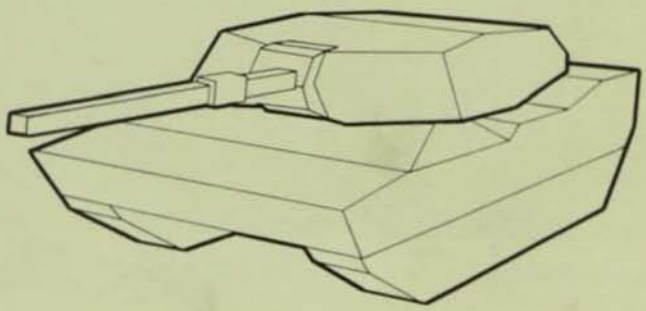
SIMNET M-1



SIMNET M-1 CREW MANUAL

DARPA

TABLE OF CONTENTS

INTRODUCTION

The SIMNET M1 combat simulator does not contain all the functions and controls found in the M1 tank. Rather, the SIMNET M1 contains only those functions and controls needed to fight.

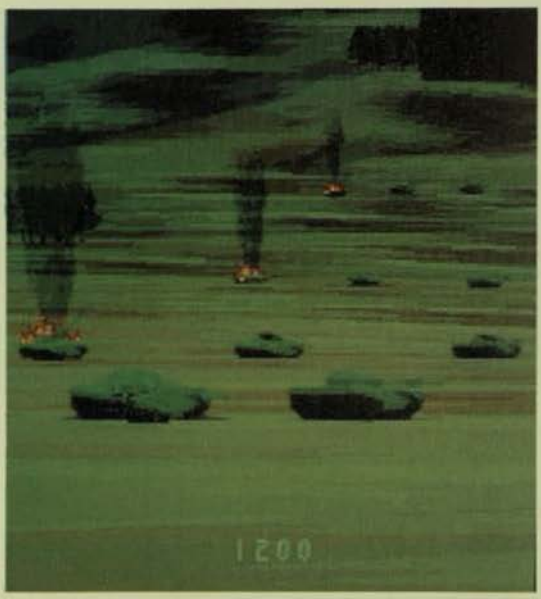
This manual provides crews with an understanding of the SIMNET M1 and describes those functions and controls that have been modified from the M1 tank and those which are unique to the SIMNET M1.

1 The SIMNET World

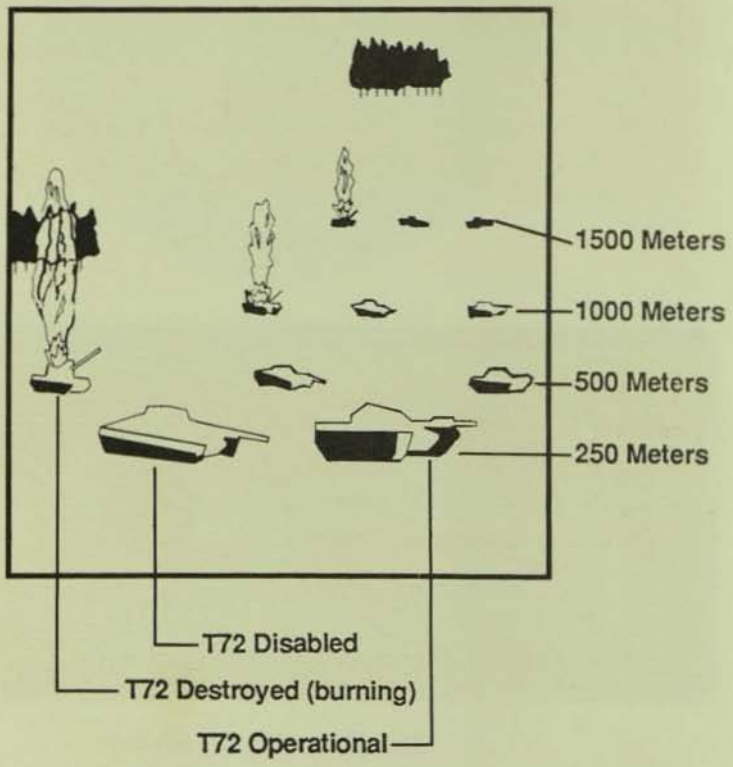
The SIMNET M1 and its crew live in a world created by a computer. In this world you will find hills, trees, buildings, roads, streams, power lines, tanks, APCs, trucks, howitzers, mortars, command posts, etc. You will also find other crews in their combat vehicles, both friendly and enemy. You will interact with these just like the M1 tank and its crew does in the real world. For example, if you ram a big tree with your gun tube you may break the turret traversing gear, or if you drive into an unfordable stream you will get your vehicle stuck. If you get hit by fire, you may be disabled or killed. If you shoot another target, it will suffer damage or be knocked out. You will see and hear the explosions of nearby direct and indirect fire, and bombs dropped by aircraft.

The illustrations on the facing pages show the vision envelopes from a SIMNET M1 maneuvering in the SIMNET world with other friendly and enemy combat simulators.

Pay particular attention to the pictures of disabled tanks. They are immobilized (due to lack of fuel, thrown track, reparable damage, etc.) but can still carry out limited operations (fuel and ammunition loading, turret traversal, enemy engagement, etc.). Destroyed tanks have suffered catastrophic, irreparable damage and are permanently out of action.

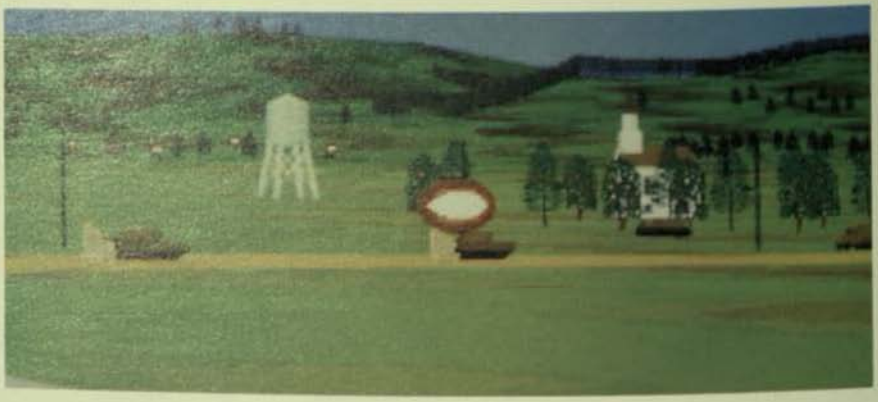


Range vs. Visibility



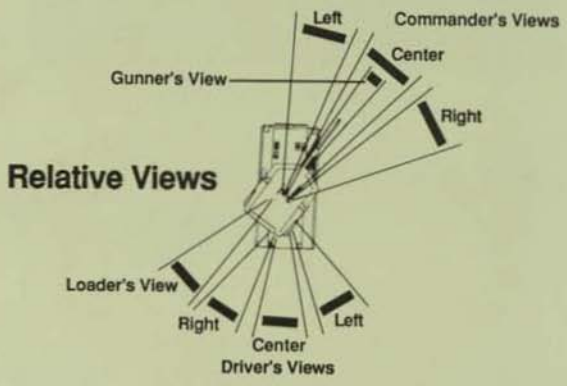
Commander's View - Right

Loader's View



Driver's View - Right

Commander's View - Left



Driver's View - Left

Commander's View - Center

Gunner's View - 10x

Driver's View - Center

2 SIMNET M1 Systems

SIMNET M1 systems and hardware create the SIMNET battleground.

Visual System

The visual system contains an eight-channel computer image generator. Each channel provides a view out to 3500 meters. The rotation of components (turret, cupola, etc.) of the vision system mimics views from the M1 tank and allows the SIMNET M1 crew to rapidly search for targets and terrain features, and to maintain tactical formation while moving.

- **Commander** Three 1 power vision blocks mounted in a rotatable cupola.
  The Commander's GPS Extension is a repeater (identical view) of the Gunner's GPS channel.
- **Gunner** GPS channel with two selectable magnifications: 3 power and 10 power
- **Loader** One manually rotatable 1 power vision block.
- **Driver** Three 1 power vision blocks.

Sound System

The SIMNET M1 recreates realistic battlefield and M1 sounds, including:

- Vehicle sounds - For example: engine whine, track movement, and the ammo doors opening and closing
- Weapons fire - Direct, indirect, aerial, and own weapons firing
- Impacting rounds

Crew Seating System

Crew seats in the SIMNET M1 are equipped with a "rumbler" which creates vibration and sounds that are appropriate to tank speeds, soft soil or hard surface roads, steering and gear changes. The commander's seat is adjustable in height but does not flip up to provide a commander's stand nor does the loader's seat fold out of the way.

Weapons System

The SIMNET M1 is armed with the 105 MM main gun only and is capable of firing HEAT and SABOT rounds. This gun is boresighted and zeroed. The gun and fire control system (laser range finder and GPS) are stabilized. The stab system is adjusted to the null point and drift control knobs are not provided.

The cant sensor, wind sensor, and ballistics computer are always operational.

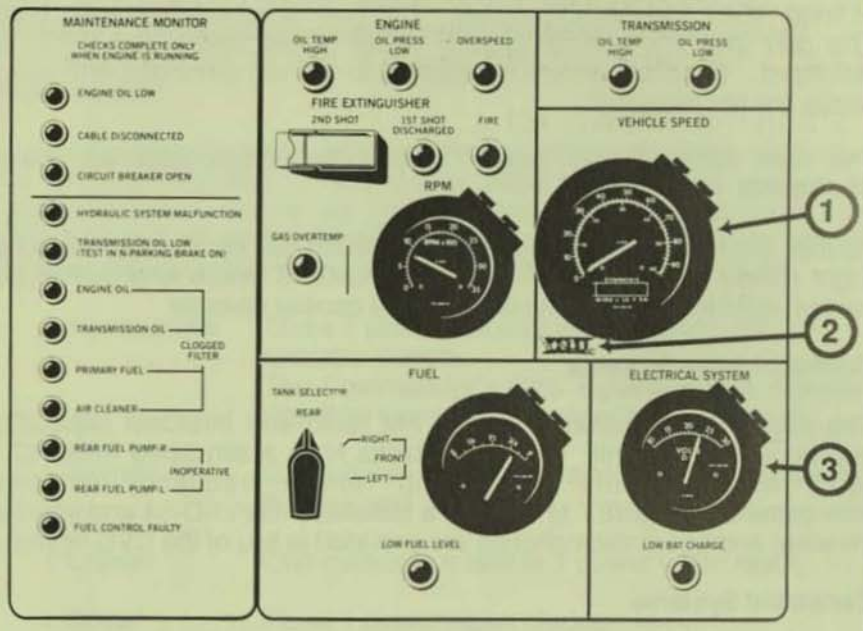
Neither the Muzzle Reference System (MRS) nor the Gunner's Auxiliary Sight (GAS) are provided. However, the GAS reticle is provided as a backup sight in the event the GPS suffers combat damage.

Communication Systems

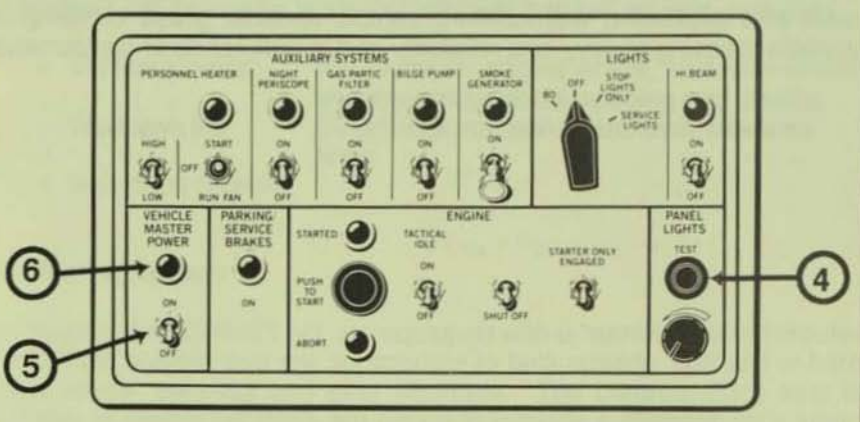
The SIMNET M1 includes normal FM radio and intercom capabilities appropriate to the unit. Command tanks have a simulated AN/GRC 12 radio which permits preset and remote frequency selection. Non-command SIMNET M1's have a simulated AN/VRC-64 and intercom. Headset and boom microphones are provided in lieu of the CVC helmet.

Constraint Systems

The SIMNET M1 has a number of systems that logistically or operationally limit the vehicle in much the same way that real-world conditions limit the M1 tank. These systems take into account such factors as M1 armor protection limitations, fuel capacity and consumption, basic ammunition loads and expended ammunition, vehicle speeds, grade climbing and obstacle crossing ability, and reliability and maintenance of components.



Driver's Instrument Panel (Left)



Driver's Master Panel (Right)

3 How to Fight the SIMNET M1

This section describes those features of the SIMNET M1 which differ from the M1 tank. Unless noted here, routine crew procedures to operate the SIMNET M1 should be performed exactly as they are in the M1 tank.

Starting the SIMNET M1

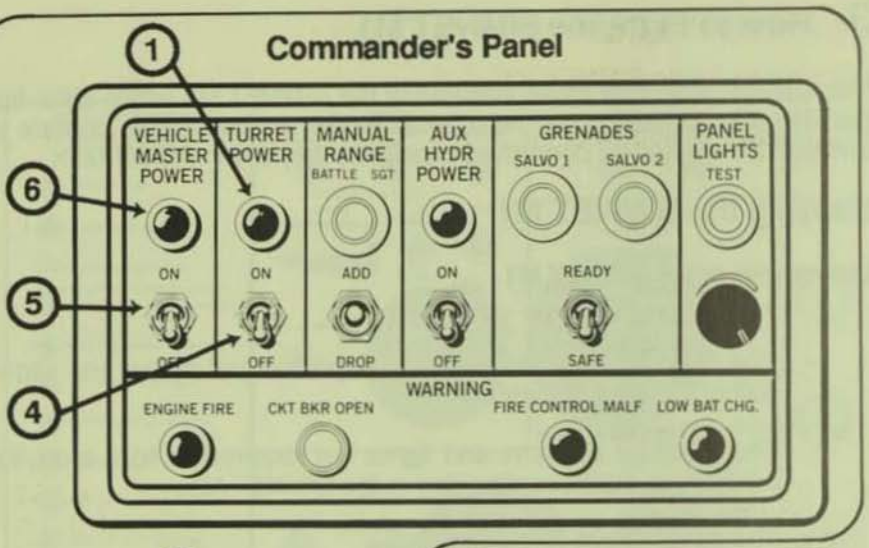
Differences in the SIMNET M1

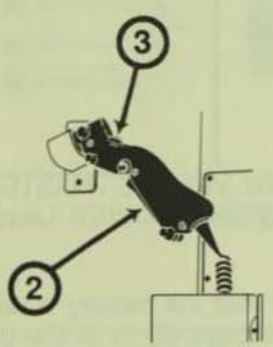
- The SIMNET M1 odometer (2) is placed just below and slightly left of the speedometer (1).
- The auxiliary systems and lights not required to fight a daylight battle have not been provided in the SIMNET M1.
- The driver's seat is not adjustable.

How to Start

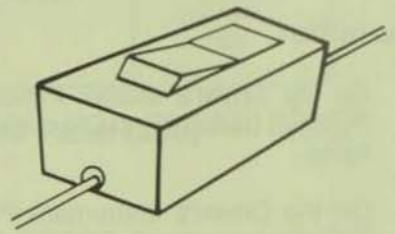
1. On the Driver's Master Panel, position the VEHICLE MASTER POWER Switch (5) to ON. VEHICLE MASTER POWER Lamp (6) lights.
2. On the Driver's Instrument Panel, verify that the battery condition indicated on the ELECTRICAL SYSTEM gage (3) is in the green zone.
3. On the Driver's Master Panel, press the PANEL LIGHTS TEST button (4) and check that all warning, caution, and panel lamps light. If all lamps do not light, notify the SIMNET Site Manager or his representative.
4. Start the SIMNET M1 as you would the M1 tank.

Commander's Panel



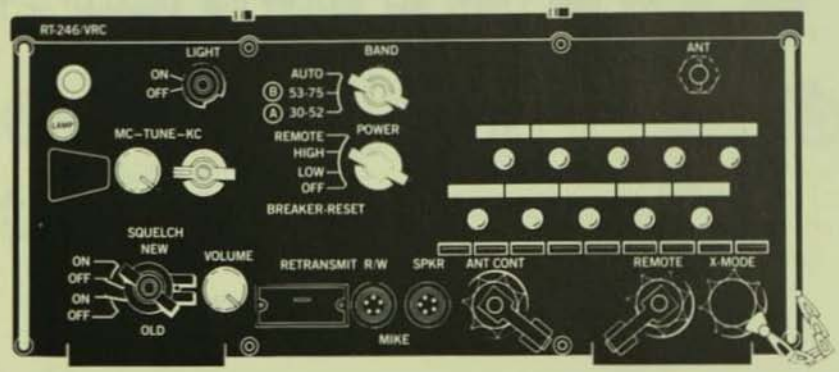


CWS Power Handle



Helmet Switch

Command Vehicle Radio



Operating the Commander's Cupola

Differences in the SIMNET M1

- Cupola (vision block) movement is limited to 150 degrees right and left of center.
- Full power rotation of the cupola from stop to stop takes 8 seconds.
- The .50 Cal manual elevation disk and trigger and the Commander's Weapon Station (CWS) sight have been omitted since there is no .50 Caliber secondary armament system on the SIMNET M1.

Operating the Cupola

1. On the Commander's Panel, position the VEHICLE MASTER POWER Switch (5) to ON. VEHICLE MASTER POWER lamp (6) will light.
2. Position the TURRET POWER Switch (4) to ON. TURRET POWER lamp (1) will light.
3. Grasp the CWS Power Control Handle, depress the palm switch (2), and move the red thumb switch (3) right or left as desired. Release the red thumb switch to stop cupola (vision block) rotation.

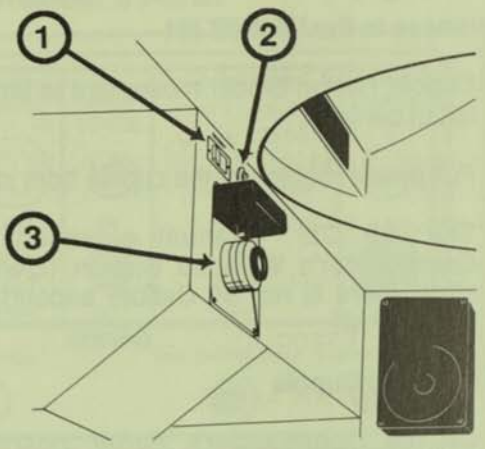
Using SIMNET M1 Radios

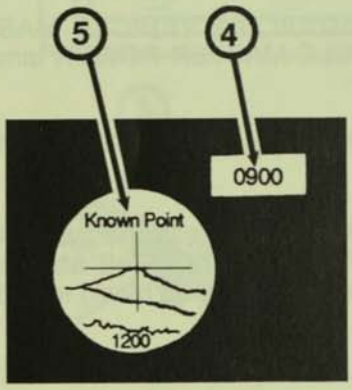
Differences in the SIMNET M1

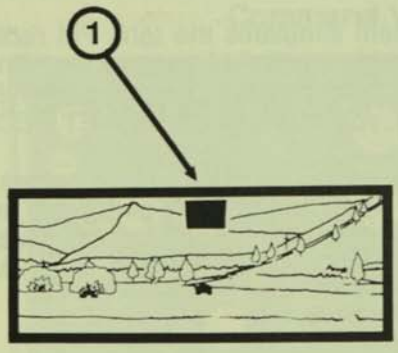
The SIMNET M1 radio/intercom system simulates the tank FM radios with a 40 channel radio. The 40 channels are like 40 frequencies. They are selected and pre-set as on the M1 tank. However, since the SIMNET M1 has only whole frequency selection, you must use the SIMNET CEOI.

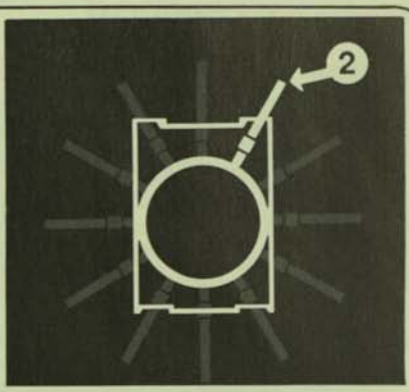
In addition, the crew are provided with rocker switches, on the cables of their headsets, which enable them to listen and transmit over radio and intercom. While these switches work just like the push-to-talk switch located on the left side of the CVC helmet used by the crew in the M1 tank, they are not physically the same.

GPSE Panel









Turret-to-Hull
Reference Display

Determining Grid Azimuth in the SIMNET M1

Differences in the SIMNET M1

The SIMNET M1 allows the commander to determine the grid azimuth on which his main gun is laying. A Grid AZ Button (2) is located to the right of the commander's push-to-talk intercom switch (1) on the GPSE Panel. This capability is needed to:

- Obtain an observer-target azimuth when calling for fire.
- Perform intersection and resection during mounted navigation.

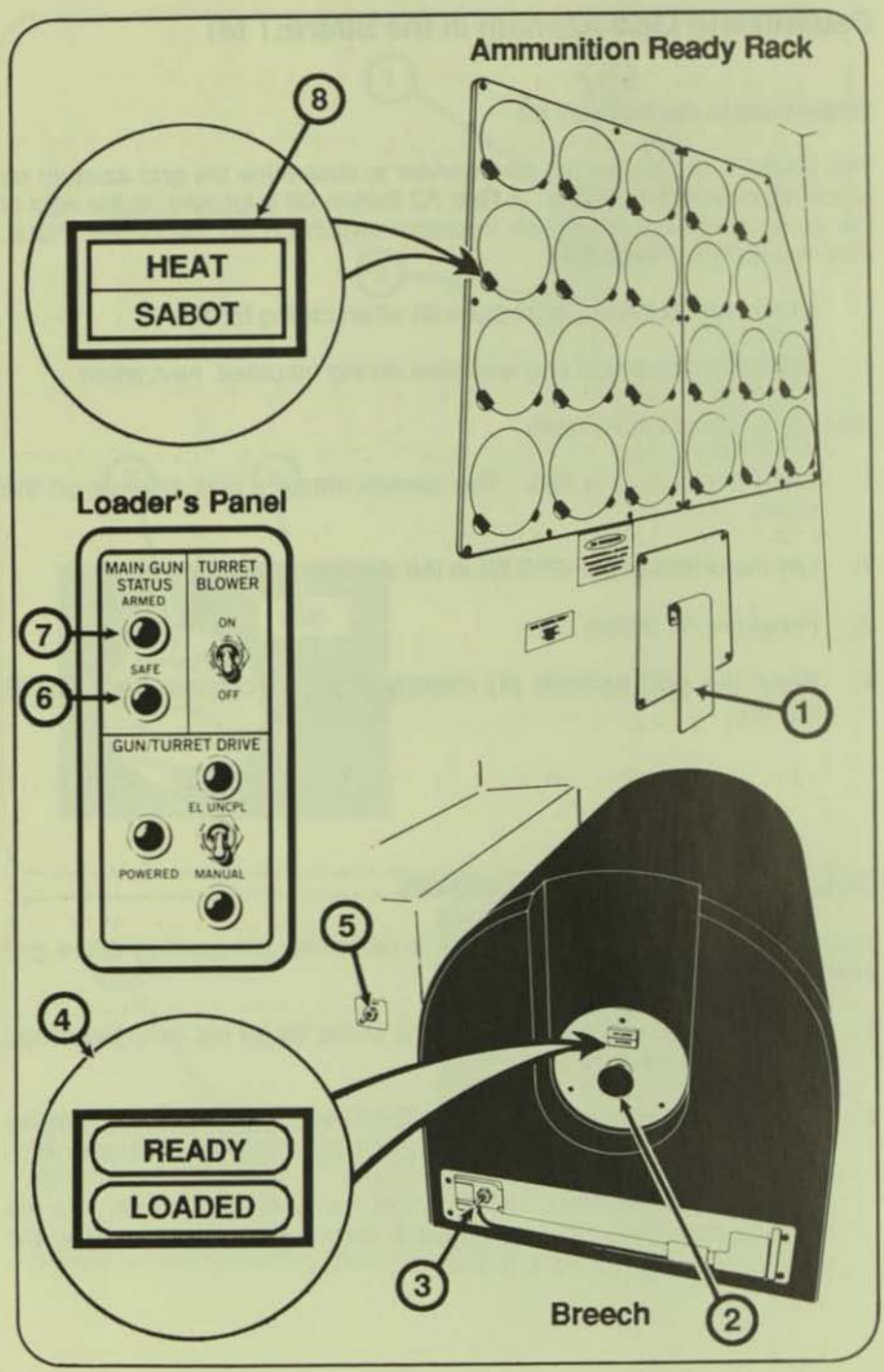
How to Obtain a Grid Azimuth

1. Bring the tank to a halt. You cannot obtain a grid azimuth on the move.
2. Lay the reticle of the GPS (3) in the desired direction (5).
3. Press the AZ button (2).
4. Read the grid azimuth (4) directly from the commander's GPSE display.

Determining Gun Tube Position

The SIMNET M1 crew has two ways to determine the position of the gun tube:

1. The driver can see the gun tube (1) in the top of his unity periscope when the tube is over the bow.
2. The turret crew is provided a Turret-to-Hull Reference display to determine the position of the gun tube relative to the hull (and thus, the line of sight of the GPS and Commander's GPSE). The display is mounted to the left of the gunner's station. As the turret turns, one of the 12 light bars (2) lights to show the orientation of the gun tube to the hull.


Ammunition Ready Rack
8
HEAT
SABOT
Loader's Panel
MAIN GUN STATUS
ARMED
SAFE
TURRET BLOWER
ON
OFF
7
6
GUN/TURRET DRIVE
EL UNCPL
POWERED
MANUAL
1
5
4
READY
LOADED
3
Breech
2

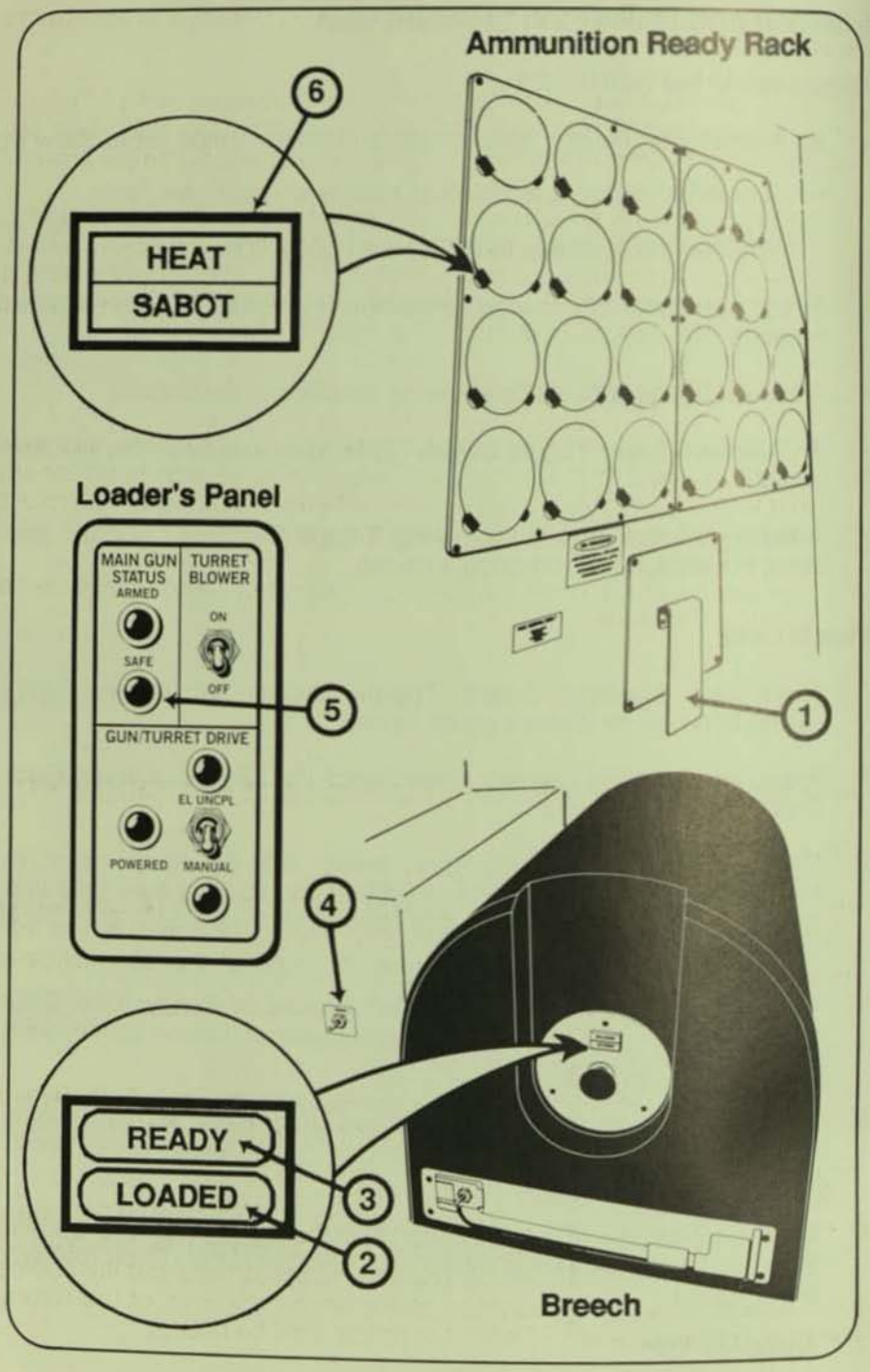
Loading and Unloading the Main Gun

Differences in the SIMNET M1

- An Ammunition Ready Rack contains indicator lamps (8) to show if :
  - A round of ammo is available in each ready rack tube, and
  - Whether the available round is HEAT or SABOT
- A red Load button (2) to load ammunition (for loading a round into the breech).
- A Breech Status light (4) (to show the condition of the breech)
- An Ejection Guard Toggle Switch (3) to open and close the ejection guard.
- A spring loaded Breech Operating Toggle Switch (5) to open and close the breech (for removing a round).

How to Load

1. Move the Ejection Guard Toggle Switch (3) to the **left.** (SAFE lamp (6) on loader's panel lights.)
2. **Press and hold** the Loader's Knee Switch (1). (Sound of Ready Rack Door opening is heard.)
3. On the Ammunition Ready Rack, press a lit Ammo Indicator (8) button to select either a HEAT or SABOT round. You now have that round "in your arms." You can only have one round "in your arms" at a time.
4. Release Loader's Knee Switch (1). (Sound of Ready Rack Door closing is heard; READY lamp (4) on breech comes on 2.5 seconds after knee switch is released.)
5. After READY light comes on, press red Load button (2). (Clanging sound of breech closing is heard and LOADED lamp (4) on breech lights).
6. Move Ejection Guard Toggle Switch (3) to the **right**. (Sound of ejection guard snapping closed is heard and ARMED lamp (7) on loader's panel lights).
7. **Announce "UP".**


Ammunition Ready Rack
6
HEAT
SABOT
Loader's Panel
MAIN GUN STATUS
ARMED
SAFE
TURRET BLOWER
ON
OFF
5
GUN/TURRET DRIVE
EL UNCPL
POWERED
MANUAL
1
4
READY
LOADED
3
2
Breech

How to Unload a Round from the Breech and Return It to the Ammo Ready Rack

NOTE: Once you have removed a round from the breech and it is "in your arms," you cannot remove another round from the ready rack until you have replaced the first one in the ready rack or put it back into the breech.

1. To the left of the breech, push the spring loaded Breech Operating Toggle Switch (4) down. ("Click" sound of the breech block extractors engaging will be heard. On the Breech, LOADED status indicator (2) will go out and READY status indicator (3) will light. On the Loader's Panel, SAFE lamp (5) will light.) The round is now "in your arms."

2. Open the Ready Rack Door.

3. On the Ammunition Ready Rack, select an unlit Ammo Indicator (6) and press it to return round to ready rack. (Ammo Indicator will light with the type of round you removed from the breech.) The round has now left "your arms" and is back in the rack.

4. Release Loader's Knee Switch (1). (Sound of Ready Rack doors closing will be heard.)

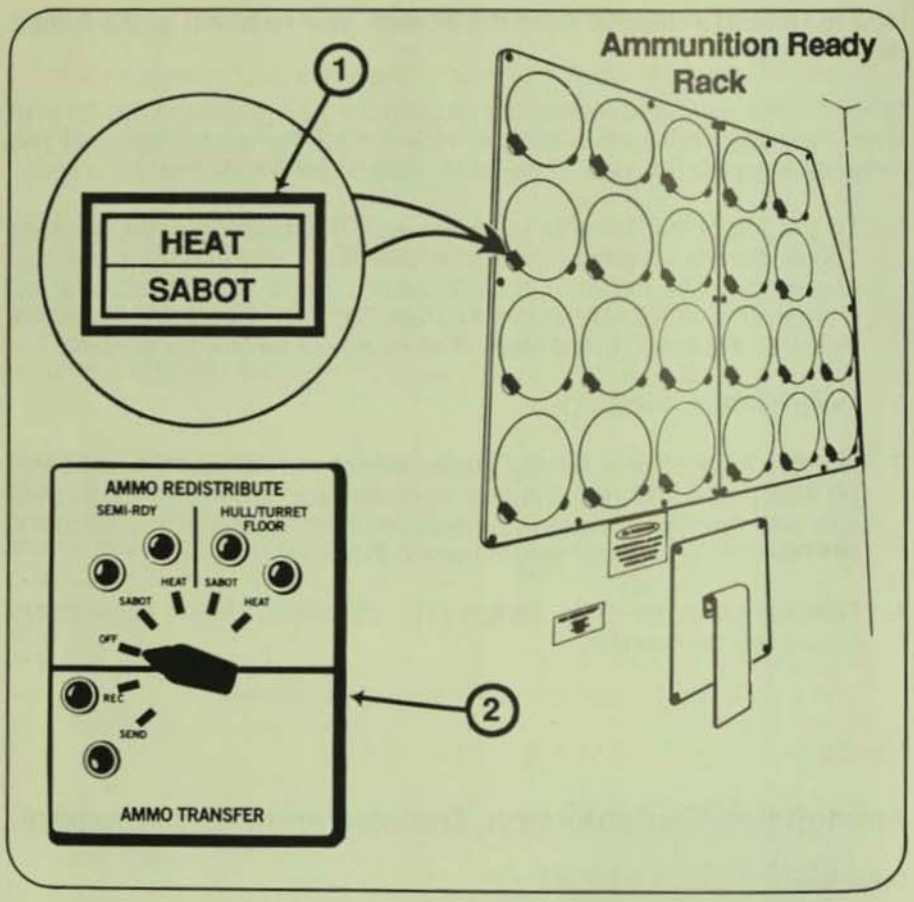
Ammunition Redistribution, Transfer, and Rearrangement

Differences in the SIMNET M1

The SIMNET M1 is equipped with an AMMO REDISTRIBUTE and AMMO TRANSFER Panel not found in the M1 tank. This panel is mounted on the turret wall to the right of the commander's station.

How to Redistribute Ammo From Semi-Ready Rack or Stowage to the Ready Rack

1. At the AMMO REDISTRIBUTE Panel, position the selector switch to the type of ammo you wish to redistribute and the source location of the ammo. (Sounds of the Ready Rack door opening will be heard.)



2. Press any empty (unlit) Ammo Indicator (1). (If the type of ammo selected is available at that source location, the Ammo Indicator selected will blink for 40 seconds indicating that a round is being transferred. If it doesn't blink, you don't have any more of that type of ammo in that location.)

3. After the Ammo Indicator (1) stops blinking and stays lit, select another round by pressing any other unlit Ammo Indicator. Continue this process until you have redistributed the desired amount of ammo or until all ammo is exhausted from the source location.

4. On Ammo Redistribution Panel, position the selector switch (2) to OFF.

How to Transfer Ammunition Between SIMNET M1 Tanks

1. Move SIMNET M1 tanks to within 20 meters of each other and halt.

2. **Sending Tank:** Position Ammo Transfer Switch (2) to SEND. (Sounds of the Ready Rack Doors opening will be heard.)

3. **Receiving Tank:** Position Ammo Transfer Switch (2) to REC. (Sounds of the Ready Rack Doors opening will be heard.)

4. **Sending Tank:** At the Ammunition Ready Rack, press Ammo Indicator button (1) to send either HEAT or SABOT. Indicator will blink 40 seconds per round to indicate that transfer to other SIMNET M1 is taking place.

5. **Sending Tank:** Repeat steps above until desired number of rounds have been transferred.

6. **Sending Tank**: When transfer has been completed, position Ammo Transfer Switch (2) to OFF. (Sounds of Ready Rack Door closing will be heard.)

7. **Receiving Tank:** Position Ammo Transfer switch (2) to OFF. (Sound of Ready Rack Doors closing will be heard.)

How to Rearrange Rounds in the Ready Rack

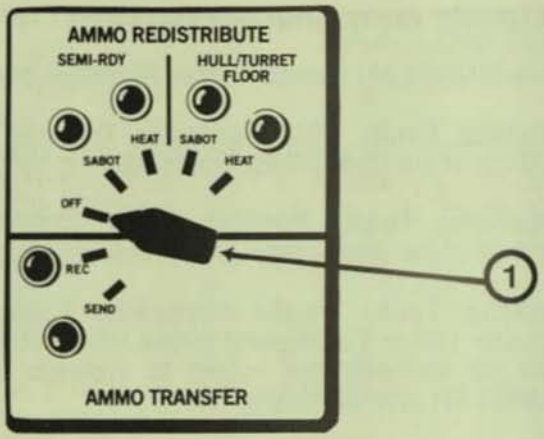
1. Open the Ready Rack Door.

2. Select a round. (It's now "in your arms.")

3. Move it to an unused slot by pressing an unlit Ammo Indicator. (The round has now left your arms and is in the new rack tube.)

4. Remember, you can only have one round "in your arms" at a time.

Ammo Redistribution Panel



How to Transfer Ammunition From an Ammo Carrier to a SIMNET M1

1. Move your SIMNET M1 to within 20 meters of an ammo carrier (HEMMT) and halt.

2. On the Ammo Transfer Panel, position the Ammo Transfer Switch (1) to REC. Ammo transfer will occur automatically as follows:

   - Ammo will be transferred at a rate of one round every 40 seconds
   - Ammo will be placed in the ammo stowage racks beginning with the Ready Rack
   - The number of HEAT and SABOT ammo rounds transferred will be in the amount needed to restore the ammo mix specified for your SIMNET M1 basic load.

   Transfer ends when:

   - There is no more ammo of the type you need on the HEMMT
   - Your SIMNET M1 moves beyond 20 meters from the HEMMT
   - Your Support Platoon moves the HEMMT
   - HEMMT or SIMNET M1 is destroyed by combat action.

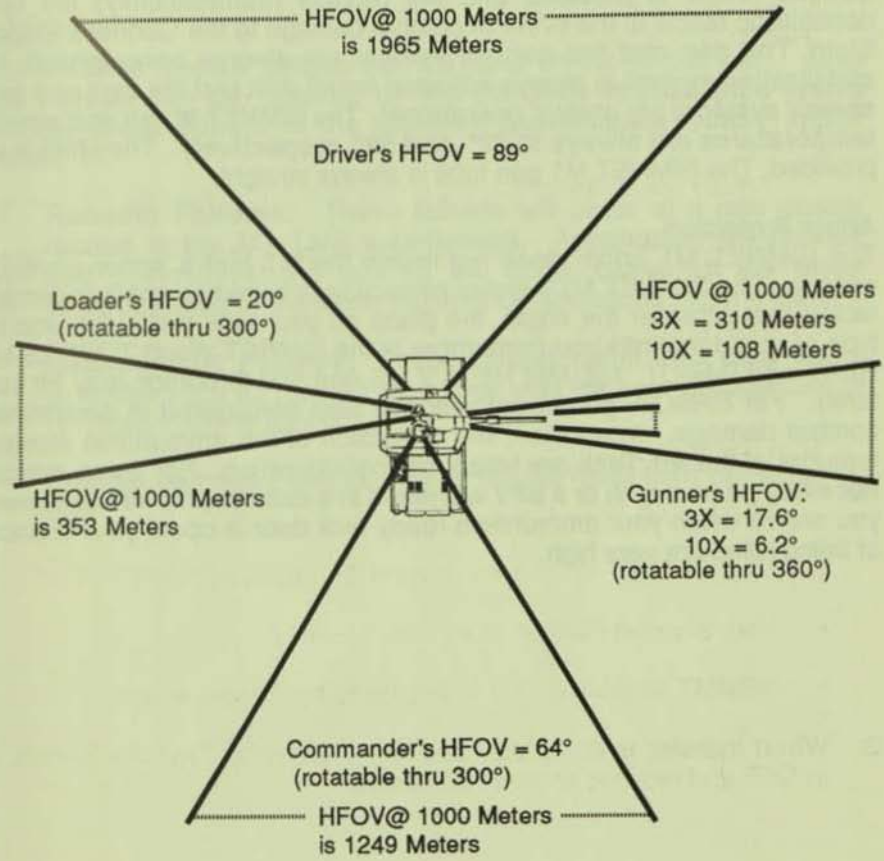
3. When transfer is complete, position the Ammo Transfer Switch (1) to OFF and resume normal operations.

4 SIMNET M1 Technical Data

The SIMNET M1 weapon is almost as capable in the SIMNET world as the M1 tank is on the battlefield. This section provides you with an important ready reference of what the SIMNET M1 will and will not do.

Visual Systems

The seven unity vision blocks, together with the GPS and GPSE, provide the SIMNET M1 crew with a view of the SIMNET world out to a maximum range of 3500 meters. This is also the effective maximum range of the fire control system and main gun. The horizontal fields of view (HFOV) are shown below.



Communications Systems
The SIMNET M1 operates in the communications nets normal to the TO&E. Bn/TF Command; Bn/TF Admin/Log; Co/Tm Command; and platoon command FM nets are used. SIMNET M1 tanks have the following simulated commo:

- Command Vehicle — AN/GRC-12 w/full crew intercom as in the M1 Tank
- NonCommand Vehicle — AN/VRC-64 w/full crew intercom as in the M1 Tank

Fire Control
The SIMNET M1 is equipped with the Gunner's Primary Sight and the Commander's extension providing the nonballistic reticle, range display and fire control malfunction symbology. 3X and 10X are selectable at the gunner's station. The laser range finder is selectable for first or last return and safe. The Gunner's Auxiliary Sight is not provided. However, the GAS ballistic reticle is provided and will replace (automatically) the GPS nonballistic reticle in the event of combat damage to the Gunner's Primary Sight. **The gun and fire control system are always boresighted; the stabilization system is always adjusted for nil drift and the cant and wind sensor systems are always operational. The SIMNET M1 air and powder temperatures are always at 72° and 59°, respectively.** The MRS is not provided. The SIMNET M1 gun tube is always straight.

Armor Protection
The SIMNET M1 armor does not match the M1 tank's armor envelope exactly. The SIMNET M1's armor protection is based on combat damage tables that consider the angle, the place on your tank that is hit, and the type of round that hits you (remember in the SIMNET World TOW, 25 MM HEI-T and SABOT, 155 MM HE, 4.2 HE and 500 lb bombs may hit your tank). For SABOT, gun-target range is also considered in determining combat damage. In addition, the protection of the ammunition stowage features of the M1 Tank are taken into consideration. For these reasons **not every hit on a tank or a BFV will result in a catastrophic kill.** However, if you are hit when your ammunition ready rack door is open, your chances of being killed are very high.

SIMNET Weapons Effectiveness

In SIMNET, a hit on soft targets such as artillery, mortars, wheeled vehicles, helicopters, fixed wing aircraft and command post facilities by indirect fire and bombs will have a catastrophic effect which will result in a kill. Indirect fire and bomb effects are based on the bursting radius of effects (air bursts) and the circular error probable (CEP) for point detonating rounds. For these reasons, the following factors should be considered while fighting your SIMNET M1:

1. Flank and rear shots on tanks significantly increase kill probabilities.

2. At ranges beyond 2000 meters, TOW and 105 MM HEAT are best able to penetrate the frontal armor of tanks.

3. When not moving, seek and occupy covered and concealed positions at all times.

4. When moving, use covered and concealed routes.

Failures

There are three types of failures that will occur on the SIMNET M1. All of these failures can be repaired by the company maintenance teams operating under control of the Battalion Maintenance Officer and/or Company XO.

- **Random Failures:** These failures will occur at a rate closely related to the M1 Tank experiences. Automotive, fire control, and communications failures will occur based on the Mean Miles operated or the Mean Number of Operations experienced.

- **Deterministic Failures:** These failures result from crew errors or abuse such as running an engine with the Low Oil pressure or Hi-Temp warning light lit.

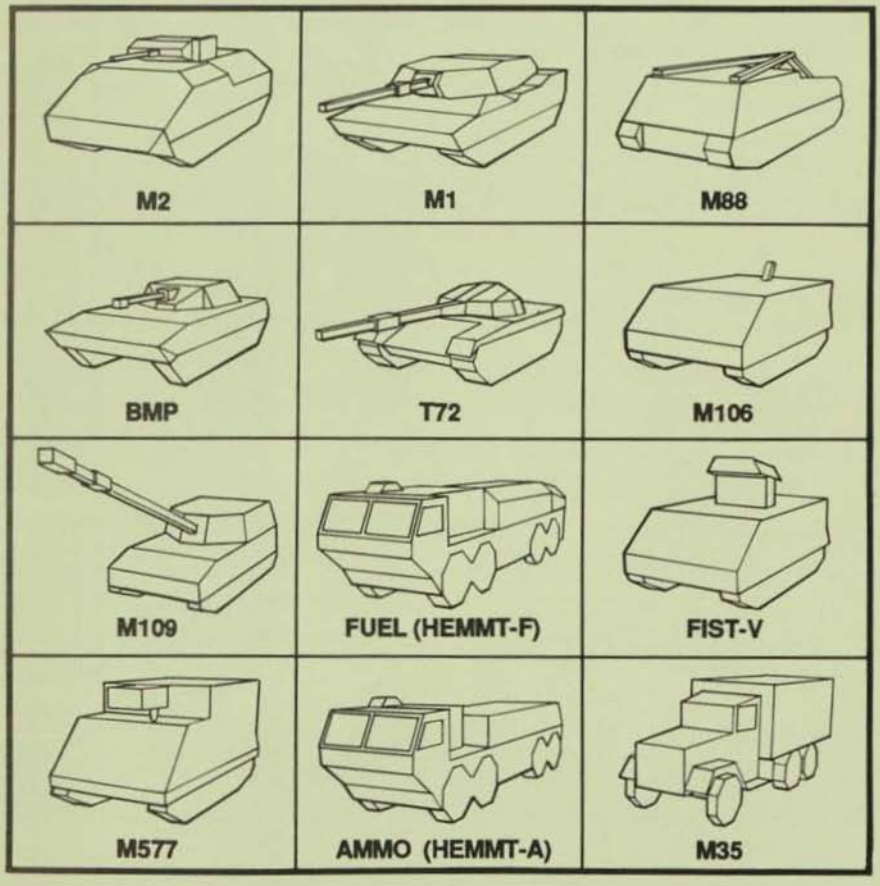
- **Combat Damage Failures:** These failures result from nonlethal hits.

Repairs/Recovery
Specific times to repair have been obtained from the US Army Armor School for each failure possible on the SIMNET M1. Time to repair starts when the automotive or turret mechanic (who must move to your SIMNET M1's location in the SIMNET World) starts the repair. If the mechanic selected the right repair procedure, your SIMNET M1 will be operable when the time to repair has elapsed. If the correct repair has not been selected, your SIMNET M1 will remain inoperative. If enemy action threatens to overrun your tank because of a mobility failure, the mechanic has the capability to effect a recovery operation by using the M88A1 available to each company maintenance team if the M88A1 is not being used elsewhere.

Simulated Effects
The illustration at the top right and many of the illustrations in this manual show examples of the simulated weapons effects that you will see in SIMNET during the conduct of battle. In addition, you will note that trailing dust clouds kicked up by vehicles (see illustration - inside front cover - driver's view, center) and engine exhausts are displayed in SIMNET. Be alert for these signs of vehicle activity and remember that your SIMNET M1 is giving similar signs to other vehicles in your area.

Vehicle Identification
The illustrations at the lower right and many of the illustrations in this manual show examples of the numerous types of vehicles that you will see through your SIMNET M1 vision blocks and the GPS and GPSE. Friendly vehicles are tan in color. Opposing vehicles are green.

Simulated Effects



Vehicle Identification

SIMNET M1 Performance Characteristics

Speed

The SIMNET M1 terrain behavior is very similar to that of the M1 tank. For example, the SIMNET M1 will get stuck if you attempt to cross a stream deeper than 48 inches. (Streams deeper than 48 inches are shown as dark blue in the SIMNET world.)

- Forward Speed, maximum (paved level surface) 45 mph
- Reverse Speed, maximum (paved level surface) 25 mph

Obstacles

- Vertical.....49 inches
- Ditch.....108 inches
- Grade.....60% (31 degrees)
- Side slope without throwing a track.....40 %

Traversing

- Turret Traverse.....360°
- Commander's Cupola .....300°
- Loader's Periscope.....300°

Armament and Ammunition Stowage

55 rounds of either 105 MM HEAT or SABOT selectable at vehicle initialization and during resupply operations or ammunition redistribution. Loader is capable of stowing individual rounds as desired. No secondary armaments. Stowage capacities are as follows:

- Ready Rack 22 rounds
- Semi-Ready Rack 22 rounds
- Hull Stowage 8 rounds
- Floor Stowage 3 rounds

Fuel Capacity 505 gallon capacity (498 gallons usable before fuel exhaustion)

Operating Range

Dependent on soil and slope conditions and on throttle and gear positioning. At steady 25 MPH on hard surface roads maximum operating range is 385 miles.

Change Requests

You can help improve this manual. If you find any mistakes, or if you have any suggestions for improving this manual, please let us know. Mail your comments to: SIMNET Program Office, Perceptronics, Training and Simulation Division, 21122 Erwin St., Woodland Hills, CA 91367-3717

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