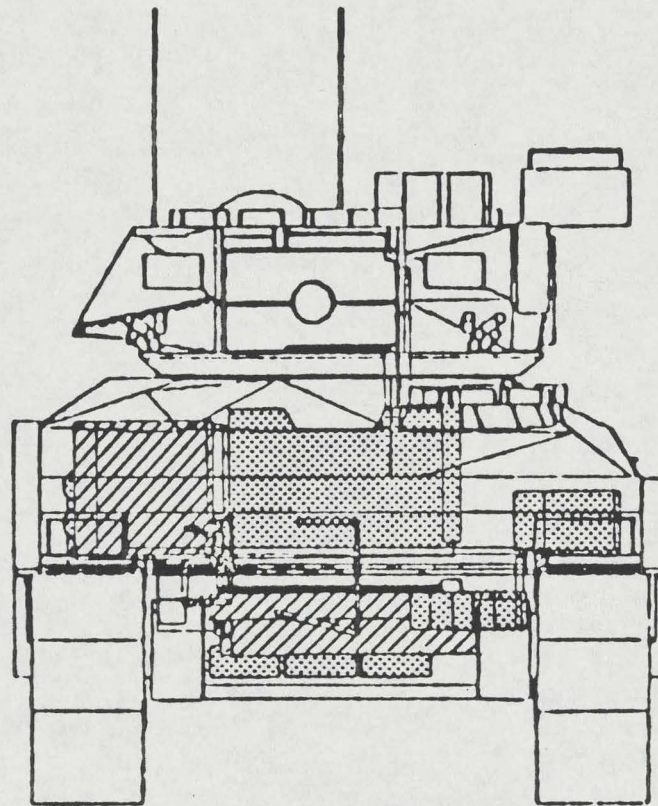
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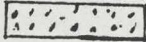
FIGHTING VEHICLE SYSTEMS

M2 VEHICLE ARRANGEMENT

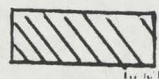
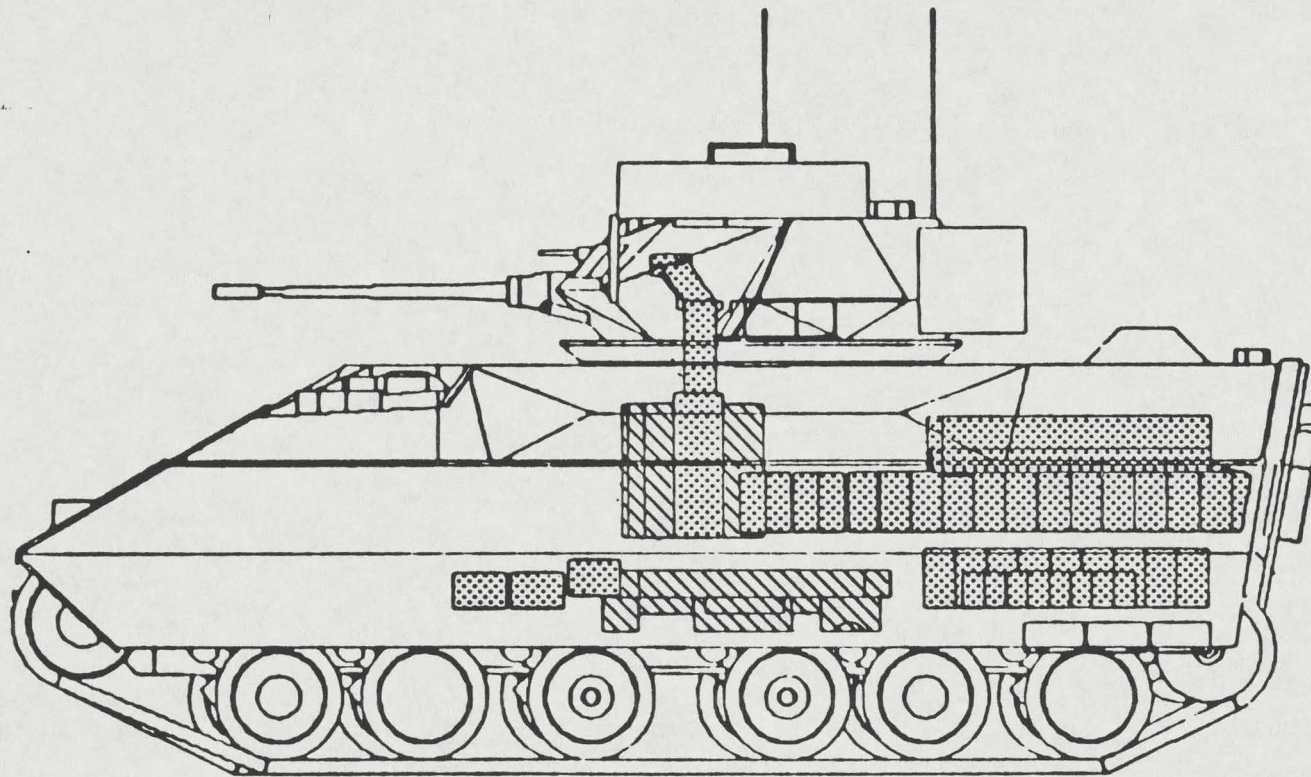


M-3 FUEL & AMMUNITION CONFIGURATION

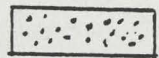


-  - Fuel
-  - Ammunition (25mm + TOW)

M-3 FUEL & AMMUNITION CONFIGURATION

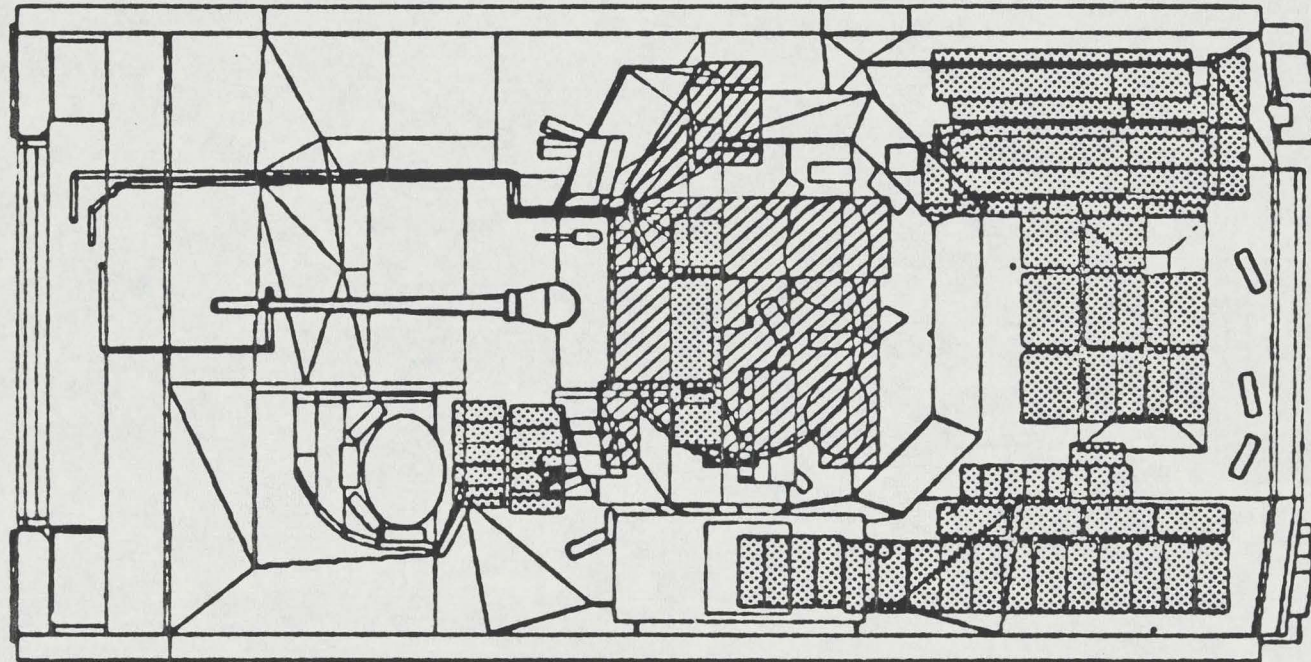


- Fuel



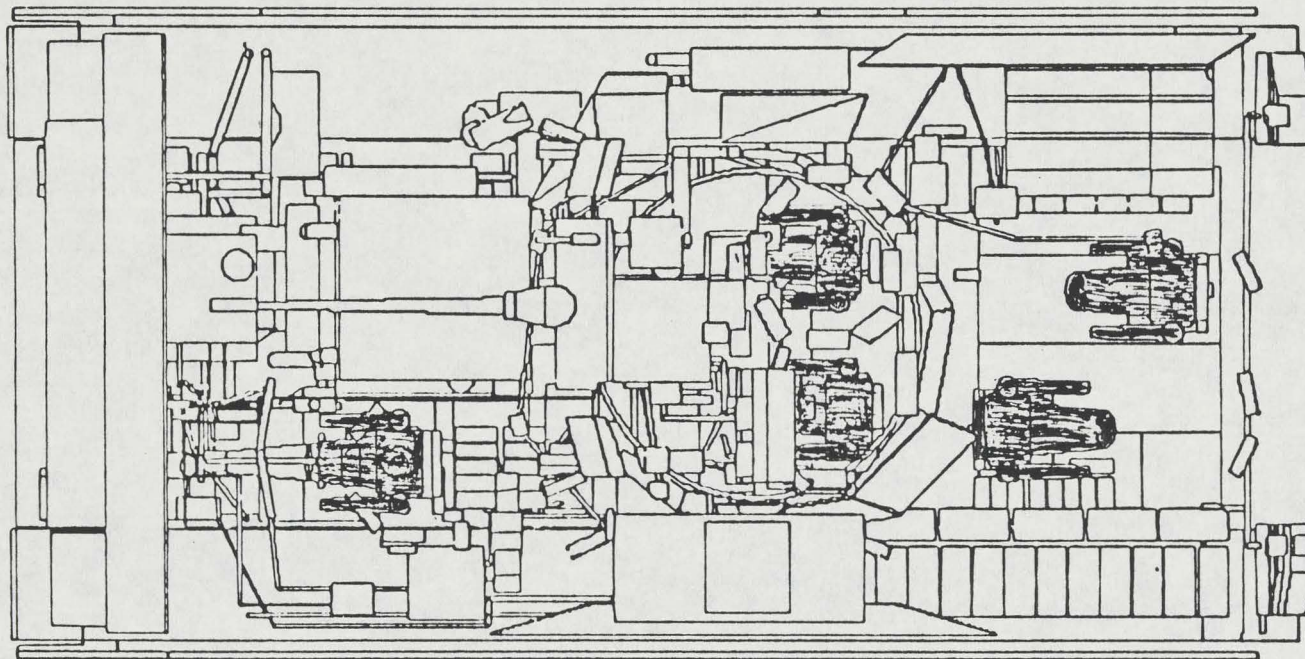
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M-3 FUEL & AMMUNITION CONFIGURATION

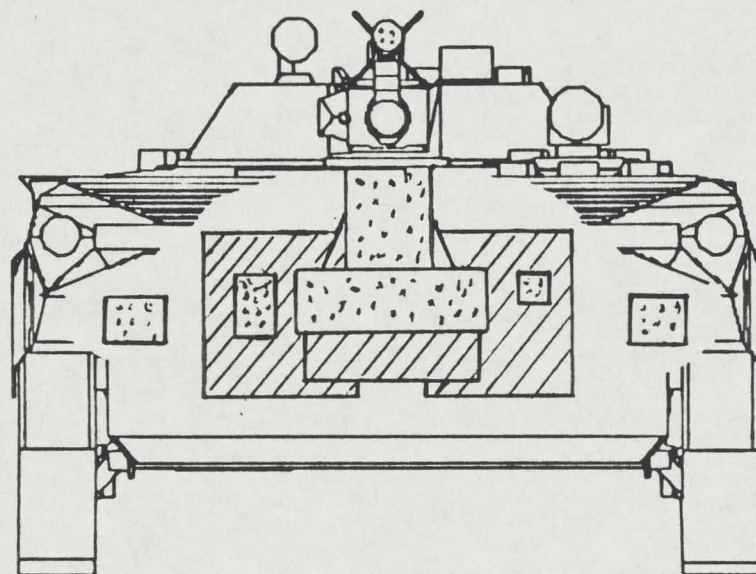


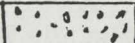
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-  - Ammunition (25mm + TOW)

M-3 CREW POSITIONS



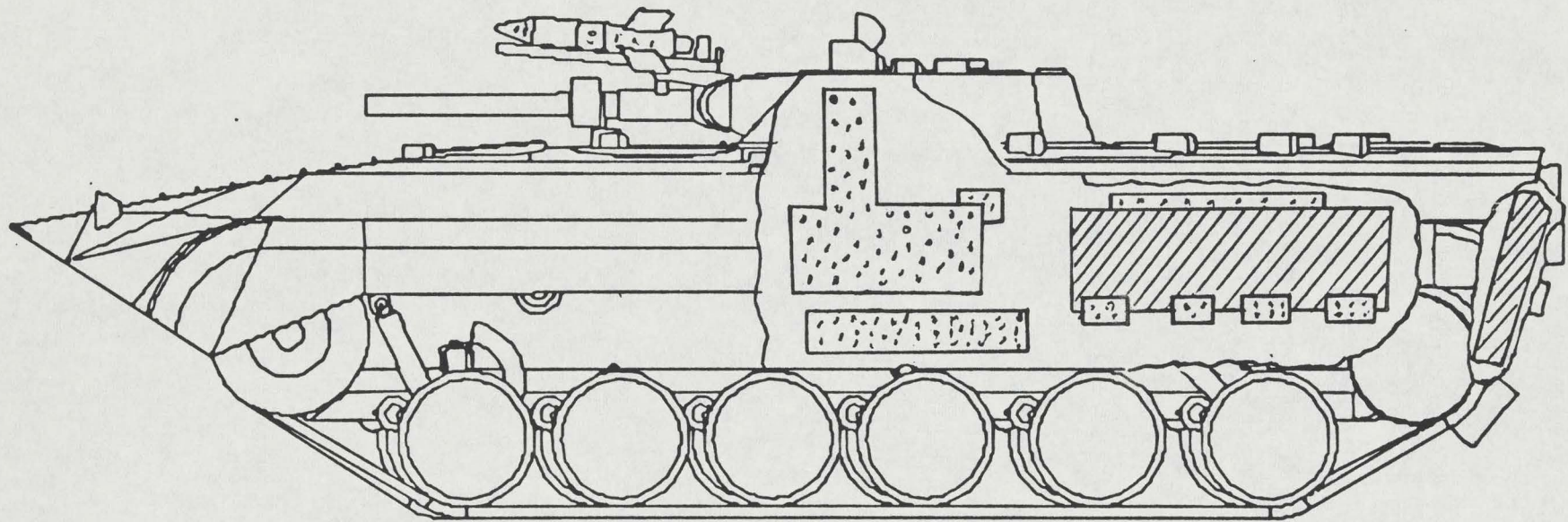
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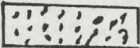


 - Ammunition

 - Fuel

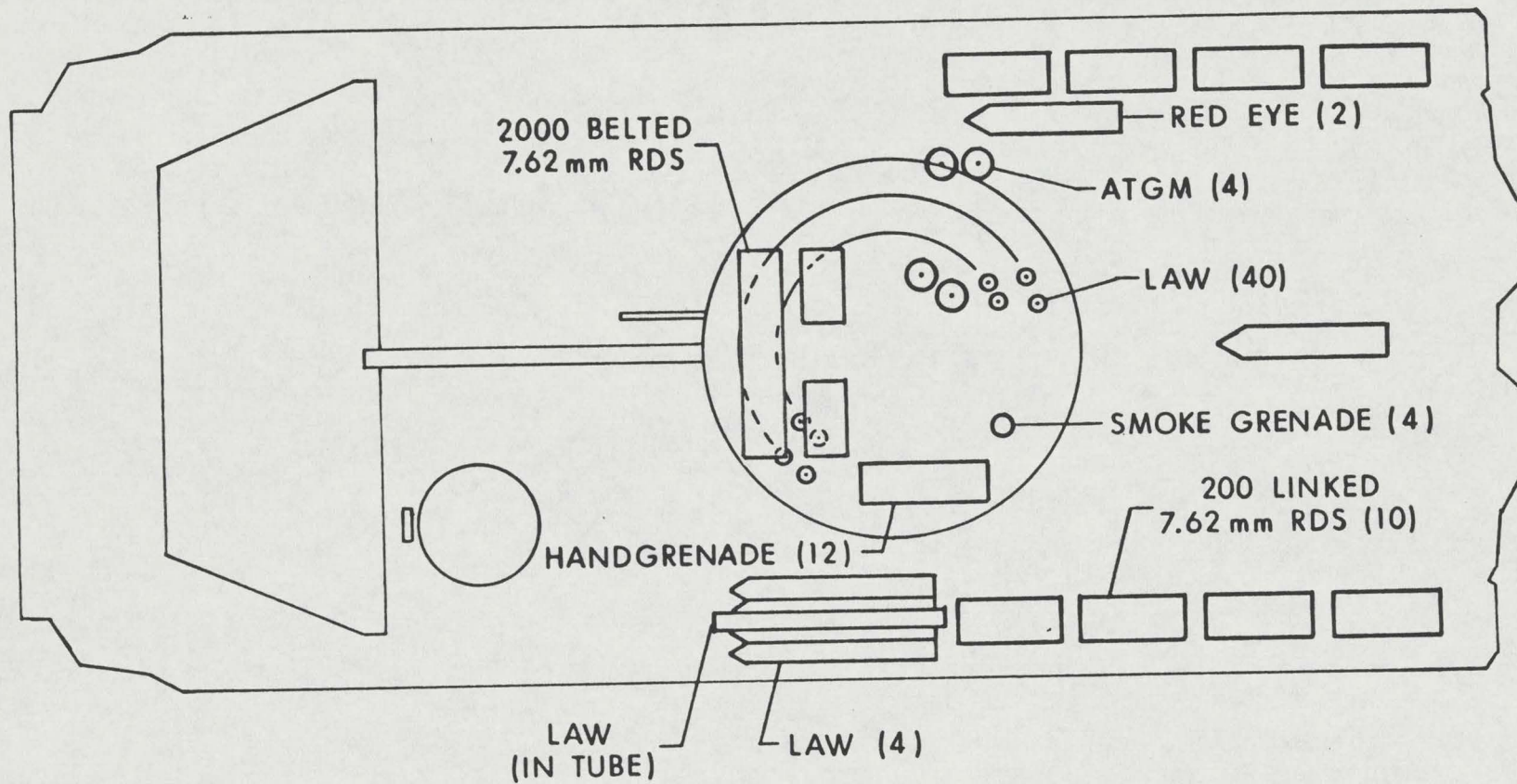
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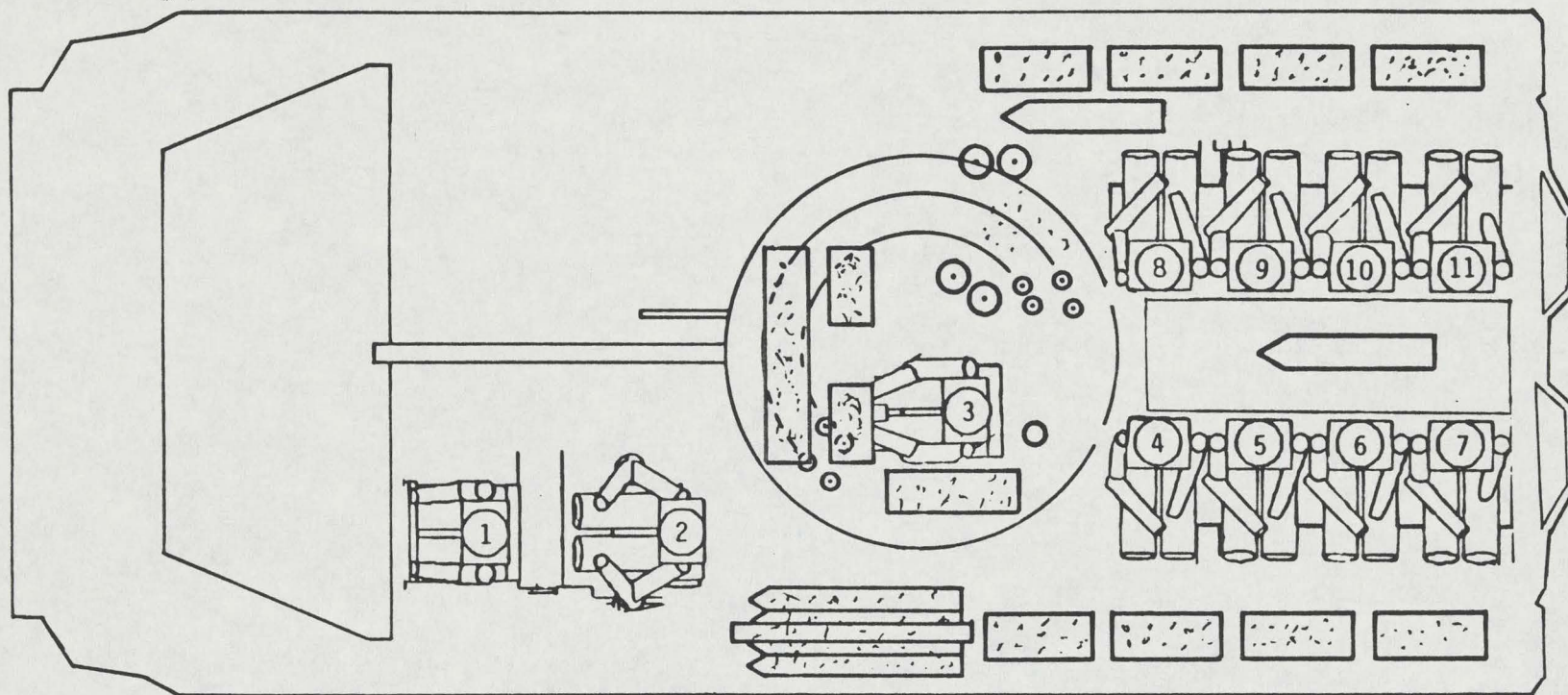
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 - Fuel

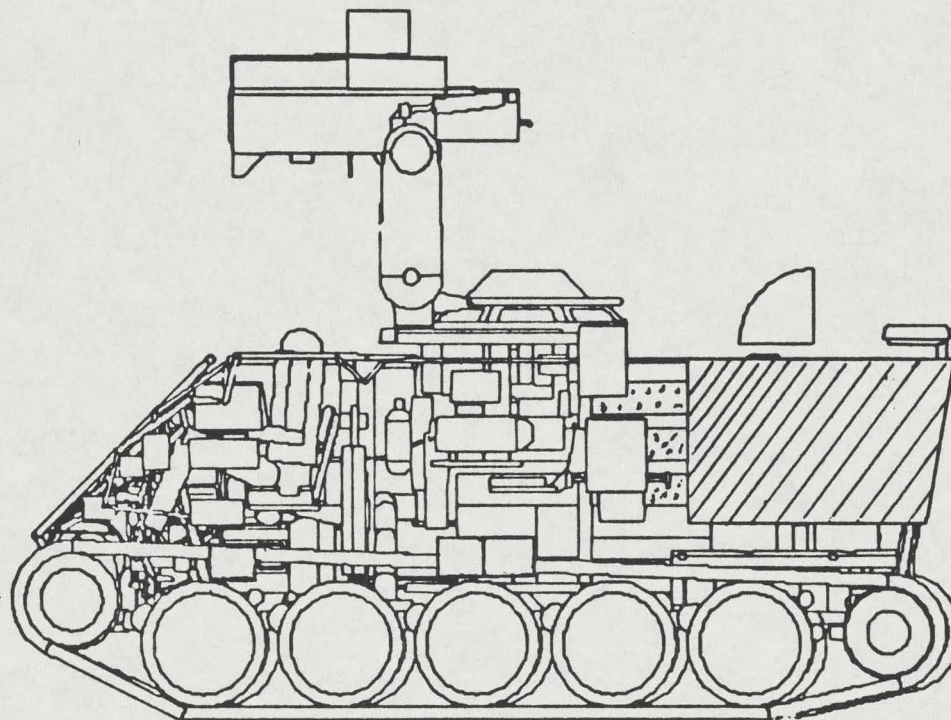
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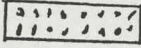
BMP-1 CREW POSITIONS



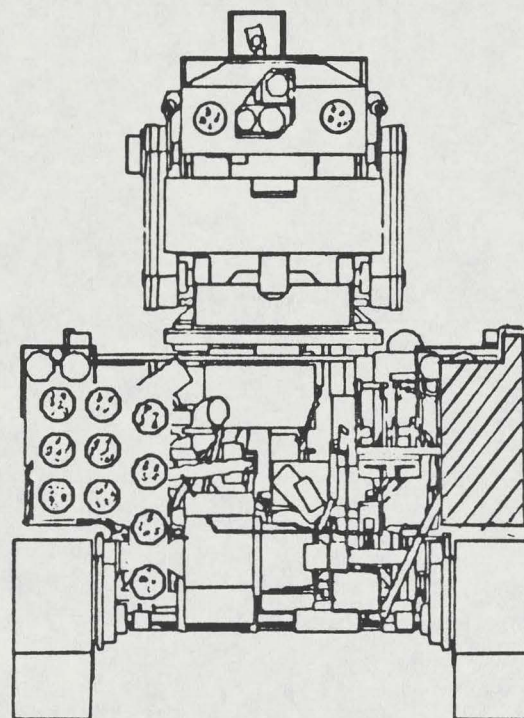
M901/ITV FUEL & AMMUNITION



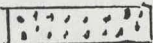
IMPROVED TOW VEHICLE XM901
AZIMUTH 90.0 ELEVATION .0

-  - Ammunition
-  - Fuel

M901/ITV FUEL & AMMUNITION

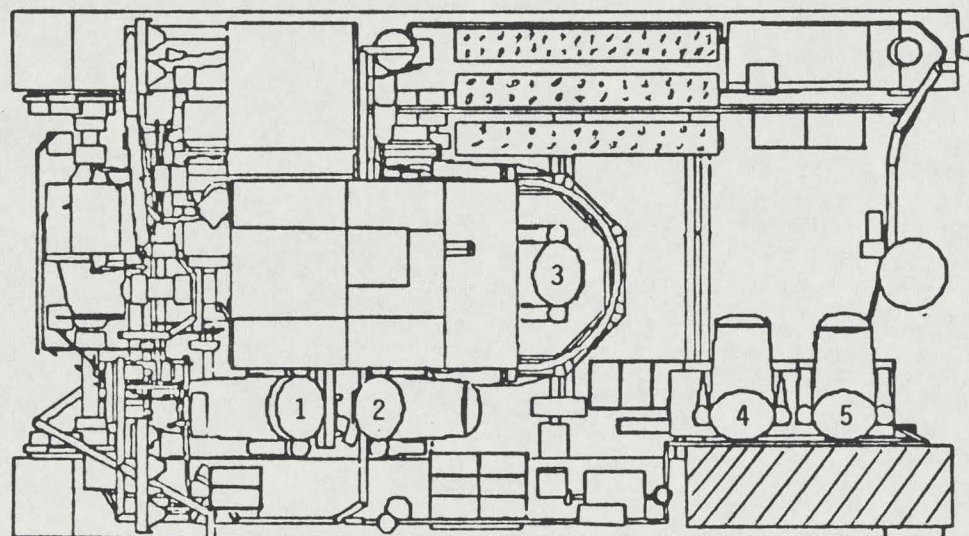


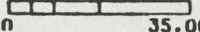
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AZIMUTH .0 ELEVATION .0

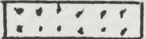
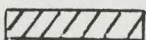
 - Ammunition

 - Fuel

M901/ITV FUEL & AMMUNITION CONFIGURATION



IMPROVED TOW VEHICLE XM901 INCHES SCHMOKE
 AZIMUTH 90.0 ELEVATION 90.0
 SCALE  35.00

-  - Ammunition
-  - Fuel

ANNEX B

SHOT BY SHOT SUMMARY OF

ALL M-3 FIRINGS

ANNEX C

SHOT BY SHOT SUMMARY OF
ALL BMP AND ITV SHOTS



OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

27 DEC 1985

RESEARCH AND
ENGINEERING
(DDTE)

MEMORANDUM FOR MR. WATT

THROUGH: GENERAL JONES

SUBJECT: Halon and "Vaporifics" Effects

Since I completed my report on the Bradley Vulnerability tests, I have continued to research the topic of Halon and its toxic effects. After reading additional reports and talking to toxicologists in private practice, the Navy, and the FAA, I have prepared the attached update which I intend to incorporate in my report on pages 6-7.

James G. Burton
James G. Burton
Colonel, USAF
Military Staff Assistant
for Tactical Air and
Land Warfare Systems

Attachment

(U) Halon extinguishes fires by displacing the oxygen and by a chemical inhibition of the fire reaction. While Halon is not lethal to the crew, it does have toxic effects. Experiments have been conducted with human subjects breathing concentrations of Halon 1301 of up to 7 percent by volume without long term health problems; however, there are toxic effects which include transient dizziness, momentary loss of balance, and decrements in mental performance. The effects are more pronounced as Halon concentration increases^{1/}. The Bradley Halon system is designed for 7 percent ; however, since there is no manifold to insure even distribution, those troops sitting near the two Halon bottles will be subjected to higher concentrations.

(U) When Halon reacts with a fire, it decomposes into toxic substances such as hydrogen fluoride (HF), hydrogen bromide (HBr) and others. The hotter the fire and the longer the interaction, the more by-products are produced. Brief exposures (less than 2 minutes) to these by-products cause irritation to eyes, skin and respiratory tract. Prolonged exposure to high concentrations may cause permanent injury to the respiratory track^{1,2/}. Previous Army experiments with Halon extinguishers in gasoline powered M-113 vehicles determined that these by-products are present in concentrations that "usually exceed that considered tolerable by man." Several animals in these experiments were left in the vehicle for 5½ minutes after the Halon/fire reaction. Three animals died of severe bronchial constriction. The remaining four animals were found to also have severe irritation of the respiratory tract. Animals that were removed 2½ minutes after the detonation were found to have less severe lesions. As a result, even though Halon was recommended for use in the M-113, crews were advised to immediately evacuate the vehicle once a fire was suppressed (as well as recommended to evacuate when Halon accidentally discharged into the crew compartment).

1/ J. Soc. Occup Medicine (1982) 32, 37-43

2/ US Army Environmental Hygiene Agency Edgewood Arsenal, MD,
Report 33-032-70/72



OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

RESEARCH AND
ENGINEERING

17 DEC 1985

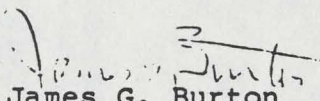
(DDTE)

MEMORANDUM FOR MR. WATT

THROUGH: GENERAL JONES

SUBJECT: Bradley Fighting Vehicle Vulnerability Tests Report

As part of my oversight responsibilities I was tasked by you and General Jones to prepare an independent report on the results of the Bradley Vulnerability Tests. I began this effort when it appeared that the Army's report was going to be incomplete and unacceptable. I prepared two separate drafts and staffed them with the OSD staff, the Army Secretariat, and Army staff. I received comments from the Army and PA&E; comments which I incorporated for the most part. I hereby submit my finished product.


James G. Burton
Colonel, USAF
Military Staff Assistant
for Tactical Air and
Land Warfare Systems

Attachment

REPORT TO CONGRESS ON PHASE I-RESULTS
OF THE LIVE-FIRE SURVIVABILITY TESTING FOR
THE BRADLEY FIGHTING VEHICLE SYSTEM

(U) The 1986 Authorization Act requires the Secretary of Defense to report to Congress by December 1, 1985, the results of survivability testing of the Bradley Fighting Vehicle System. Phase I of the Bradley FVS tests was conducted from March through October 1985 and pertained to currently configured Bradleys. Phase II involves testing candidate survivability enhancements based upon lessons learned during Phase I. Phase II testing must be complete by April 1986 and results reported to Congress by June 1986. This report is the Secretary of Defense report required by the 1986 Act. There is a separate U.S. Army report. Each major point of disagreement between the two is identified and discussed in this report.

(U) System Description

(U) The Bradley Fighting Vehicle System is comprised of two configurations; the M-2 Infantry Fighting Vehicle (IFV) and the M-3 Calvary Fighting Vehicle (CFV). A total of 2,043 vehicles have been produced, 1,203 M-2's, 840 M-3's. The Army plans to procure a total of 6,882 Bradleys. The M-2 provides the Army the infantry-carrying part of the combined arms team employing armor, infantry, artillery, and attack helicopters operating in concert. The M-3 provides the armored calvary units a vehicle for their screening, reconnaissance and security missions. Annex A depicts the M-2 and M-3 configurations showing positions of the crew relative to the internal fuel and internal ammunition. Both the M-2 and the M-3 have a two-man turret which mounts the 25mm automatic stabilized cannon, its primary armament, supported by a TOW launcher outside the turret, and the 7.62mm coaxial machine gun. The M-2 has, in addition, six firing ports for infantry 5.56mm rifles positioned along the side and rear of the vehicle. The overall mobility of M-2/3 is comparable to the M-1 tank. The M-2 carries a nine man team; commander, gunner, driver and six squad members. The M-3 carries a five man team; commander, gunner, driver and two scouts. The vulnerability tests were conducted on the M-3 configuration with results extrapolated to the M-2 configuration.

(U) Threats to the Bradley Fighting Vehicle

(U) Table 1 lists the spectrum of threat weapons the M-2/3 can expect to encounter on the battlefield. The threat weapons most frequently encountered will be the weapons found in each enemy infantry squad, platoon and company, which are principally small arms (rifles, machine guns, etc.) and shoulder-fired High Explosive Anti-Tank (HEAT) infantry weapons. Larger weapons, primarily tank fired and artillery

rounds, plus anti-tank guided missiles will also be widely encountered. The Bradley design specification did not require protection against battlefield threats other than small arms, artillery fragments or antipersonnel mines.

(U) First prototype of the Bradley was delivered in June 1979. The first production vehicle was delivered in December 1980. In 1981, ballistic tests of small arms bullets and artillery fragments were conducted against a Ballistic Hull and Turret (BH&T) vehicle which is essentially an armor shell with no working subsystems. While some rounds as well as artillery fragments penetrated the armor shell under certain conditions, there were no interior effects available since the BH&T was not loaded with fuel or ammunition. Until 1984, there was no further vulnerability testing of the Bradley and none planned. In June 1984, the Joint Live Fire Test Program of the USD(R&E) drew up plans for testing the vulnerability of combat loaded Bradleys. In September 1984, the U.S. Army offered to conduct the tests themselves and a test plan was jointly agreed to by USDR&E and the Army.

(U) The 1985 vulnerability tests concentrated on the most common anti-armor threat weapons (beyond small arms). Tank fired kinetic energy penetrators, anti-tank field guns and direct fire artillery were not included in this high-urgency first round of tests because it was felt that vulnerability reduction measures would have less chance of helping against those more destructive rounds.

(U) Test Conditions

(U) The tests were conducted in a building block approach. Testing began with eight limited realism firings at a BH&T armored shell and thirty-six firings at operating M-3 vehicles containing inert ammunition. To understand the critical area of ammunition fires and explosions better, fourteen additional limited-realism firings, referred to as "off-line" tests, were conducted at a BH&T which contained various amounts of live 25mm ammunition in the crew compartment. For these limited-realism 14 shots, the internally stowed ammunition was intentionally struck so that the violence of the reaction could be measured directly.

(U) The test program culminated with 10 full live fire shots at an M-3 realistically combat loaded with a full complement of fuel, uniformed mannequins and live ammunition. For these 10 live fire shots, the impact points and attack directions were not random nor representative of the locations of combat impacts. Instead, they were carefully selected to resolve vulnerability uncertainties. Shots for which there was a high probability of a catastrophic fire or explosion on the one hand, or trivial mechanical damage on the other hand, were

deemed unnecessary and therefore avoided. For example, each of the 10 live fire shots was aimed so as to avoid intentionally striking the explosive elements of internally stowed ammunition--even though there are likely to be a fair number of direct hits on ammunition in real combat. During the live fire tests, there were two accidental impacts on internal ammunition; the results are discussed in a later section. Additional "off-line" firings were conducted at individual potentially explosive components such as TOW missile launch motors, flight motors and warheads.

(U) The operating M-3 vehicles were loaded with fuel heated to operational temperatures and the majority of equipment and supplies normally carried in combat. Plywood mannequins in battledress uniforms were placed in all crew positions. All combustible and explosive materials normally carried inside the Bradley were also stowed in the vehicle. All ammunition (either inert or live) was loaded in normal stowage containers and stowed in accordance with the M-3 stowage plan. All ammunition for the ten live fire shots as well as the fourteen limited-realism BH&T shots, contained inert fuzes for the safety of the test crews when they entered the vehicle following a shot. There is a possibility that the presence of live fuzes would have increased the violence of the reactions when ammunition was struck directly. Tests of this possibility are scheduled for January.

(U) After each firing, an assessment team inspected the vehicle to determine the nature and extent of damage which occurred on that firing. All damage to the vehicle, individual components, and soldier mannequins was photographed and recorded; videotapes of each firing were also made. Functional checks were made of the engine, transmission, turret, TOW launcher, 25mm gun, and automatic fire suppression system. The detailed assessment data is available in BRL Report SP-49.

(U) The Soviet RPG-7G grenades, the West German 120mm HEAT projectiles, and the U.K. 30mm APDS projectiles were fired at the Bradley target vehicle from actual launchers or gun barrels. The U.S. ROCKEYE II bomblets and the U.S. M718 mines were placed above and below the vehicle and statically detonated. Nine TOW missiles were dynamically launched from a rail to ensure sufficient accuracy of impact. The remaining TOWs and the 3.2 inch laboratory shaped charge were attached to the vehicle and statically detonated to ensure that the jet impacted the desired item. Statically detonated rounds do not represent combat conditions and may have much-reduced effects relative to dynamic impacts. This was observed to be particularly true for the larger TOW missile impacts in which the kinetic energy of the missile added to the damage mechanisms of the warhead. Structural failures of the armor

near the impact point occurred; additional debris including the attacking missile body itself entered the vehicle and caused additional damage. The striking velocities of all dynamically fired munitions were representative of combat conditions.

(U) The 10 full live fire shots against the Bradley consisted of .3 U.S. TOWs, 6 Soviet RPG-7G's, and one West German 120mm HEAT round. We would have preferred to use all Soviet rounds, but Soviet ammunition was not available in time for the tests. Eight of the firings were dynamically fired, two statically. In addition, live fire testing of the Soviet BMP and US 901 Improved TOW Vehicle (ITV) was conducted to provide comparative data for vehicles with similar missions. Live fire testing of the M113 is currently in progress. Annexes B and C contains a shot by shot summary of all test results.

(U) Live Fire Test Results

(U) In this report, the results of the 10 live fire shots* are assessed in two ways, one primary and one secondary:

1. Troop casualties per hit--this is clearly the single most important measure of vulnerability for the Bradley (or any other armored vehicle). In fact, it is the principal purpose of combat-loaded live fire testing, that is, to determine whether there are excessive U.S. troop casualties in first-line U.S. vehicles and, if so, whether there are any feasible modifications or measures that can reduce these casualties.

2. Vehicle damage per hit--this measure of vulnerability is clearly secondary. It is assessed in terms of a) whether or not the vehicle can move after being hit; b) whether or not it can shoot; c) whether or not the vehicle is catastrophically destroyed; and d) whether the vehicle has to be evacuated by the troops after being hit.

* Where appropriate, some additional insights are drawn from the "off-line" ammunition tests, even though they were statically detonated. No conclusions in this report are based on any of the remaining firings against non-fully combat loaded vehicles due to their limited realism.

(U) Casualties

(U) There is a large degree of uncertainty in the medical community on what constitutes a casualty. For this report, casualties are defined to include only (1) puncture wounds from the penetrating round and or spall fragments, (2) burns, and (3) ruptured eardrums, lung hemorrhage or death as a result of blast overpressures. The Army uses the same

casualty criteria for punctures and burns, but chooses to use incapacitation criteria for blast over-pressure effects; they do not consider ruptured eardrums as casualties.

(U) Shots into actual fuel produced more casualties than shots into the vapor space above the fuel. Five shots into actual fuel produced additional burn casualties in the BMP and the ITV (none in the two Bradley fuel shots). Three shots through vapor space produced no additional casualties since no fire or explosion occurred.

(U) Table 3 indicates that as expected, the larger, more energetic weapons produce significantly higher average casualties. The 120mm HEAT shots were limited to engine compartments so no results are available concerning their casualty-producing effects.

(U) Vehicle Damage

(U) Other Major Findings

(U) Aluminum Vaporifics Effects

(U) The tests do not answer the questions of whether aluminum armor creates higher overpressures (i.e., vaporifics) than steel armor, particularly for the important case of TOW-size warheads. This is because the steel-armored BMP had ammunition explosions during the one effective TOW impact and thus cannot be compared to TOW impacts on aluminum armor where no ammunition was set off.

(U) Vulnerability Models

(U) Computer based vulnerability models were used to generate pre-test predictions for all Bradley and BMP shots. During the diagnostic tests prior to the live fire shots, anomalies in the models were discovered which led to three major model revisions. Annexes B and C contain a shot by shot summary of all firings including pre-test predictions and assessed results. The pre-test predictions were based on the third model revision. For the live fire series of 10 shots on the Bradley and BMP, the model predictions were reasonably accurate for 40 and 62 percent of the shots respectively, and

grossly incorrect for the remainder of the shots. After three major revisions, the models clearly have no predictive value for individual outcomes. The Army position is that, while the models are inaccurate in predicting the outcome of any particular shot, they are accurate in general when all of the outcomes are averaged. In addition, the models failed to predict the vulnerability of electric wiring, the fact that some direct hit impacts on ammunition do not lead to catastrophic explosions or sustained fires, failed to predict the structural failures resulting from dynamic warhead blasts on the outside of the vehicle, etc.

(U) Value of Live Fire Testing

(U) All major problems and results which surfaced during the diagnostic tests involving inert ammunition also surfaced during the 10 live fire shots. On the otherhand, significant surprises (with important design lessons) occurred during the live fire shots which could not have occurred when inert ammunition was used. For example, when inert ammunition was struck, catastrophic kills were automatically assessed. Live fire shots demonstrated clearly that some ammunition hits are survivable and that there are likely to be techniques for improving this survivability. The value of live fire testing in revealing actual vulnerabilities and lethalties was clearly demonstrated and in the way to significantly reducing vulnerability.

(U) Major Problems and Possible Vulnerability-Reduction Measures

(U) Several candidate solutions are being developed and tested in Phase II which will either reduce the probability of the ammunition being hit, or reduce the violence of the reaction when it is hit. The simplest solution, removing the TOW missiles and 25mm ammunition from the troop compartment, is not being considered. External stowage of some small arms ammunition and antipersonnel mines is being considered.

(U) The above candidate survivability enhancements are currently being tested in Phase II. The most promising enhancements will be incorporated in prototype Bradley vehicles and subjected to a 10 shot live fire test series starting in March 1986. The results will be reported to Congress in June.

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TABLE 1

THREATS TO THE BRADLEY FIGHTING VEHICLE

Weapon Class	Fielded Soviet Equipment	Tested vs. M-2/3 In 1981 (DT-II)	Tested vs. M2/M3 In 1985
<u>Weapons in every Infantry Squad, Platoon, and Company</u>			
Rifle	AK-74	None	None
Anti-Tank Grenades	RPG-7, 16 and 18	None	3.2in Device, RPG-7G
Recoilless Rifle	SPG-9	None	None
<u>Guns On Vehicles</u>			
Machine Guns on Trucks, APCs etc.	12.7mm, 14.5mm	30cal, 50cal, 14.5mm	None
Automatic Cannons	30mm, 73mm	None	UK 30mm(APDS)
Tank Cannons	100mm, 115mm, 125mm	None	FRG 120mm(HEAT)
<u>Anti-Tank Guided Missiles</u>			
Missiles in Infantry Units and Helicopters	AT-3,4,5,6,7, and 8	None	US TOW-I
<u>Artillery</u>			
Howitzer	122mm, 152mm	US 155mm(VT)	None
Field Guns	85mm, 100mm, 130mm	None	None
<u>Mines</u>			
Blast/Frag	Multiple	US M16A1	None
Anti-Tank	Multiple	None	US M718
<u>Air Delivered Weapons</u>			
Guns, Bombs and Bomblets	Multiple	None	US ROCKEYE II

UNCLASSIFIED

THIS DOCUMENT BECOMES
UNCLASSIFIED WHEN SEPARATED
FROM CLASSIFIED ATTACHMENTS

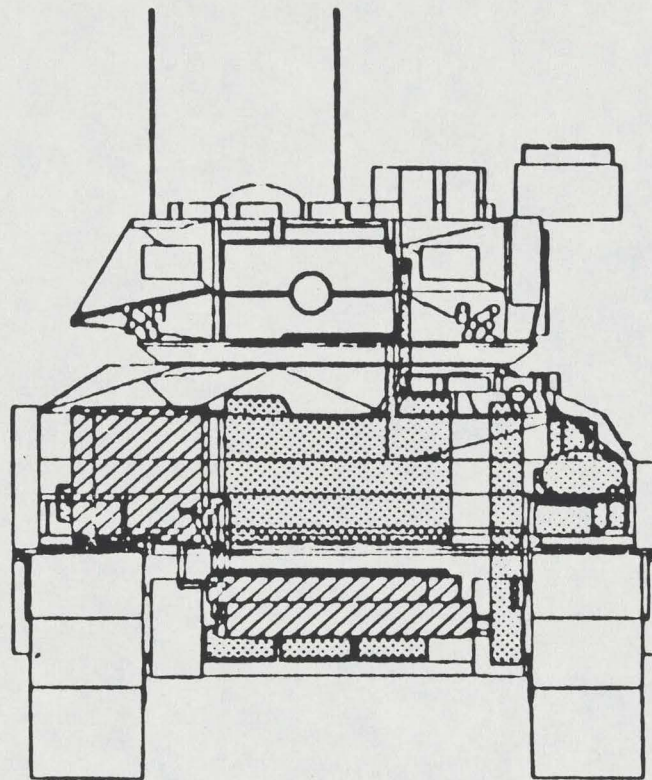
ANNEX A

CREW, FUEL & AMMUNITION CONFIGURATION

FOR M-2, M-3, BMP-1, BMP-2, ITV

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

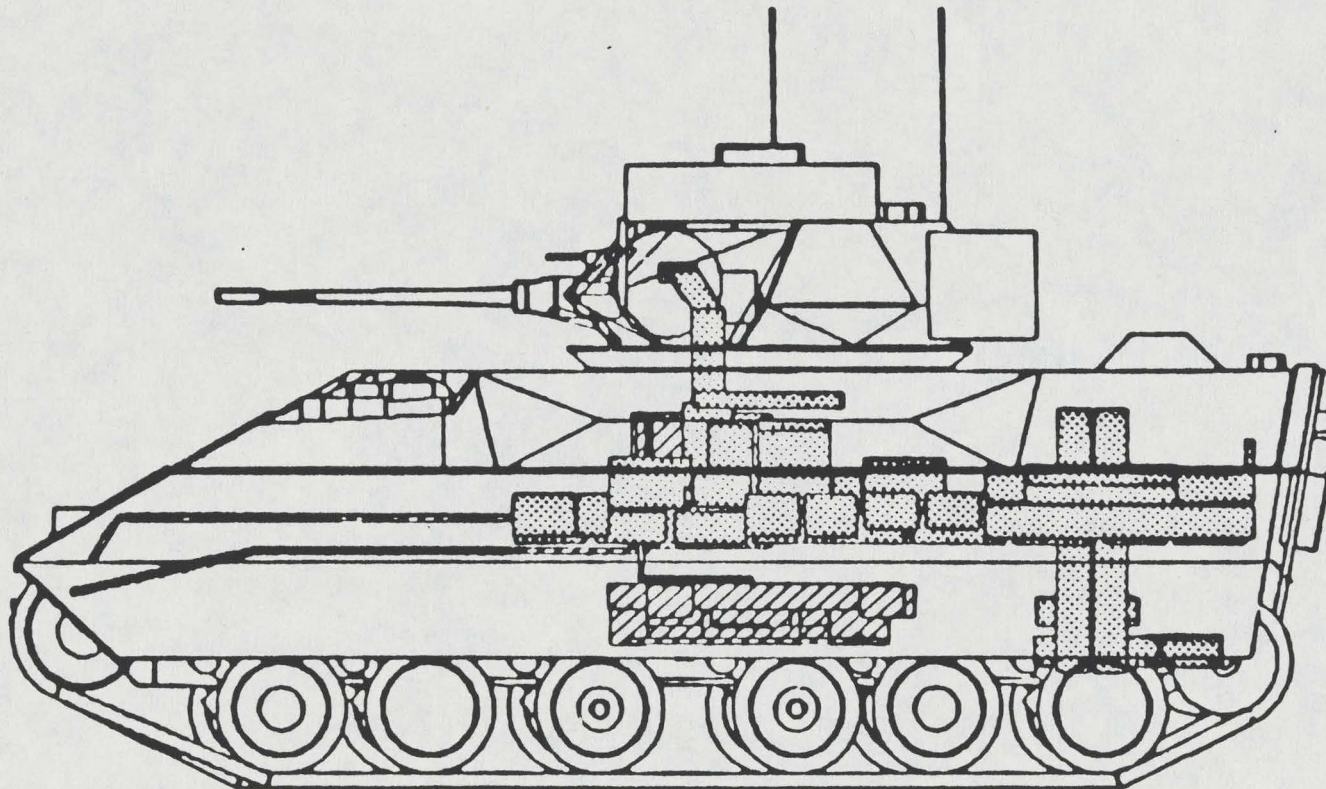
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0° ELEVATION



KEY:  TOW/ DRAGON MISSILES
 AMMO
 DIESEL FUEL

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

90° AZIMUTH
0° ELEVATION



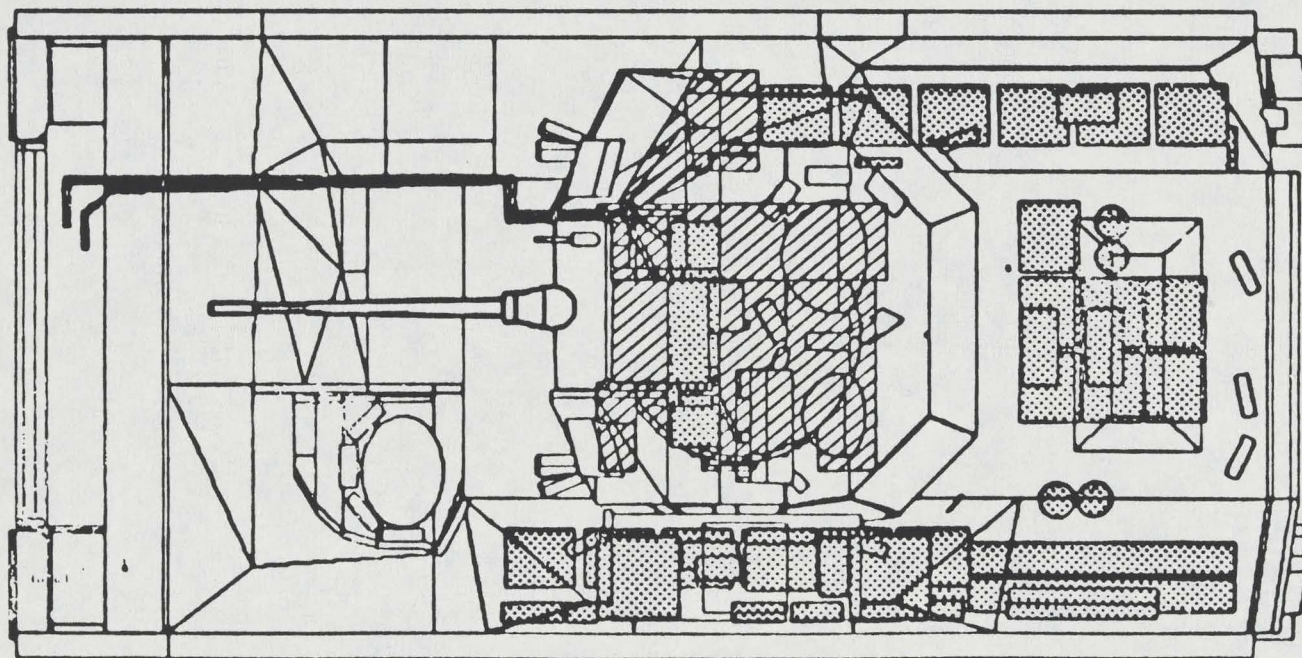
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	DIESEL FUEL

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

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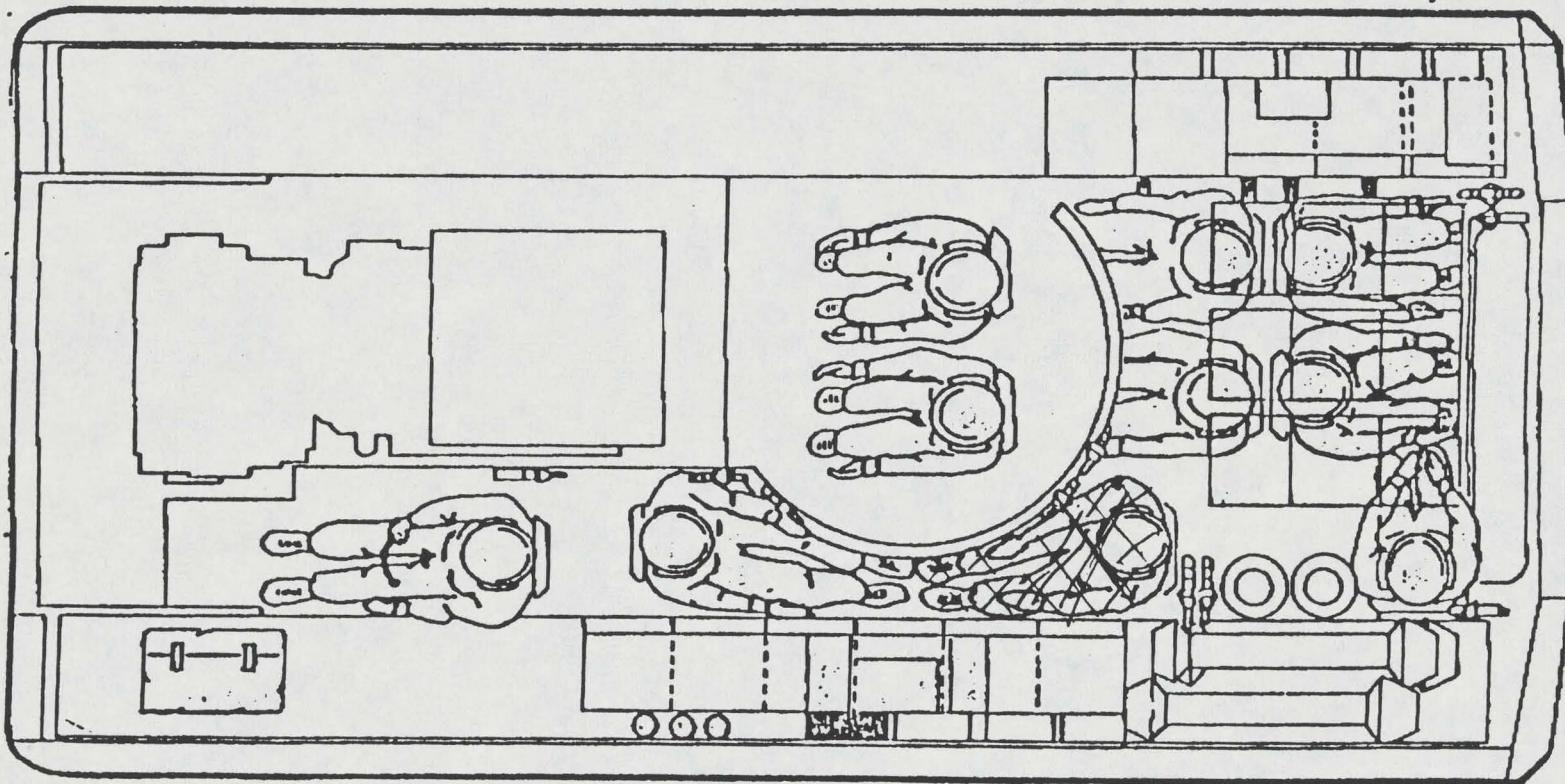
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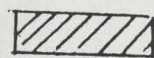
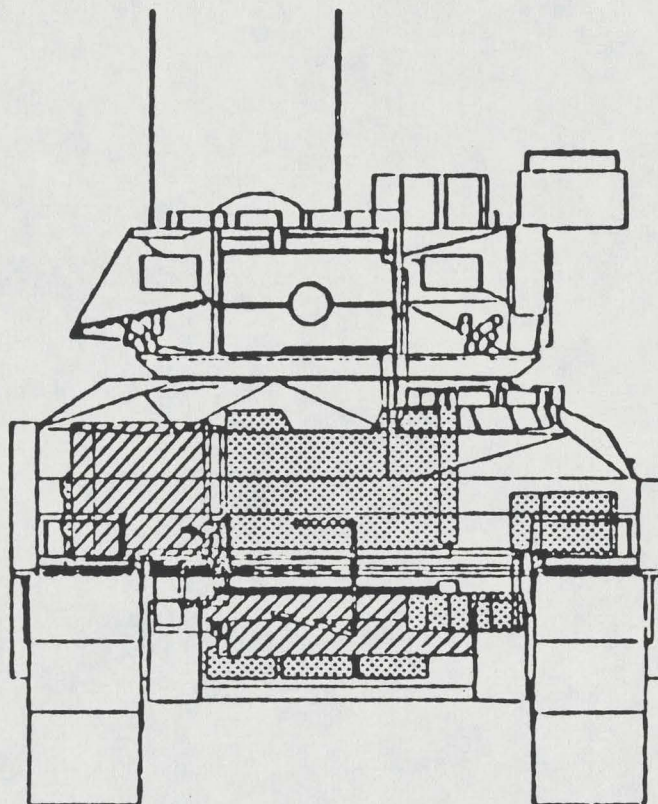
BRADLEY

FIGHTING VEHICLE SYSTEMS

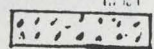
M2 VEHICLE ARRANGEMENT



M-3 FUEL & AMMUNITION CONFIGURATION

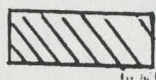
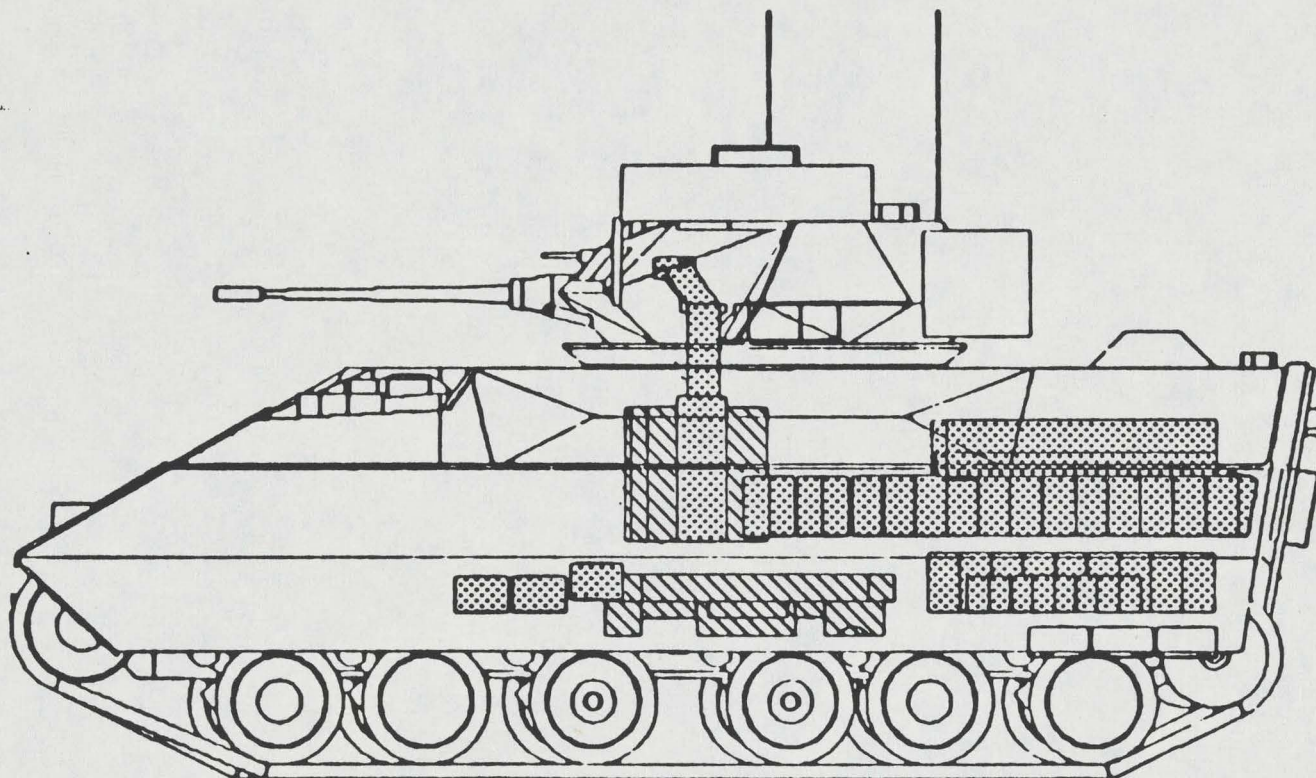


- Fuel



- Ammunition (25mm + TOW)

M-3 FUEL & AMMUNITION CONFIGURATION

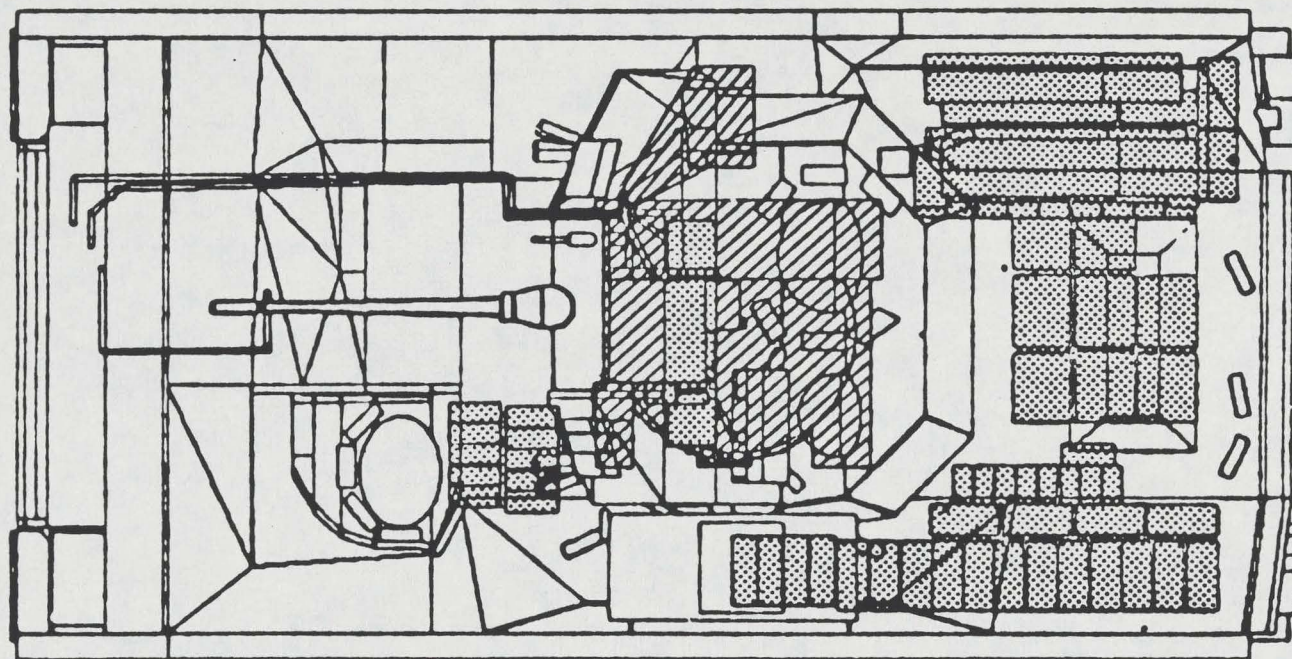


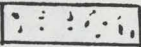
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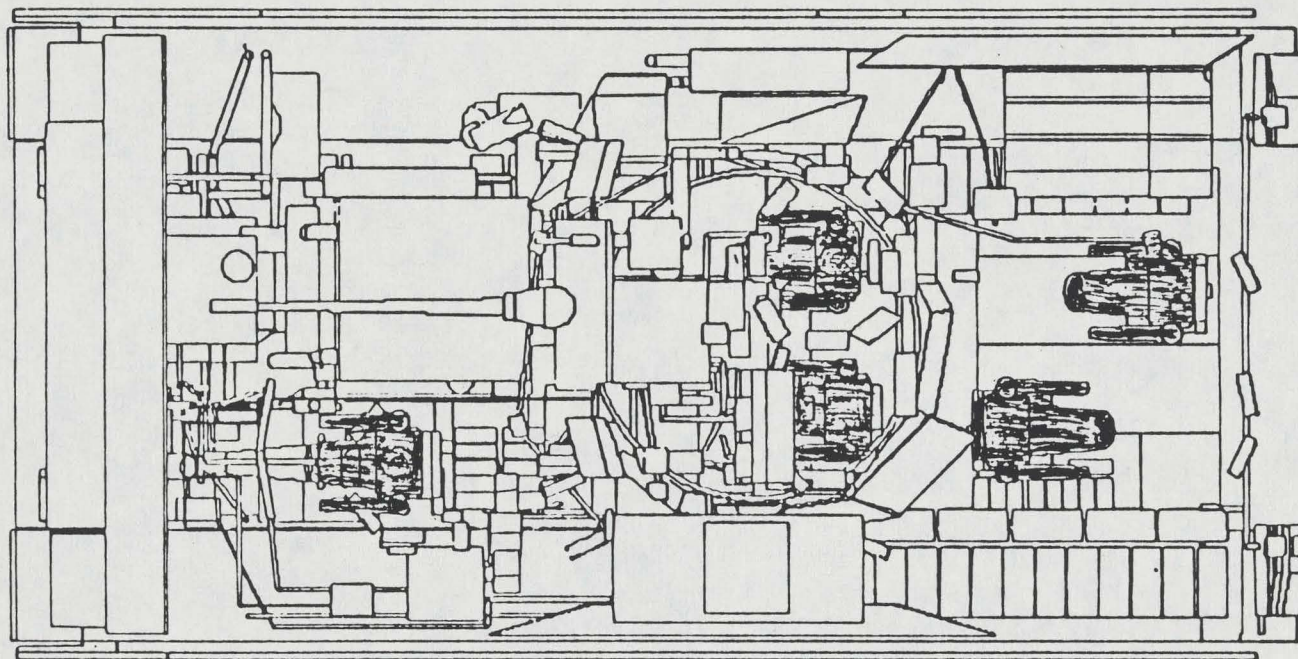
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M-3 FUEL & AMMUNITION CONFIGURATION

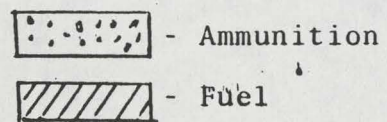
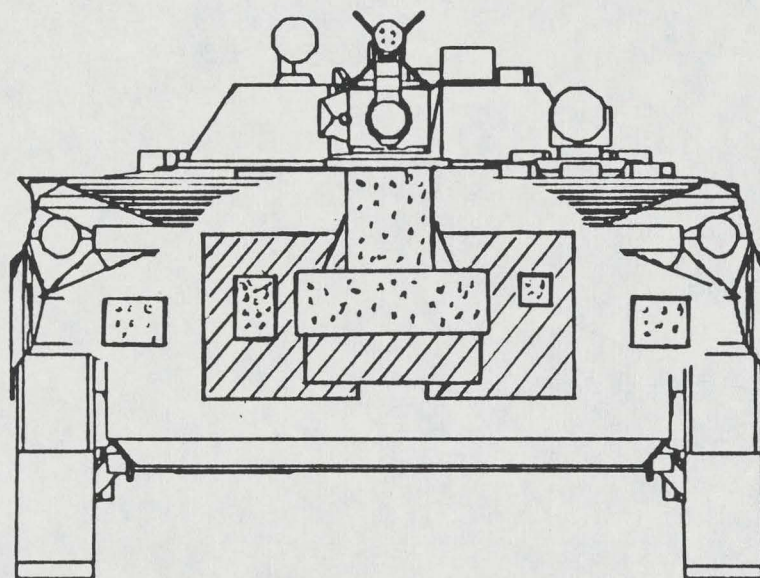


-  - Fuel
-  - Ammunition (25mm + TOW)

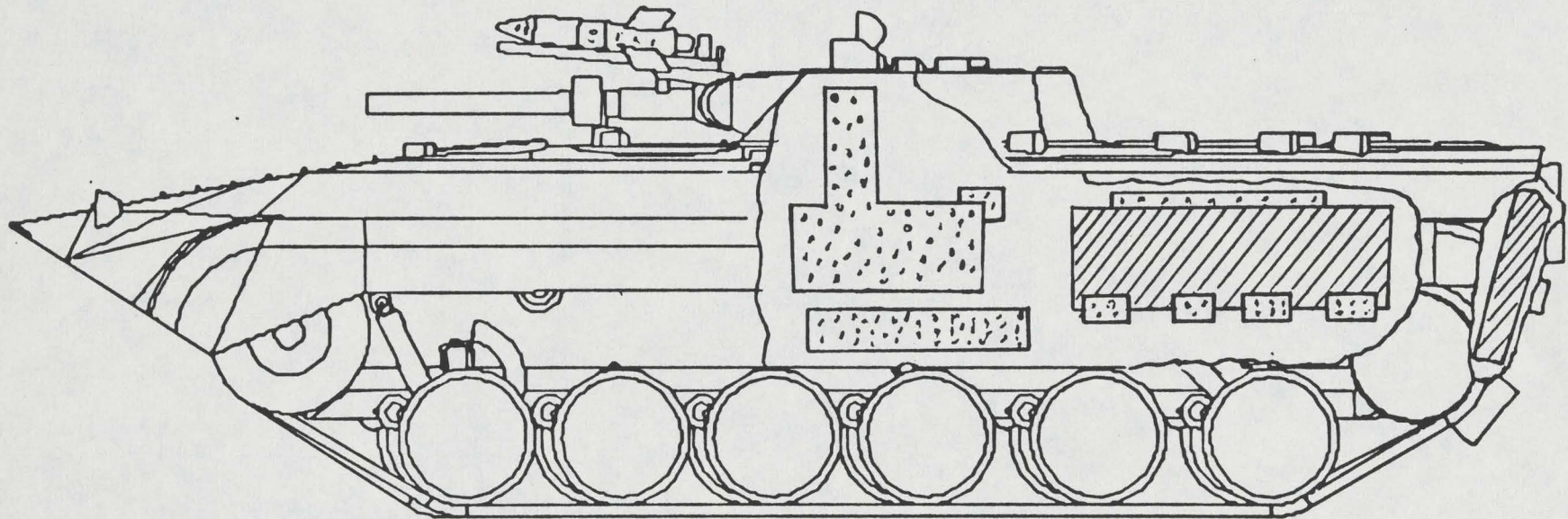
M-3 CREW POSITIONS



BMP-1



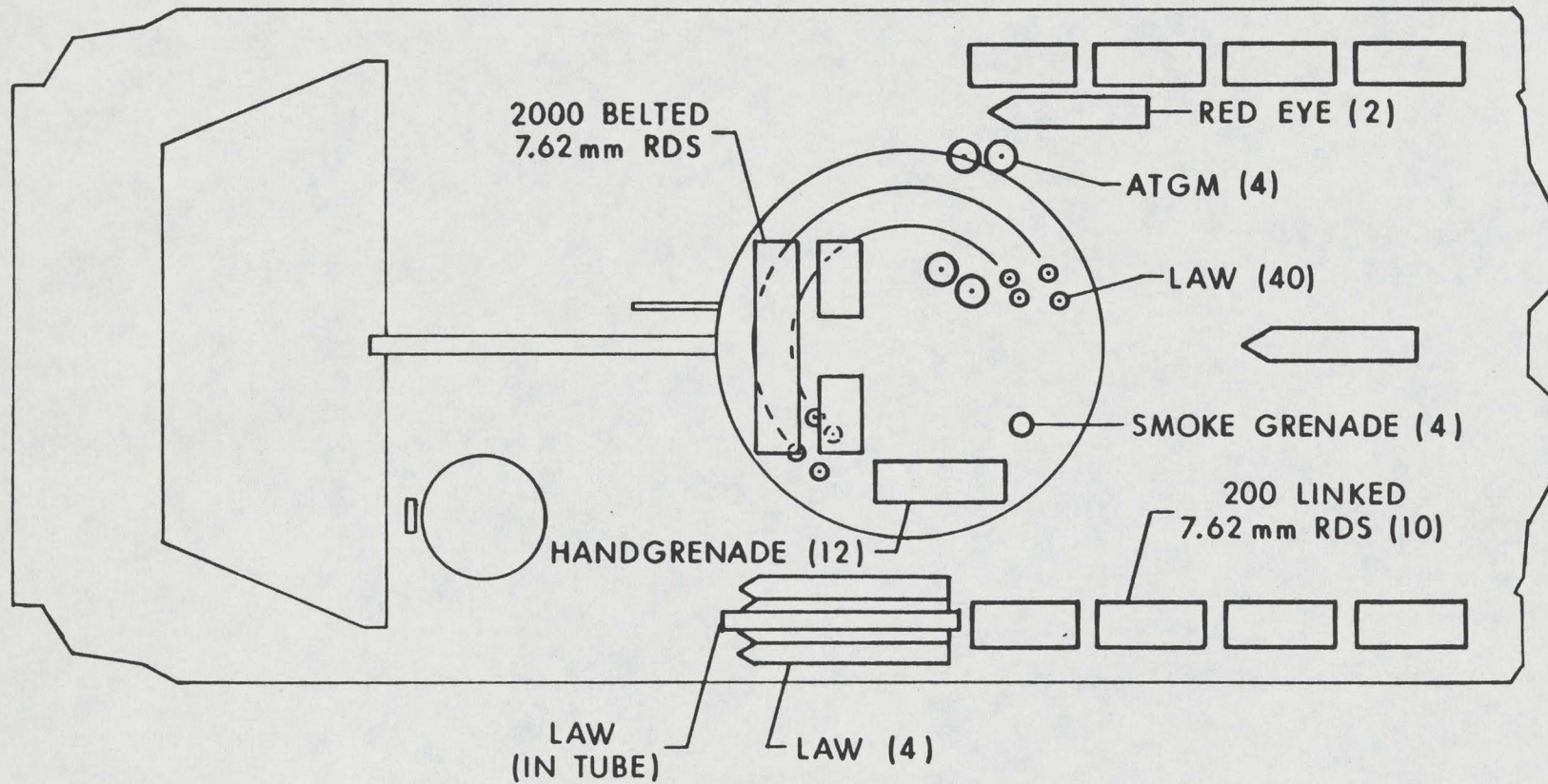
BMP-1



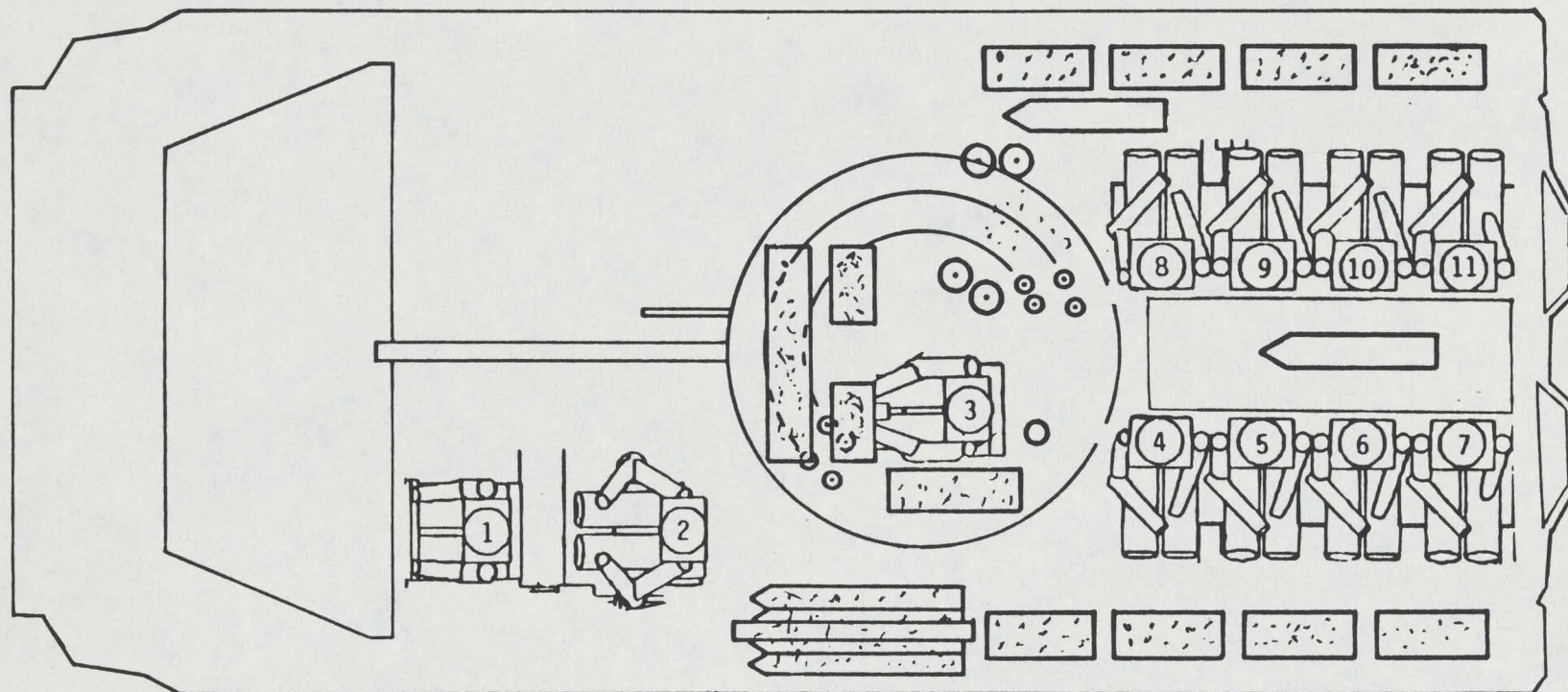
 - Ammunition

 - Fuel

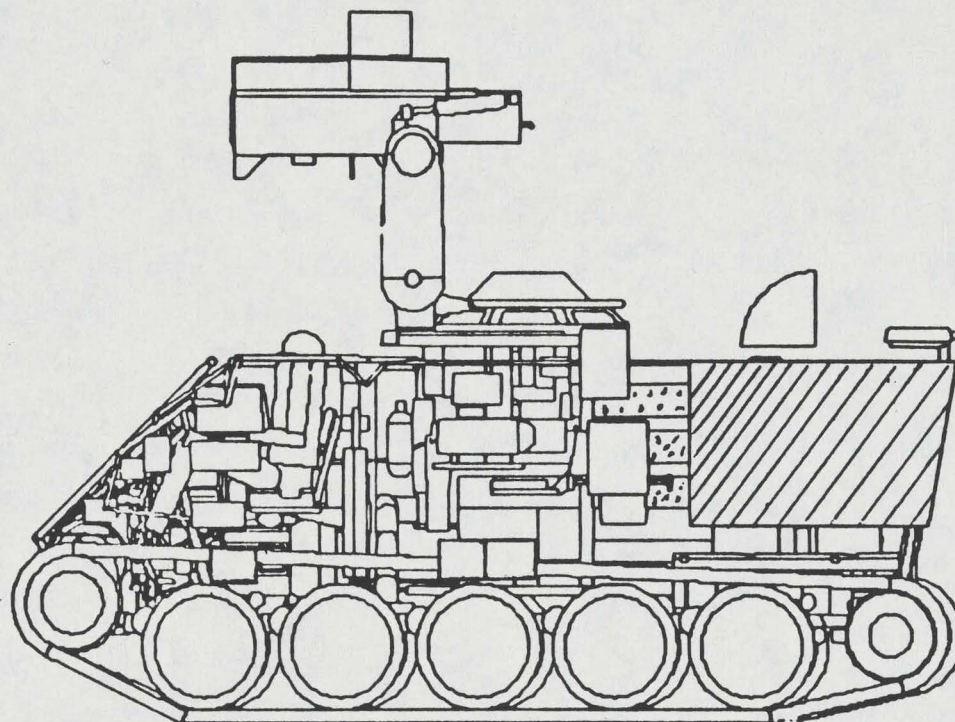
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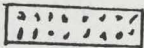
BMP-1 CREW POSITIONS



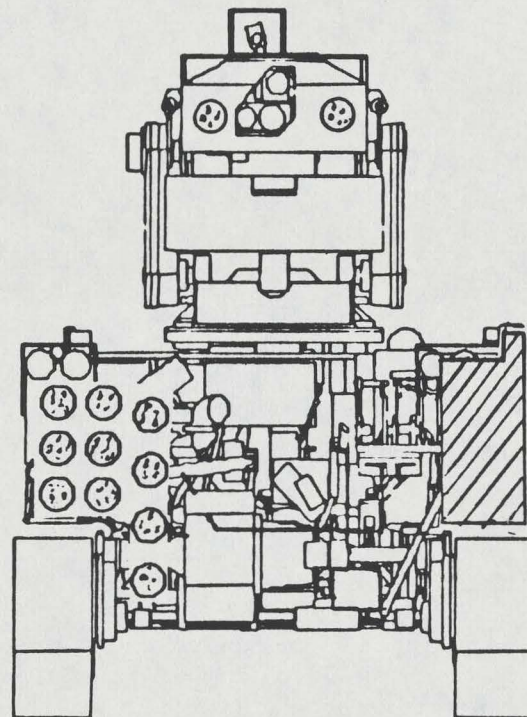
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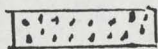
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AZIMUTH 90.0 ELEVATION .0

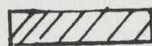
-  - Ammunition
 - Fuel

M901/ITV FUEL & AMMUNITION

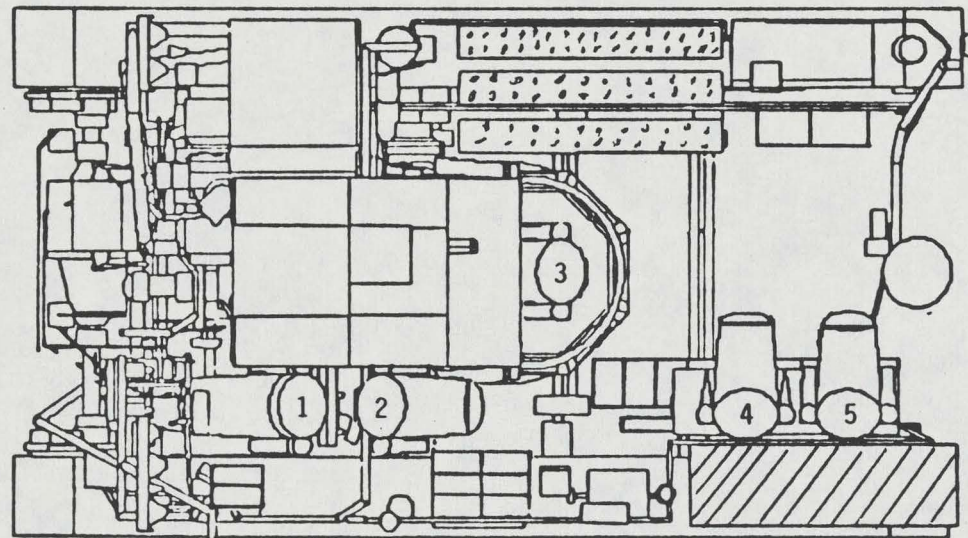


IMPROVED TOW VEHICLE XM901
AZIMUTH .0 ELEVATION .0

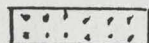
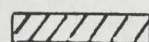
 - Ammunition

 - Fuel

M901/ITV FUEL & AMMUNITION CONFIGURATION



IMPROVED TOW VEHICLE XM901 INCHES SCHMOKE
 AZIMUTH 90.0 ELEVATION 90.0
 SCALE 0 35.00

-  - Ammunition
-  - Fuel

ANNEX B

SHOT BY SHOT SUMMARY OF

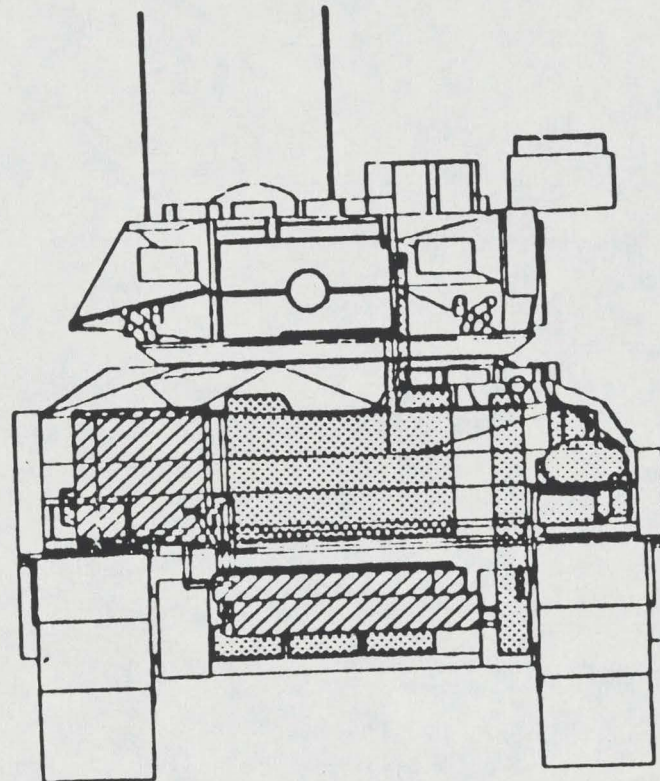
ALL M-3 FIRINGS

ANNEX C

SHOT BY SHOT SUMMARY OF
ALL BMP AND ITV SHOTS

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

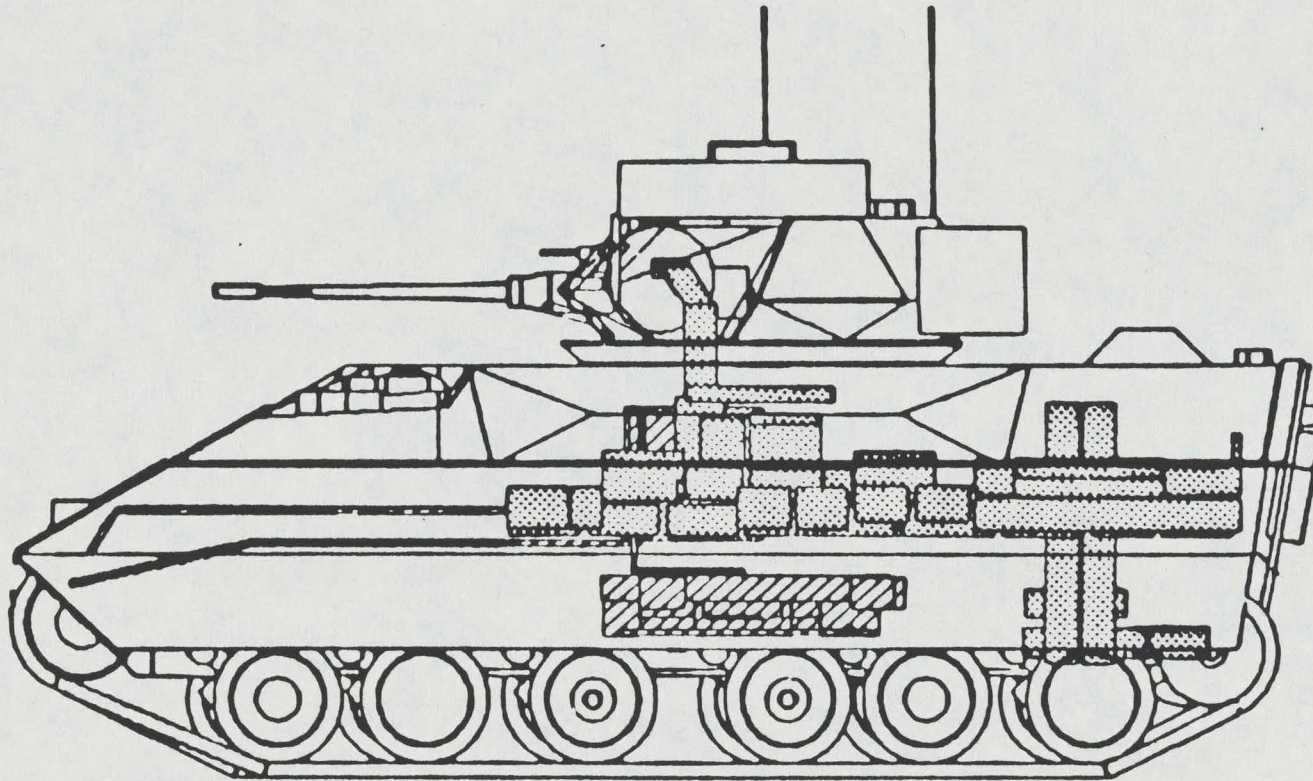
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KEY:  TOW/ DRAGON MISSILES
 AMMO
 DIESEL FUEL

CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

90° AZIMUTH
0° ELEVATION



KEY:

	TOW/ DRAGON MISSILES
	AMMO
	DIESEL FUEL

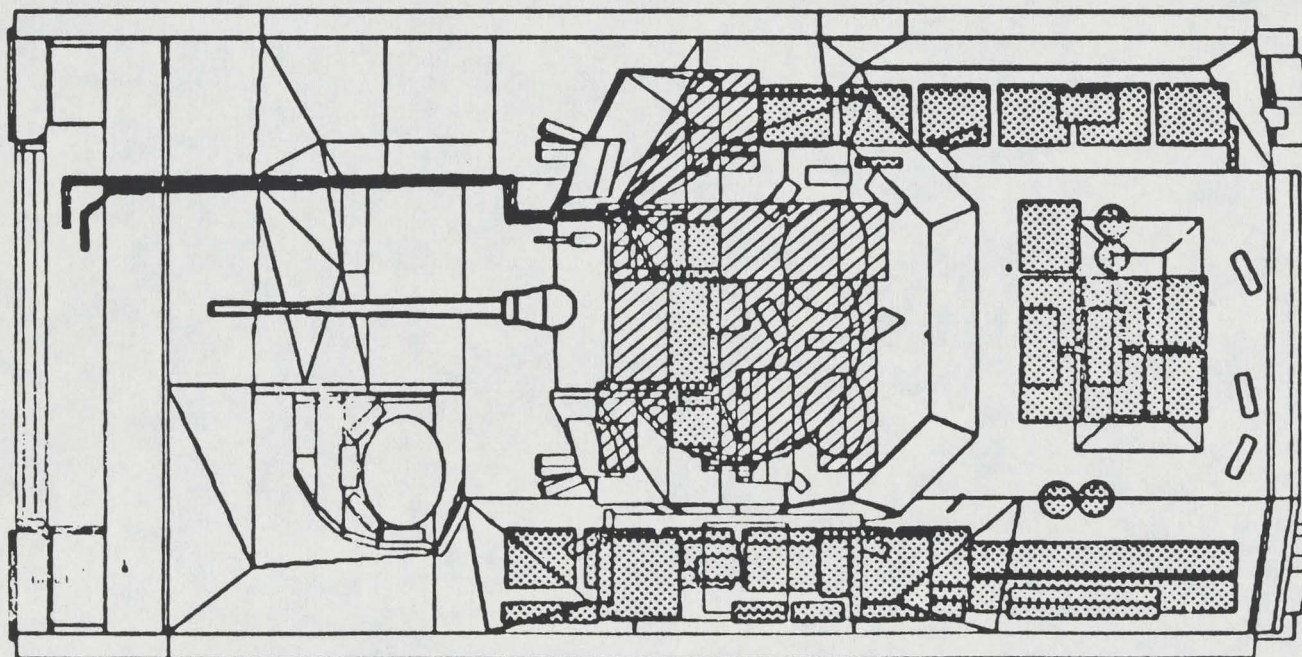
CONFIGURATION OF AMMUNITION IN THE BRADLEY M-2

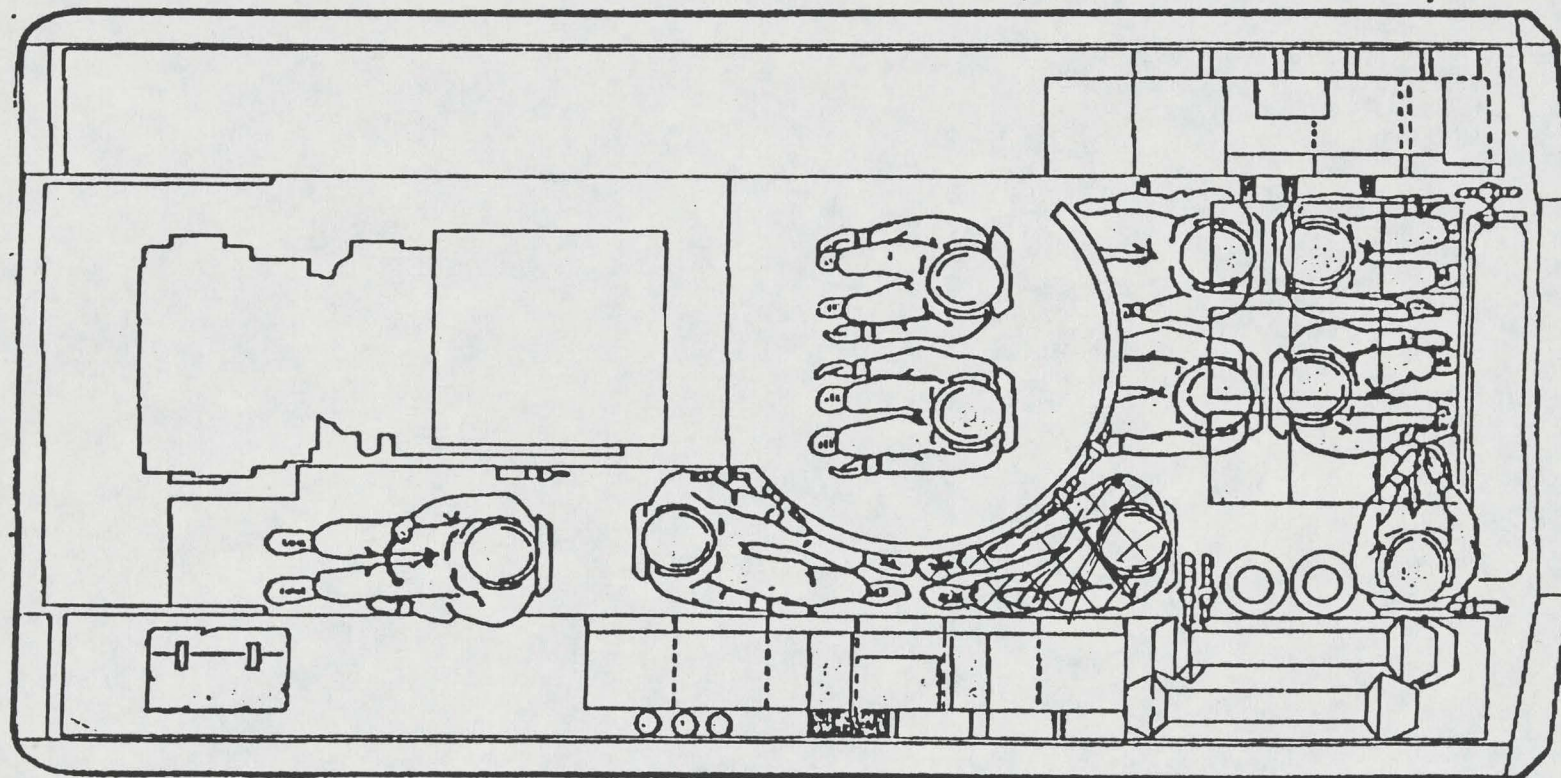
KEY:  TOW/ DRAGON MISSILES

 AMMO

 DIESEL FUEL

90° AZIMUTH
90° ELEVATION



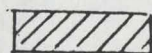
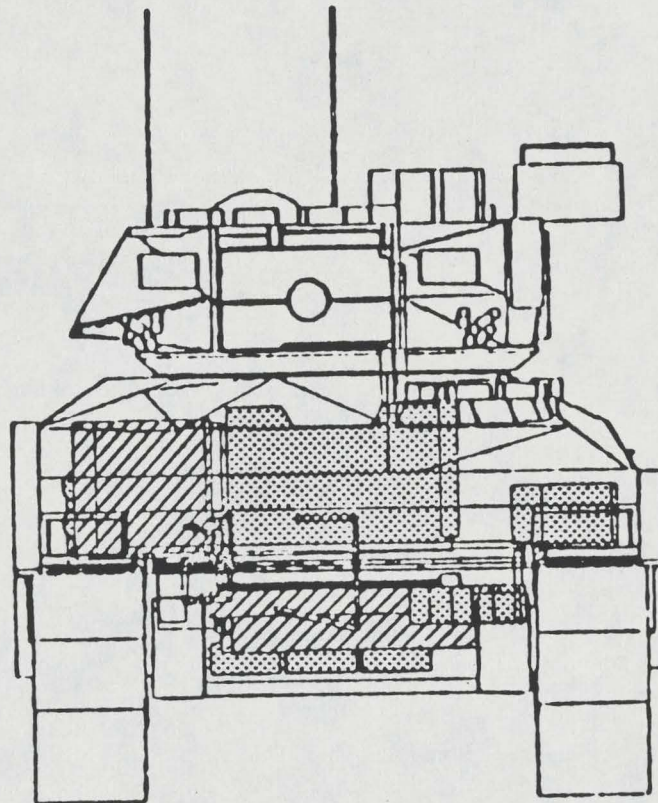


M2 VEHICLE ARRANGEMENT

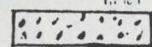
BRADLEY

FIGHTING VEHICLE SYSTEMS

M-3 FUEL & AMMUNITION CONFIGURATION

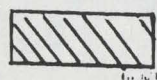
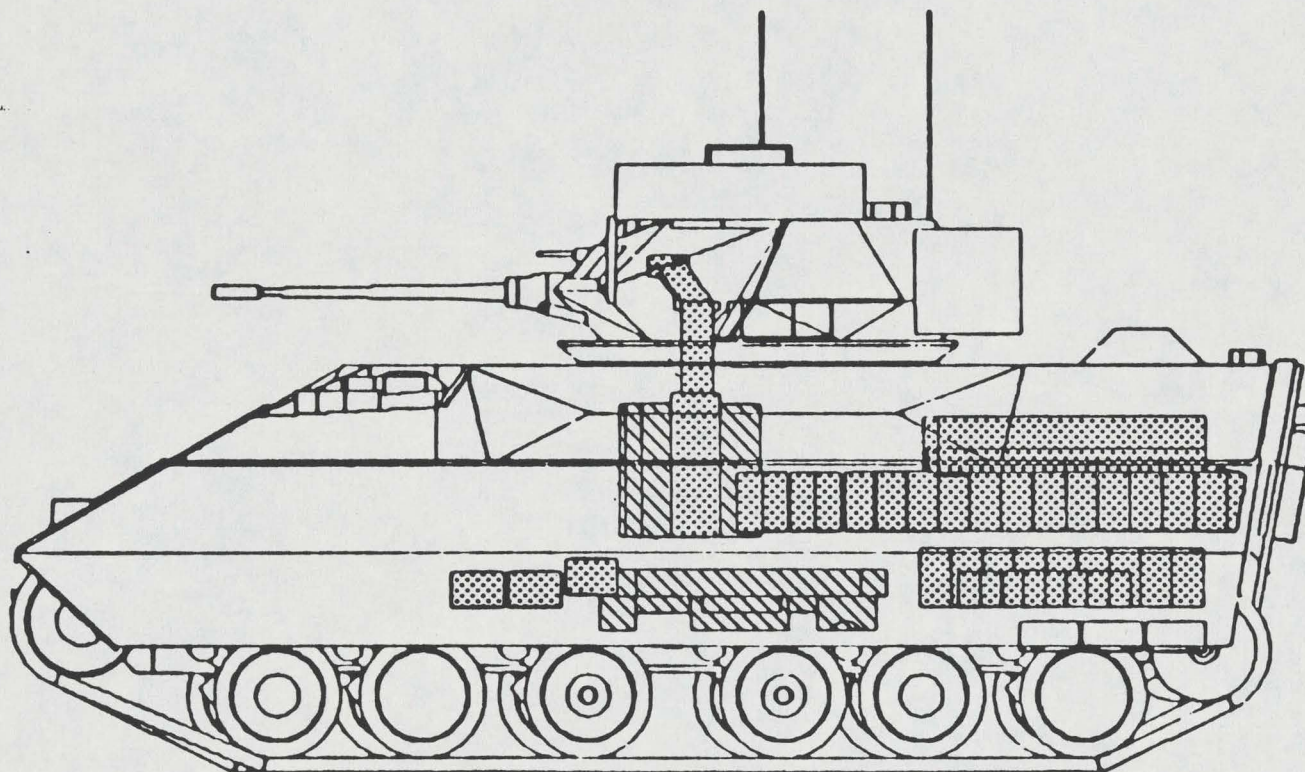


- Fuel

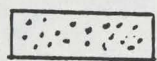


- Ammunition (25mm + TOW)

M-3 FUEL & AMMUNITION CONFIGURATION

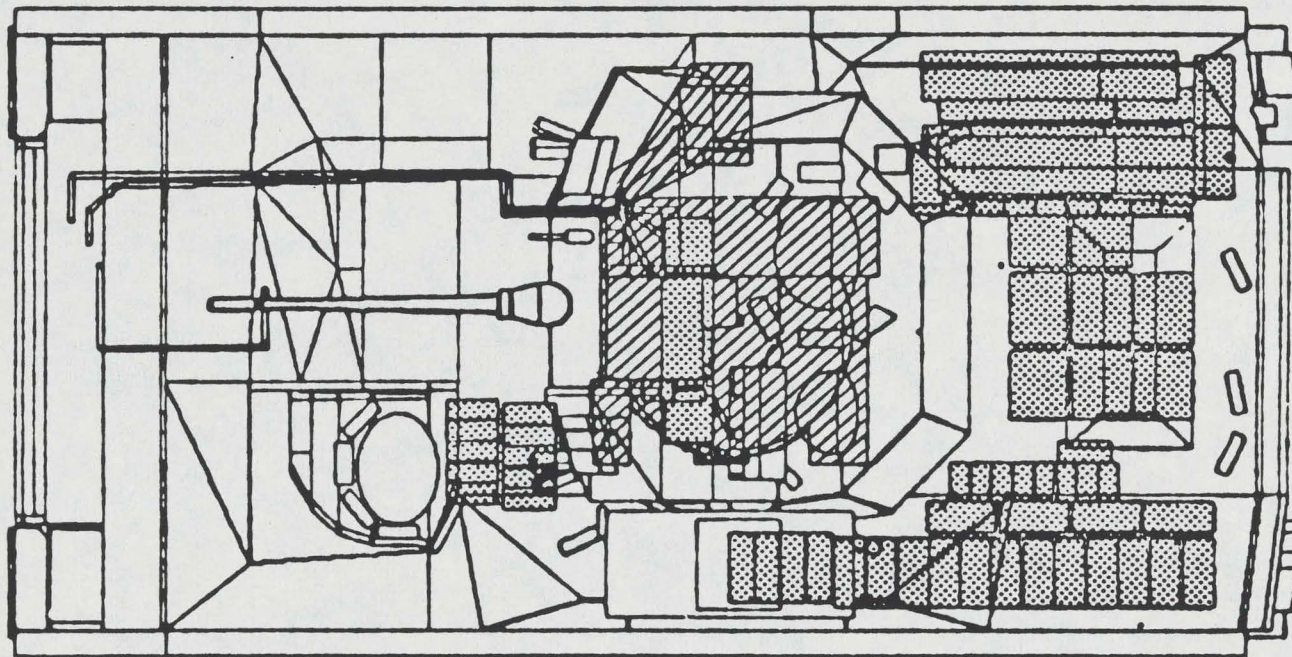


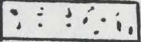
- Fuel



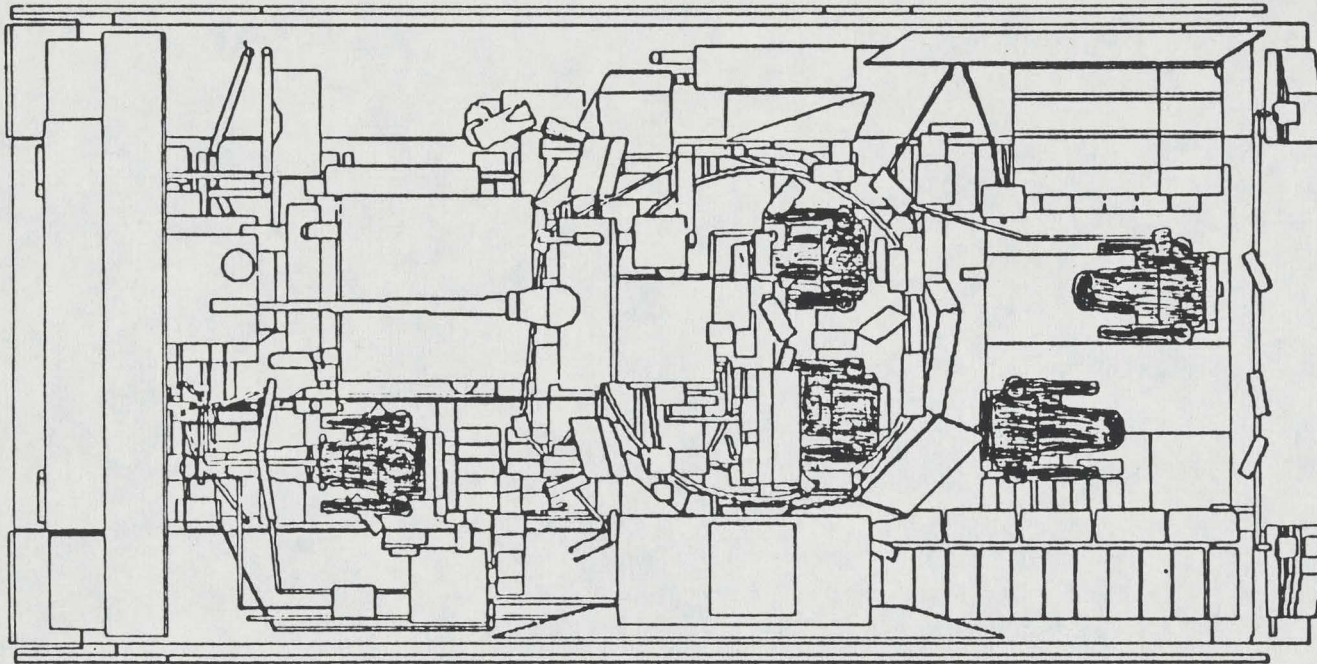
- Ammunition (25mm + TOW)

M-3 FUEL & AMMUNITION CONFIGURATION

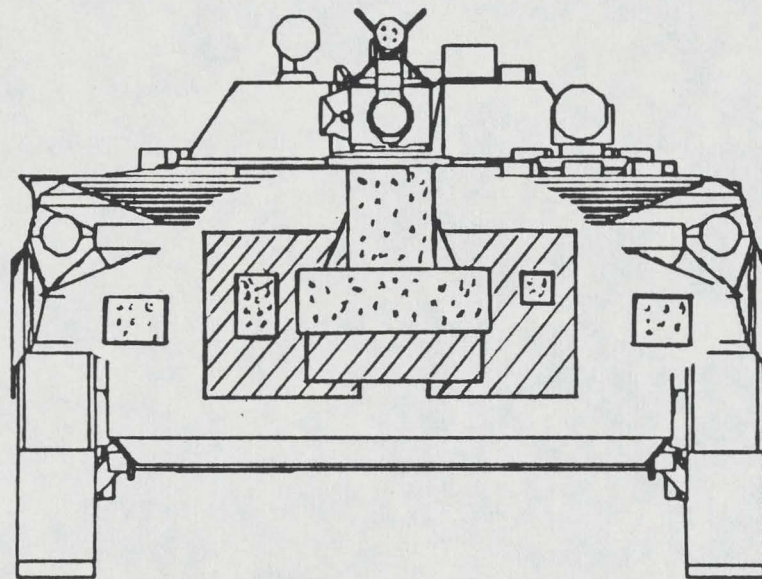


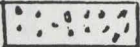
-  - Fuel
-  - Ammunition (25mm + TOW)

M-3 CREW POSITIONS

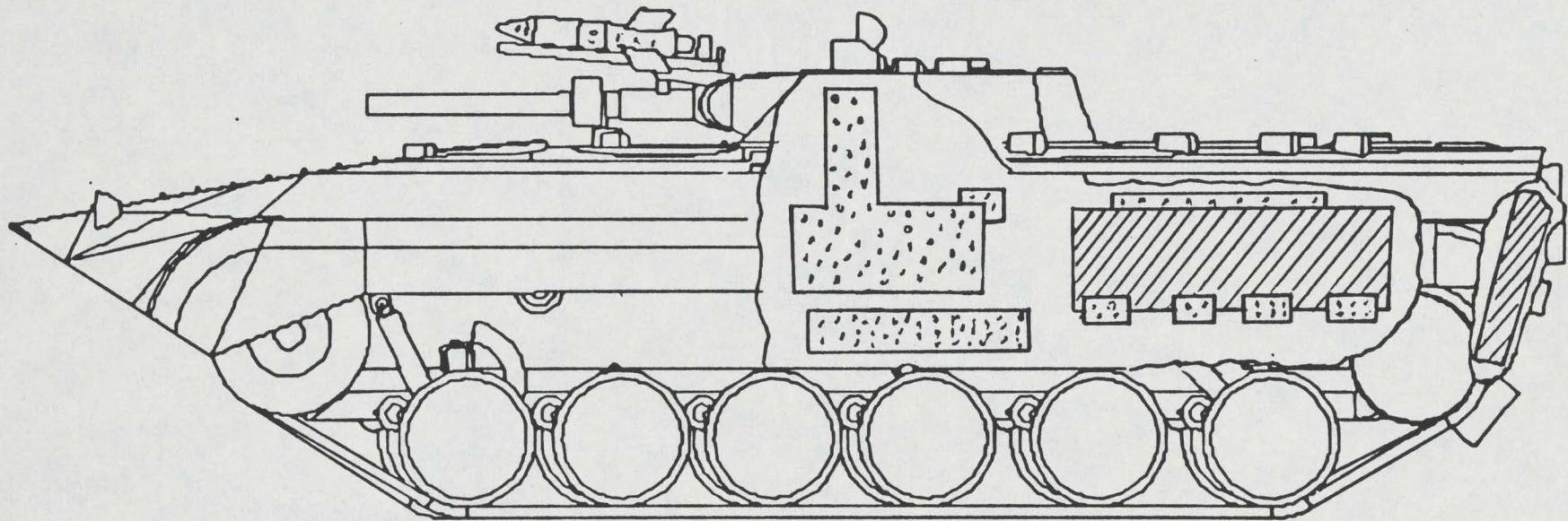


BMP-1



-  - Ammunition
-  - Fuel

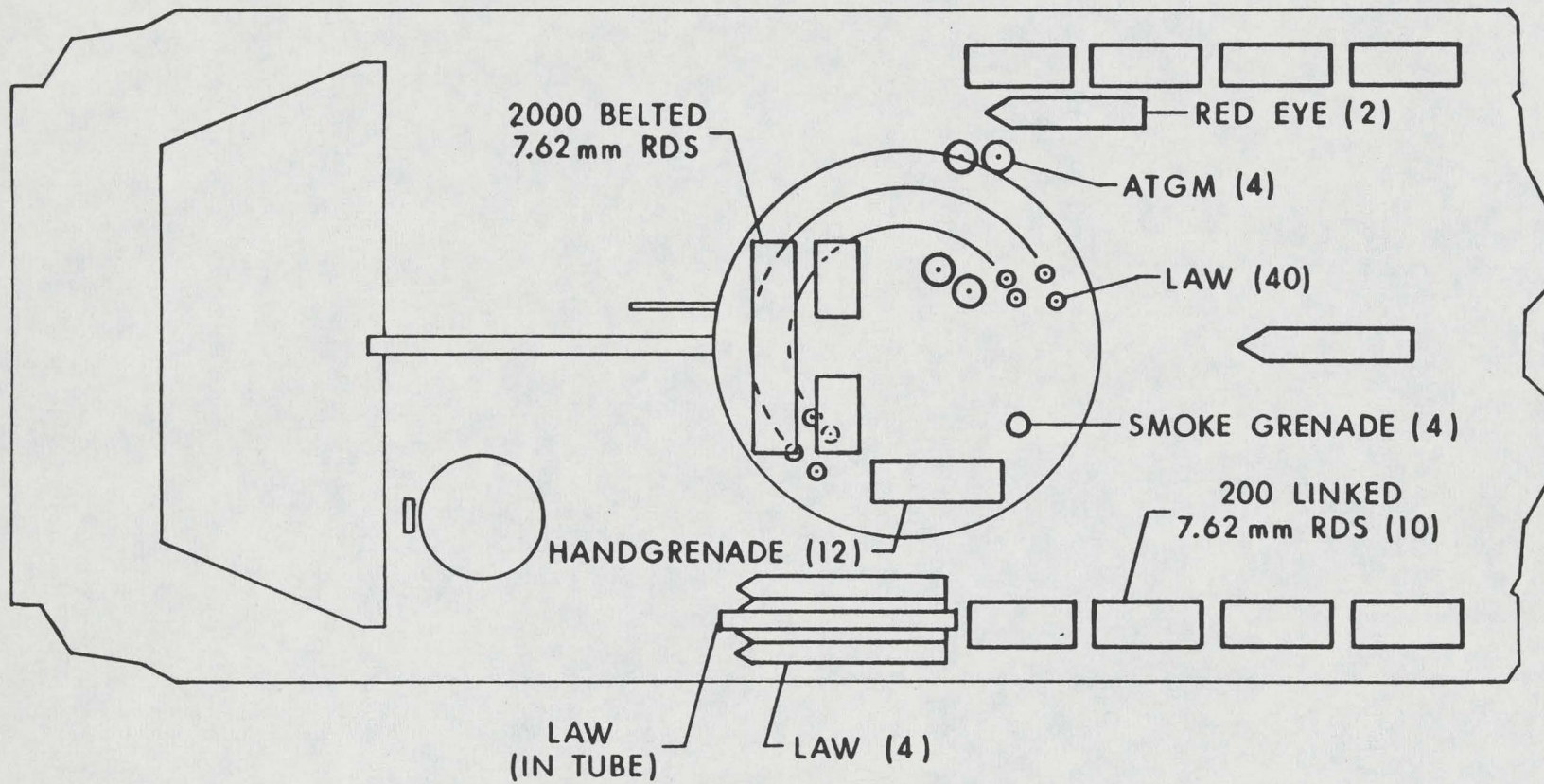
BMP-1



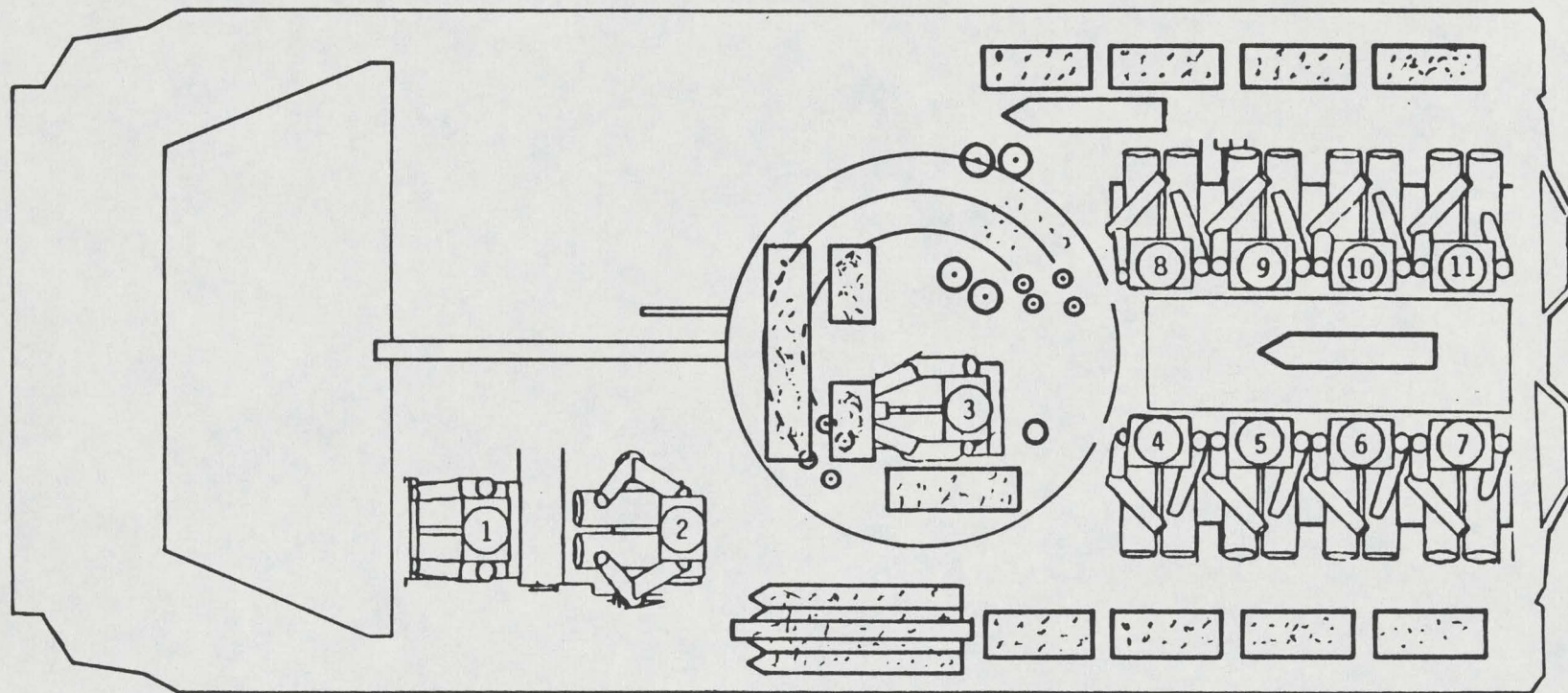
 - Ammunition

 - Fuel

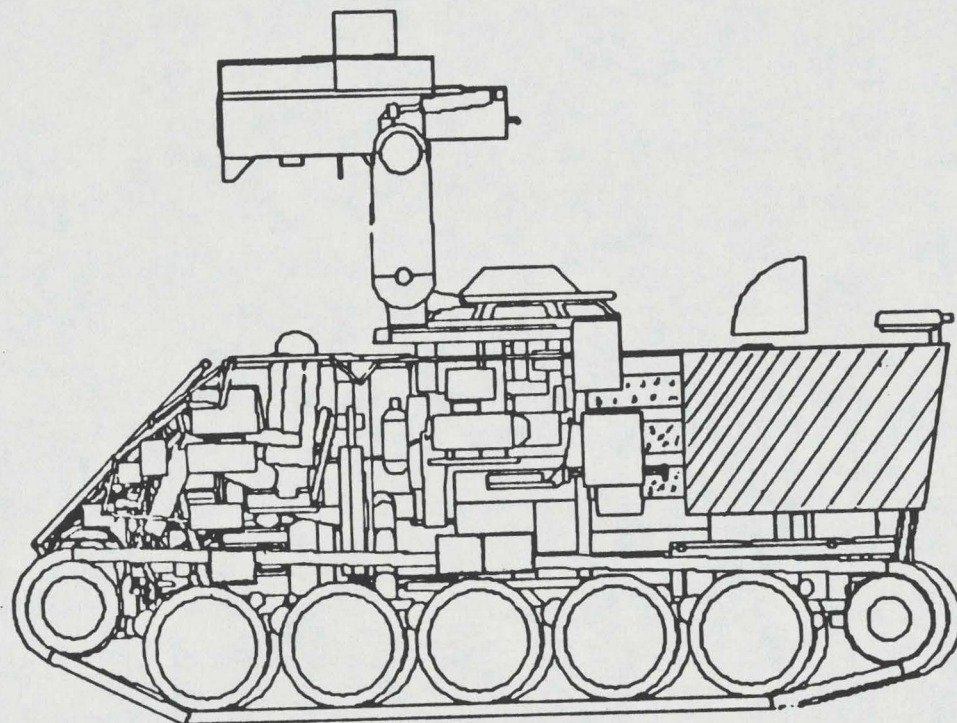
BMP-1



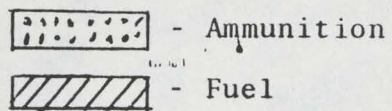
BMP-1 CREW POSITIONS



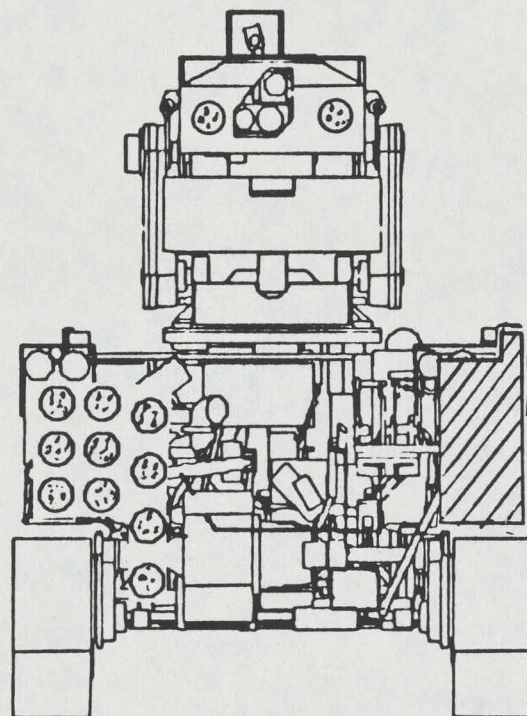
M901/ITV FUEL & AMMUNITION



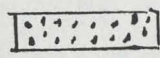
IMPROVED TOW VEHICLE XM901
AZIMUTH 90.0 ELEVATION .0



M901/ITV FUEL & AMMUNITION

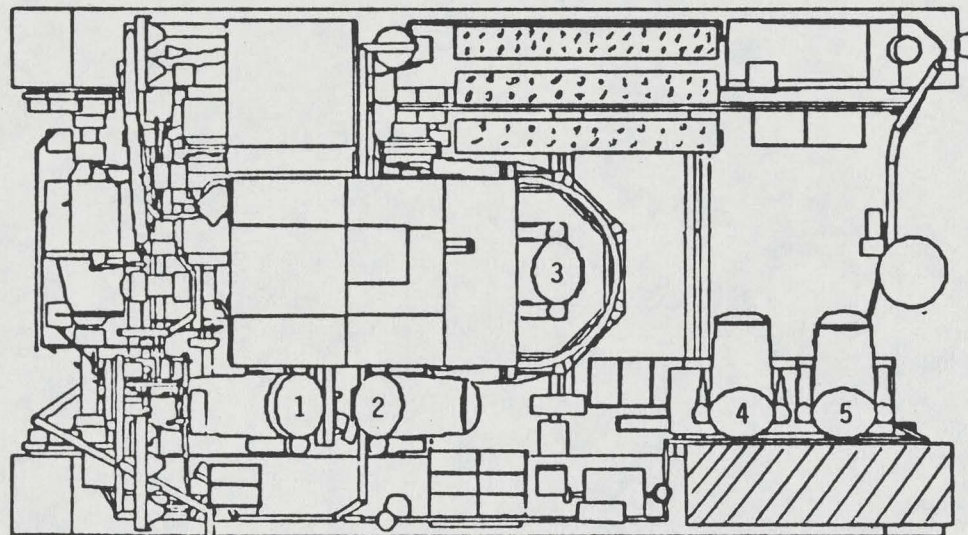


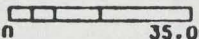
IMPROVED TOW VEHICLE XM901
AZIMUTH .0 ELEVATION .0

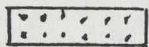
 - Ammunition

 - Fuel

M901/ITV FUEL & AMMUNITION CONFIGURATION



IMPROVED TOW VEHICLE XM901 INCHES SCHMOKE
 AZIMUTH 90.0 ELEVATION 90.0
 SCALE  35.00



- Ammunition



- Fuel

ANNEX B

SHOT BY SHOT SUMMARY OF

ALL M-3 FIRINGS

ANNEX C

SHOT BY SHOT SUMMARY OF
ALL BMP AND ITV SHOTS



OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

2 SEP 1983

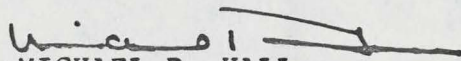
RESEARCH AND
ENGINEERING

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Joint Planning Committee Meeting - 2 September 1983

The Joint Planning Committee was briefed by Col Jim Burton OSD/DDTE on a proposal for a Joint Test involving live fire of munitions against full scale, operational targets. An assessment as to the need for the test as well as the feasibility of supporting a test for a start in 1986 is desired. Other recommendations such as an appropriate location for a test bed or alternate supporting agencies would be welcome. Comments from the JCS, Services, and OSD offices are requested by 19 September 1983.

A second meeting of the Joint Planning Committee is being planned for 11 October 1983 to discuss the results of the comments.


MICHAEL D. HALL
Brigadier General, USAF
Deputy Director Defense
Test and Evaluation

2 Attachments
Attendee List
Briefing Charts

DISTRIBUTION:
HQ DA ODCSOPS (DAMO-FDT) (LTC Sughrue)
JCS/J-3 (CAPT Lesesne)
JCS/J-3 (MAJ Heckman)
OTEA/CSTE-POJ (LTC Parsons)
OTEA/CSTE-POJ (Dr. Saputo)
CAC ATZL-TIE-J (Mr. Hauschild)
HQUSAF/XOORE (LTC Friebe)
AFOTEC/JT (MAJ Weninger)
AFOTEC/JT (COL Kindurys)
USDRE/AW (Mr. Hinman)
OTEA/CSTE-POC (LTC Kehres)
OPNAV 983 (LCDR Popek)
HQMCD RDD 28 (MAJ Patterson)

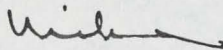
OFFICE OF THE UNDER SECRETARY OF DEFENSE
FOR RESEARCH AND ENGINEERING

Date 25 Nov 83

Memo for Admiral Linder

To date, Jim's contact with the JTCG on the live fire test has been informal; this memo would formalize our interest and allow development of a basic test concept for SAC review.

Request your concurrence on the Test Force concept prior to dispatch. We are looking at a limited staff under our test direction with the majority of the experts coming from the JTCG. I think that this approach is workable and appears more palatable to the Services who basically support the test but do not want to provide sufficient manpower.


MICHAEL D. HALL
Brigadier General, USAF
DDTA&LWS

Attachment

This looks good L

DDTA&LWS

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

25 NOV 1983

RESEARCH AND
ENGINEERING

MEMORANDUM FOR JOINT LOGISTICS COMMANDERS

SUBJECT: Joint Live Fire Test

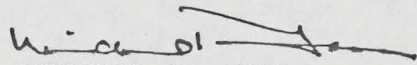
The Director of Defense Test and Evaluation (DDT&E) is currently considering a proposed Joint Live Fire Test for a FY 86 start. The test has as its objective the gathering of empirical data on the lethality of US weapons against Soviet systems and the vulnerability of US systems to Soviet weapons.

The proposed test has been formally nominated by DDT&E and presented, in conceptual form, to the Services for their comment and recommendations (atch 1). The Services' initial responses were generally favorable, however, more detailed information is needed in the areas of schedules and costs before a final decision can be made. The Services also suggested that the Joint Technical Coordinating Group (JTCG/AS and ME) be utilized for the planning, coordination, and execution of the test as much as possible in lieu of forming a separate, large Joint Test Force. This approach is acceptable to us, with appropriate caveats with regards to test plan approval and funding release, data rights, etc. This approach was used some 10 years ago when DDT&E sponsored essentially the same type of a test on what were then front line aircraft. If implemented, we would establish a Joint Test Director with a skeletal staff to interface with DDT&E and the JTCG. The details of this arrangement will be worked out later.

It is in this light that we solicit the Joint Logistics Commanders' support for this effort and request the JTCG's assistance in defining the proposed test in more detail so that a final decision can be made in the March 1984 time frame.

My staff has met informally on several occasions with the JTCG members over the past six months so the JTCG has a thorough understanding of the intent and approach desired. For this planning phase, we ask the JTCG to concentrate on the Antiarmor and Aircraft Phases with emphasis on front line equipment such as M1, M2/3, M-60, M-113, F-15, F-16, F/A-18, AV-8, AH-64, etc., and similarly, front line US and Soviet munitions.

Although the proposal is for a FY 86 start, the plans should be able to accommodate a FY 85 start on a limited scale if FY 85 funds become available. My staff is prepared to work closely with the JTCG during this planning phase.


MICHAEL D. HALL
Brigadier General, USAF
Deputy Director Defense
Test and Evaluation

Attachment



OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

RESEARCH AND
ENGINEERING
(DDTE)

22 MAR 1984

MEMORANDUM FOR CHAIRMAN OF THE JOINT CHIEFS OF STAFF
ASSISTANT SECRETARY OF DEFENSE (AE)
ASSISTANT SECRETARY OF THE ARMY (RD&A)
ASSISTANT SECRETARY OF THE NAVY (RE&S)
ASSISTANT SECRETARY OF THE AIR FORCE (RD&L)
DEPUTY UNDER SECRETARY OF DEFENSE (C3I) (OUSDRE)
DEPUTY UNDER SECRETARY OF DEFENSE (TWP) (OUSDRE)
DEPUTY DIRECTOR GENERAL PURPOSE PROGRAMS (OSD/PA&E)

SUBJECT: Senior Advisory Council (SAC) - 20 March 1984

I would like to thank the members of the SAC for their assistance in the recent review of the four programs nominated for new starts in FY 85 and FY 86. Your comments and analysis were extremely beneficial in the selection of the new programs. As I mentioned in my opening remarks at the meeting, the DDT&E current budget allows one new program to be initiated each year. In view of the support evidenced at the SAC, I intend to charter the Joint Chemical Warfare test (JCHEM) as the FY 85 new start and the Joint Live Fire test as an FY 86 start. Some funds are available in FY 84 to support both programs at a nominal level until their budget lines are established in FY 85 and FY 86.

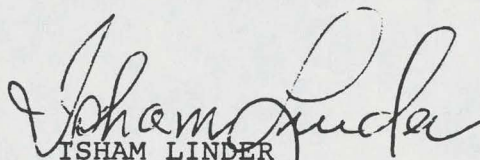
The Army will continue as the lead Service for the JCHEM test and provide the necessary manning and support as requested by the JCHEM Joint Test Director (JTD) and as specified in the Joint Test and Evaluation Procedures manual. The Air Force will appoint an O-6 deputy test director and provide other staffing as agreed upon with the JTD. The Navy and Marine Corps will each provide one officer with operations or flight experience (O-4 or O-5) to the test force.

The Joint Live Fire test will be conducted by DDT&E using the Joint Technical Coordinating Group under the Joint Logistics Commanders as the management structure to plan, coordinate and execute the tests. No unique service support will be required.

The Target Engagement Using Laser Designators (TELAD) program will be completed in June 1984 when the report on the CENTCOM exercise in which it is participating is finished. The Air-to-Air Missile Concept (AAMC) Joint Test Director will

complete his feasibility assessment by June 1984. Any subsequent action on the program should take the form of a new nomination from interested agencies.

I appreciate the very professional manner in which the provisional Joint Test Directors and the Services developed their programs and the briefings. I would appreciate receiving the nominations for JCHEMA billets by 20 April 1984. Colonel Morgan Jellett, USA, x57245, may be contacted for any further information.


ISHAM LINDER
Director Defense
Test and Evaluation

CC:

AAMC JTD

JCHEM JTD

TELAD JTD

Joint Live Fire





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WASHINGTON, D.C. 20301

26 MAR 1984

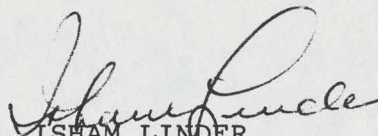
RESEARCH AND
ENGINEERING
(DDTE)

MEMORANDUM FOR COLONEL BURTON

SUBJECT: Presentation to Senior Advisory Council (SAC)

I wish to express my thanks to you and those who worked with you for the outstanding briefing to the SAC on 20 March 1984. The concurrence by the attendees in your program is indicative of the need for the program and your thorough preparation.

Keep up the great work.


ISHAM LINDER
Director Defense
Test and Evaluation



OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

RESEARCH AND
ENGINEERING
(DDTE)

27 MAR 1984

MEMORANDUM FOR DIRECTOR, JOINT STAFF (OJCS)
ASSISTANT SECRETARY OF THE ARMY (RD&A)
ASSISTANT SECRETARY OF THE NAVY (RE&S)
ASSISTANT SECRETARY OF THE AIR FORCE (RD&L)
JOINT LOGISTICS COMMANDERS

SUBJECT: Joint Live Fire Test Charter

Based on the unanimous recommendation of the Senior Advisory Council, the Director Defense Test and Evaluation is proceeding with the Joint Live Fire Test as briefed at the 20 March 1984 Joint Test Review meeting. It is requested that the two teams representing the Joint Technical Coordinating Committee for Aircraft Survivability and for Munitions Effectiveness, which provided the initial joint test planning data, continue their efforts into the detailed joint test planning phase. It is anticipated that the Joint Live Fire Test can begin in FY 85 at a modest level and that there will be a need to build up to a more vigorous Joint Live Fire Test program in FY 86.

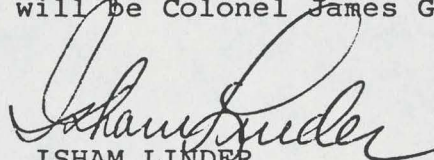
The priority test objective of the aircraft survivability component of the Joint Live Fire Test is the assessment of the survivability of first line air-to-ground attack aircraft. Specific aircraft to be tested include the F-16, F-15, A-6, AV-8B, AH-64, UH-60, MIG-23, and MI-24 (HIND) with the initial emphasis placed on fuel and propulsion subsystems, including fuel injection effects. The total funding for the aircraft survivability component of the Joint Live Fire Test is not expected to exceed \$25M over a 3 to 4 year period.

The priority test objective for the anti-armor component of the Joint Live Fire Test is the quantification of the lethality of major caliber anti-armor munitions against first line armored vehicles. The armored vehicles of interest include the T-62, M-60A3, T-72, and M-1 tanks; the M-2 (or M-3) and BMP fighting vehicles; and the USMC Light Armored Vehicle. In addition, this phase of the joint test will include a review of armored vehicle damage assessments and evaluation criteria based on a series of functional tests. The Joint Live Fire test funding for the anti-armor component of the Joint Test is not expected to exceed \$15M over a 3 to 4 year period.

Detailed test plans for the Joint Live Fire Test that could be initiated in FY 85 should be submitted to the Director Defense Test and Evaluation prior to the end of September 1984 for approval of funding within the resources available. It is recognized that these initial joint test proposals must be constrained by the availability of suitable test articles and a modest level of FY 85 funds. The Joint Technical Coordination Group (JTCG) Joint Live Fire (JLF) test teams for Aircraft Survivability and Munitions Effectiveness will arrange to conduct the tests after approval by DDT&E of each major phase of the test design; manage DDT&E funds made available for conduct of tests; coordinate any transfer of funds to participating Services; and provide financial status reports to DDT&E. The two JTCG test teams should indicate at the earliest opportunity the munitions and test articles (i.e., armored vehicles, aircraft, or major system components) required to conduct the planned tests and assist in establishing appropriate Service priorities for these test articles.

The two JTCG Joint Live Fire test teams are authorized to establish direct communication with agencies required to support the tests through their Service points of contact, and to task appropriate Service and DoD agencies identified by the respective Service/Command authorities to support the tests. The two JTCG test teams will deal directly with DDT&E on matters related to DDT&E funding, test policy, and program direction. Each of the two Joint Live Fire Test teams should be prepared to report quarterly to DDT&E on funding status, test plans, and progress to date; or as required to initiate each new phase of the live fire test. The scope and objectives of the Joint Live Fire Test have been defined in terms of general guidelines and detailed test planning should remain flexible to take advantage of interim test results. Reporting of formalized test results and recommendations based on test results should be to the Services and DDT&E in parallel. Direct communication for informational purposes between the Joint Live Fire test teams and all elements participating in or associated with the test is authorized and encouraged.

The program manager and point of contact for the Joint Live Fire test, from my office, will be Colonel James G. Burton.



ISHAM LINDER
Director Defense
Test and Evaluation