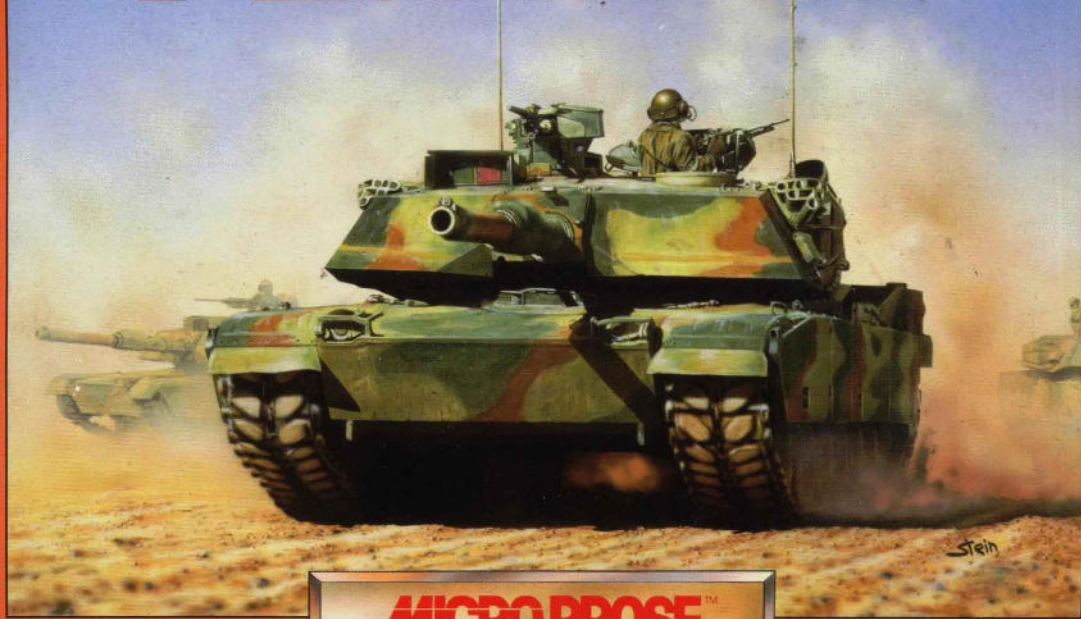
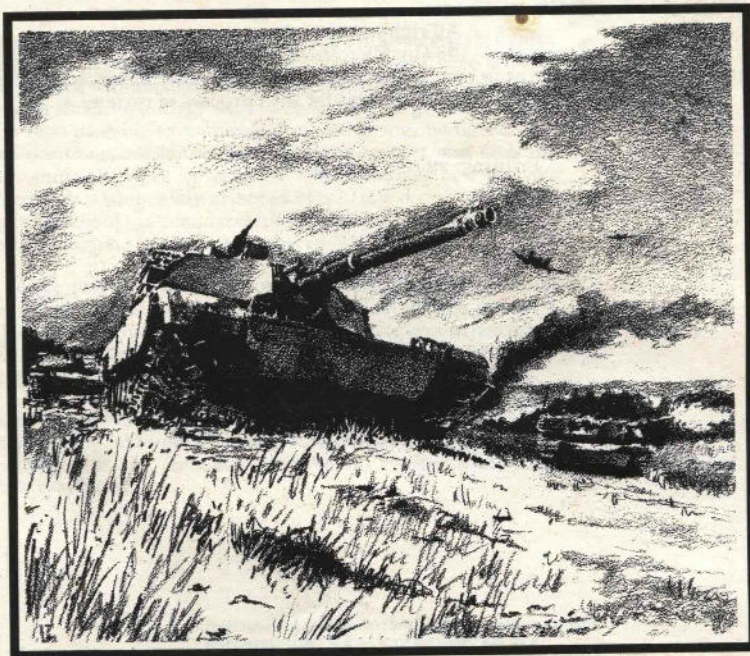


M1 TANK PLATOON



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SIMULATION • SOFTWARE

M1 TANK PLATOON

Computer Simulation

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INTRODUCTION

M1 Tank Platoon is a detailed, comprehensive simulation of modern armored combat. You control four of the world's best tanks in battle. But it's impossible for you to do the work of all 16 crewmen in battle. So in *M1 Tank Platoon* the crewmen perform their own tasks to the best of their ability, while you can jump into anyone's seat to "take over" at a critical time. But you're also issuing orders to the other tanks, and other ground, air and artillery support as well. Your tactics spell the difference between victory and defeat. You're the "guiding spirit" of the platoon.

Until *M1 Tank Platoon*, computer tank "simulations" were arcade-style games where you drove around and blasted everything in sight. As usual, here at MPS Labs in MicroProse we wanted to represent more. We wanted the *entire* experience of armored warfare, not a shooting gallery with tank-shaped targets. To us real armored warfare is groups of vehicles maneuvering and firing, using various formations, hull down positions, smoke screens, artillery support and aircraft. Most importantly, it's multiple *types* of vehicles. For example, how do you coordinate thin-skinned M2s with heavily armored M1s? How do you deal with enemies who have a mixed force of tanks and missile launchers? How do you avoid mutual destruction when slugging it out with T-80s?

These problems aren't just idle curiosity. At this very moment military tacticians around the world are puzzling over the problems of modern armored warfare. There's no clear agreement on what vehicles are best, or how to use them on the battlefield. With this simulation you can try existing doctrine, or create your own tactics and theories, then see what happens in the heat of battle.

Best of all, *M1 Tank Platoon* is more than a tactical exercise. You have the full experience of platoon command, of tanks in battle, from the same perspective as real commanders and crewmen. *M1 Tank Platoon* probably is the closest your computer can come to a real battle.

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INTRODUCING THE M1A1 MBT

Purpose

The M1A1 is a main battle tank. Therefore, its purpose is to transport a heavy, high-velocity cannon and a variety of machine-guns. The vehicle is heavily armored because it is expected to lead attacks straight into enemy lines. The vehicle is fast, with good cross-country mobility. It must be able to outmaneuver as well as outfight similarly armed enemies.

History

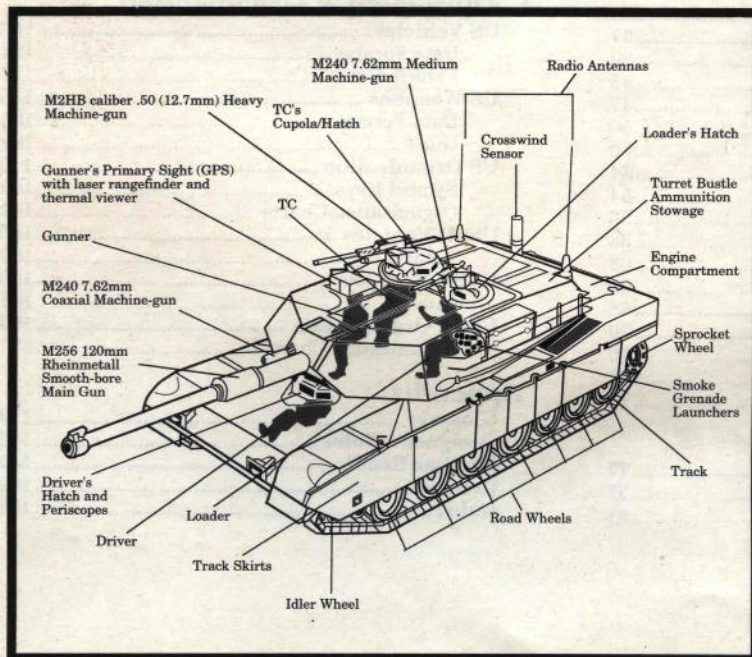
The M1A1 "Abrams" main battle tank began development in 1972. The Chrysler Corporation design was selected in 1976, with the pilot vehicles completed in 1978. The first production vehicle rolled off the line in 1980, with manufacturing ultimately reaching 70 vehicles a month. Production continues as of this writing in 1989.

Meanwhile, in 1982 Chrysler sold its tank building operations to General Dynamics, an American mega-corporation with many other military contracts. M1 manufacturing is now officially done by the "Land Systems Division" of General Dynamics, in Detroit, Michigan and Lima, Ohio. When production ends, the US Army will have 8,000 to 12,000 tanks.

The original M1 design had a 105mm rifled cannon, a NATO standard in the 1960s and 1970s. Only 2,375 of these were built. The remainder, titled M1A1, were built with a West German 120mm smooth-bore cannon of much greater power. Most of these M1A1s also have depleted uranium plating in their armor, upgrading the tank's protection as well as its armament.

Armament

Main Gun: The 120mm main gun fires either armor-piercing "sabot" (M827 APFSDS-T) or high-explosive "HEAT" (M830 HEAT-MP-T). Sabot has no explosive power, but is the most powerful armor-piercing round available. It is a kinetic energy penetrator, and therefore penetration decreases at



longer ranges. HEAT is an explosive ("chemical") penetrator, and therefore has constant effect, regardless of range. HEAT is less accurate than Sabot, but HEAT can also be used against infantry and other "soft" targets.

The majority of the 40 rounds of 120mm ammunition are stored in the rear of the turret. Sliding armored doors separate the ammo area from the crew area. The loader operates these doors with the knee-switch, opening them just long enough to reload the main gun.

Machine-Guns: The 7.62mm coaxial machine-gun is mounted beside the 120mm gun. It's also operated by the gunner. It is the most accurate machine-gun on the tank, and the primary weapon against infantry. The caliber .50 (12.7mm) heavy machine-gun on the roof, operated by the TC (tank commander), is less accurate but has greater penetrating power (enough to pierce the side or rear armor of BMPs, BTRs and BRDMs at close ranges). A spare 7.62mm is mounted on the roof at the loader's hatch, but is rarely used in combat.

Fire Control: The gunner has a laser range-finder, a fast and accurate device. However, smoke screens will block the laser. His gunsight has 3x and 10x settings, plus a thermal option that allows him to see through most smoke and at night. The rangefinder and gunsight egress optics are enclosed in an armored box on the turret roof, complete with armored doors, to protect them from explosions, shrapnel, bullets, etc.

Inside the turret the gunner has a ballistic computer slaved to his gunsight. When the computer is running, it automatically provides superelevation (elevates the gun barrel for the correct range). If the gunner is rotating the turret to track a moving target, the computer introduces a little extra "lead" for horizontal accuracy. The entire turret and gun assembly is stabilized both horizontally and vertically, allowing the M1A1 to fire while moving. The vehicle has "cant" sensors that correct for the tank sitting on an angled slope, rather than flat ground. It even has a crosswind sensor at the rear of the turret. This senses wind direction and speed, with the ballistic computer automatically making appropriate corrections to

M1A1 "Abrams" Main Battle

Main Gun:

one M256 120mm smooth-bore cannon
with muzzle velocity of 5,450 feet/sec

Machine-guns:

one M2HB 12.7mm rooftop heavy machine-gun
one M240 7.62mm coaxial medium machine-gun
one M240 7.62mm rooftop medium machine-gun

Ammunition:

40x 120mm shells (APFSDS and HEAT only)
1,000x 12.7mm rounds
12,400x 7.62mm rounds

Weight: 57,154 kg (63 tons)
Hull length: 7.918 meters (26 feet)
Hull width: 3.657 meters (7.7 feet)

Engine: 1500 hp gas turbine
Horsepower/Weight: 26.24 hp/kg
Ground Pressure: 0.96 kg/sq.cm
Max Road Speed: 66.77 kph (41.5 mph)

improve firing accuracy.

Mobility

The driver is the only crewman in the hull of the tank. His controls are similar to a motorcycle: twin handle-bars that rotate left or right for turns. The handgrips rotate forward and back for acceleration and deceleration. The only foot-pedals are the brake and parking brake. The driver also has a wide variety of dials and gauges to monitor the engine and the electrical system.

Most large AFVs (armored fighting vehicles) are powered by diesel engines. However, the M1A1 uses a 1500 horsepower gas turbine. This is the most powerful tank engine in the world. It gives the M1A1 speed and acceleration equal to any tank in the world, despite the M1A1 being extremely heavy for a main battle tank. The main disadvantage of the gas turbine is large fuel consumption: the tank travels a shorter distance on a tank of fuel. The M1A1 also has an advanced suspension that provides a smooth ride at high speeds.

Defenses

Armor: The M1A1 has extremely heavy, top-secret armor developed during the 1970s in Chobham, England. Believed to be a laminate with steel and ceramic layers, it has been further upgraded with a layer of depleted uranium. The armor is better than steel against normal kinetic-energy penetrators. But its main advantage is that HEAT warheads are almost totally ineffective. Since all anti-tank rockets and missiles use HEAT warheads, this makes the M1 "proof" to anything but other big tank guns (such as the 125mm on Pact T-64 to T-80 models).

Unfortunately, Chobham armor is extremely heavy and bulky. Only the hull and turret fronts are fully protected. The rear and top decks are covered with thinner, normal steel. Therefore the tank is vulnerable to rear flank and rear attacks, as well as air attack.

In addition, non-penetrating hits (HEAT especially) can still damage the tank, by wrecking tracks, damaging sensitive systems (such as the optics or computer), or killing the tank commander if he's unbuttoned.

Smoke: The M1A1 turret has two six-grenade smoke *launchers* on the sides of the turret, facing forward. These grenades fire forward about 50 feet in a salvo of six (three from each launcher), concealing the tank from enemy lasers and optics. The tank commander (TC) controls the smoke grenade launchers.

The M1A1 also has an engine exhaust smoke *generator* (the VEES). This device injects fuel into the hot exhaust, producing a billowing white smoke screen from the rear. The driver controls this smoke generator.

Laser Warning: The M1A1 is thought to carry a laser-warning system that alerts the crew when an enemy laser hits the tank. Such a warning tells the crew that the enemy has "ranged" them and is preparing to fire a cannon or missile.

Damage Control: The M1A1 has automatic fire suppression systems (AFSS) in the driver's compartment, turret, and engine compartment. The AFSS in each compartment has heat sensors which automatically trigger halon gas. This gas "starves" the fire of oxygen without injuring the human crew or the equipment. Each AFSS has a manual backup switch, in case the automatic trigger fails. Fire

is the primary cause of tank destruction (as opposed to repairable damage).

The turret bustle ammunition stowage area has armored blow-out panels in the roof. If the ammo compartment explodes, the panels blow out and the explosion goes upward, while armored doors keep the explosion away from the rest of the turret. Trials indicate that the turret crew and equipment should survive even if the ammo bustle blows up.

HOW TO START

Sorting the Materials

This **Manual** provides a tutorial for beginners, detailed operating instructions, and a wide variety of technical background. It is applicable to all computer systems.

The **Technical Supplement** gives specific instructions for loading and/or installing the simulation for your computer. It also provides a complete reference of all the graphics and keys used in the game.

The **Keyboard Overlay(s)** represent all the controls and orders for operating single vehicles and the computer itself. (Platoon orders are not listed, instead they appear on-screen whenever they're permissible.)

Installation

The Technical Supplement has complete information about how to install M1 Tank Platoon on either floppy or hard disks.

Learning the Simulation

The first step is to become acquainted with the real tank. Read through "Introducing the M1A1 MBT" (pages 6-9). This describes the main systems on the tank. Then there are three easy ways to learn about running a *M1 Tank Platoon*.

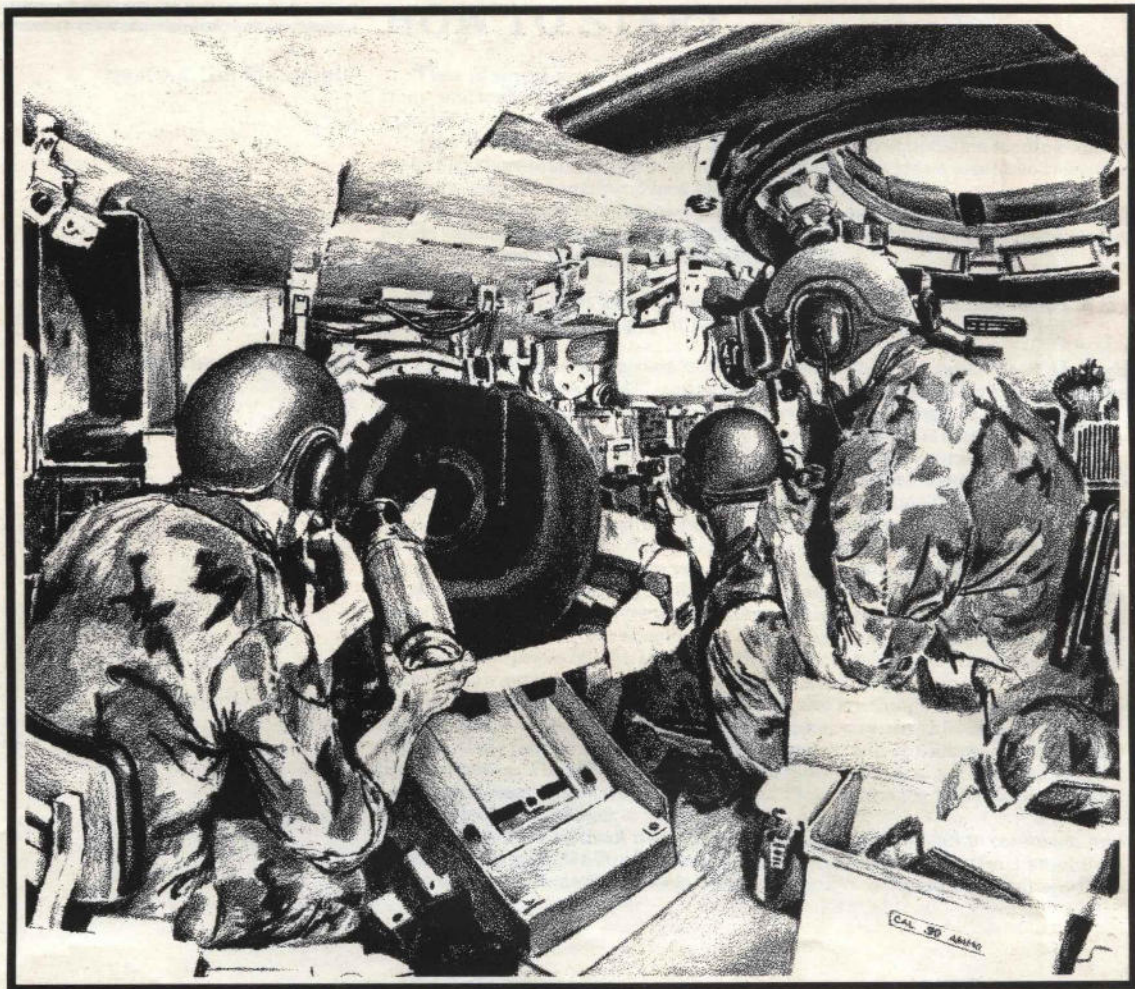
Tutorial Method: If you like step-by-step guidance while learning, turn to the "Tutorial" (pages 13-29) and follow the instructions. The tutorial, although long, introduces you to all the salient points of armored warfare. Note that the tutorial urges that you to skim through the "Operating Instructions" (pages 30-75).

Advice: We recommend the tutorial method unless you're already familiar with modern armored warfare. Experience in other arcade games or so-called "simulations" may not prepare you for the realism of this product!

Study Method: You can study the actual controls and operating instructions of the vehicle, and the orders used to control other vehicles and platoons. This is what real soldiers do (or should do). To do this, read the complete "Operating Instructions" (pages 30-75). If you're still confused, try things out on the gunnery range, following the tutorial (pages 13-29) as necessary.

Try & See Method: You can just dive in and try things out, referring to this manual and the Technical Supplement as necessary. In this case we strongly suggest that you (a) use the keyboard overlay, and (b) glance over interior illustrations in "The M1A1" (pages 37-53) to familiarize yourself with the vehicle. Later you'll want to look through "The Tank Platoon" (pages 54-67) to learn about the mapboard and orders.

Warning: This method, usually the most popular, can lead to confusion and frustration because *M1 Tank Platoon* has so many new concepts. If you absolutely insist on using this method, please try the Static or Moving Gunnery options first.



1. TUTORIAL

FAMILIARIZATION

The Narfenauer Gunnery Range is a stereotypical practice area where tank drivers can try different maneuvers and fire live ammunition at realistic targets. There are many such ranges in the USA and Western Germany.

Install: See the Technical Supplement for information on how to install *M1 Tank Platoon* on floppy disks or onto a hard disk.

Hardware Options: In some versions, after loading the game you'll see questions about your computer hardware. If you're unsure of the answers or wish to automate this process see the Technical Supplement.

Create Your Platoon: After the title screens, you'll find yourself at the battalion staff presentation with a list of possible platoons. Select the "Erase Me's" platoon and follow the instructions to erase it and start your own platoon.

Static Gunnery: The next step is to select a combat assignment. Choose "Static Gunnery". This by-passes the remainder of the staff presentation.

Gunnery Range Briefing: Here you'll see a map of the gunnery range with a quick briefing. Notice that you start in the south, on a hill facing east. See the map on page 17 for more information.

Following the instructions at the bottom of the text and you'll go directly onto the gunnery range itself.

Your tank platoon is fully crewed at every position. Each man has a name, rank and quality rating. You are not a single, specific crewman. Instead, you're the "guiding spirit" of the entire platoon. You give the orders. You can take over for any man, whenever and however you wish. If you don't take over, the crewmen will function on their own.

You begin each training exercise or battle looking at the mapboard. Your viewpoint (OP) is in the platoon's #1 tank. This is the platoon leader's vehicle.

You can move around to the four different viewpoints within that tank, see the mapboard, move your viewpoint (OP) to any of the other three tanks (#2, #3 or #4) in the platoon, or get outside the tank (the *Outside Tank* view).

Starting Options

Where You Start

Views within a Tank

Use your keyboard overlay to find the *TC Unbuttoned*, *TC Buttoned*, *Gunner* and *Driver* keys. Try each of these and refer to the diagrams on pages 39-49, which describe each position in detail. If you try any of the controls, make sure you set them back to their original state. Most keys are two-position toggles (such as switching between low and high magnification, or between the main gun and the coaxial machine-gun). Some have separate "on" and "off" keys (such as the Engine Exhaust Smoke Generator).

There is also a *Mapboard* that you should examine. This is explained in "Orders & the Mapboard" (pages 54-67), since the mapboard is used mainly to issue large-scale orders.

Finally, there is an *Outside Tank* view, which shows the tank and surrounding area from outside the vehicle.

Feel free to move to the other tanks if you wish (using the *OP to Next Tank* key), examining the scene from their perspectives. When you're done, make sure you're back in tank #1 again.

Controls and Commands

Controls are specific dials, switches, etc. used to operate a tank. ...

Commands are general orders given to a tank crewman, an entire tank, or an entire platoon (or section) of vehicles.

Controls: The controls for a single tank are all on the keyboard, using keys labeled on the keyboard overlay. These controls include driving, operating the turret and guns, and using the various vision devices available.

Whenever you touch one of these controls, you have "taken over" at that crew position. The "real" crewman there will stop functioning and let you run things. Whenever you leave that view, the "real" crewman takes over again.

Commands: These are general instructions to either a specific vehicle ("vehicle orders"), or to a group of vehicles ("platoon orders"). Whenever you issue a command, all crewmen of all affected vehicles immediately do whatever's required to carry out your order. The only exception is the position you occupy — if you've already "taken over", then the crewman there remains aside, letting you run things at that position. However, if you issue commands while at the mapboard, then nobody has "stepped aside", so every crewman will obey.

The type of commands available depend on what's on the screen. Generally, you're restricted to "vehicle orders" — orders to the crew of the vehicle you occupy (or the last vehicle you occupied, when on the mapboard or outside the tank). You can only issue "platoon orders" on the mapboard, and then only when a platoon data window is showing (see page 58).

Follow Me: All tanks in the platoon will follow the leader's tank. They will keep formation on his hull. They will cover various fields of view and fields of fire, depending on the formation.

If you jump to another tank, you automatically transfer platoon leadership to that tank. Therefore, the platoon follows whichever tank you occupy.

A "STATIC GUNNERY" TRAINING RUN

In this training exercise we'll concentrate first on just running your tank. Don't worry about the rest of the platoon, they'll just follow along and watch. The nice thing about training ranges is that the enemy never fires back. Furthermore, in this exercise the enemy doesn't even move. This makes learning and experimentation much easier.

Make sure you find the *Pause* key before you start. You'll want to read a paragraph or two and do that, then pause to read a few more paragraphs, then continue, etc.

Map Reference Check: You begin this exercise looking at the mapboard. To find your location press the *Your Tank* key. The map crosshairs jump to your location and shows a data window about your tank. Use the *Zoom* key to look at your position in more detail. Beside you are the three other tanks of your platoon.

Now *Unzoom* until you can see the whole map again. Next carefully move the crosshairs until it's on top of a target just to the east (right) of your tanks. Now press *Selector #1*. You'll see an information window about the target. It should be a URAL-375D truck. Feel free to use the map of the range on page 17 if you're having trouble finding the truck.

Do the same to find two more targets on the large hill across the stream to the north. You'll find a BMP-1 IFV (infantry fighting vehicle) and a Rifle Squad near the hill's east crestline.

If you make a mistake and don't have the crosshairs over an enemy, the data window doesn't change. Instead your tanks start forward to that point! This is because selecting an unoccupied area on the map gives a "move to" that point" command. If this accidentally happens, press the "H" key to give a "halt" order.

Eyeball Recon: Now press the *TC Unbuttoned* key. You're back in the open commander's hatch of tank #1. The facing diagrams (to the lower left inside the hatch) show you (the "C" value) and the hull (the "H" value) both

Find the Pause

Preliminary Recon Getting Your Bearings

Terminology

For compatibility across a wide variety of computers and control mechanisms, standard terms are used throughout. See the Technical Supplement and Keyboard overlay to interpret each for your computer.

Controller: A two-dimensional control device, normally a joystick, mouse, or four-directional cursor keys.

Selector #1: The first (left) button on a joystick or mouse. On the keyboard it is always the Return or Enter key.

Selector #2: The second (right) button on a joystick or mouse. On the keyboard it is always the Space Bar.

Keys: Each is referred to by an *italicized name*, which is shown on the keyboard overlay. In addition, a master list of names and keys for your computer is given in the Technical Supplement.

The Tank Gunnery Range

All tank platoons train on the same gunnery range. Static targets training is organized in the standard US Army fashion. You follow a path (counter-clockwise here) around the course, firing at targets.

Moving targets training has an "enemy" armored force moving from the northeast (NE) to the southwest (SW) part of the course. Your mission is to engage and destroy them before they reach the range control building in the southwest corner.

You end a gunnery range training session by eliminating all targets or driving all your tanks off the east or west side range (i.e., off the edge of the battlefield).

Using the TC's Heavy Machine-gun

truck should come into view soon (about C 105 on Facing Readout).

Now look left until your facing is the same as the gunner's. Because the BMP is farther away than the truck, it appears smaller in your binoculars.

It's important to get comfortable with seeing things on the map, then scanning the real countryside until you find them, or vice versa. There will come a time — very soon — that you'll see the enemy on the map. You'll want to find him with your binoculars or gunsights before he spots you!

Now swing your binoculars back to that URAL truck. Press *Selector #1* to open fire with your caliber .50 heavy machine-gun. This is the TC's (tank commander's) weapon. Use the tracer hits as guides to adjust your aim until the truck explodes into a burning wreck.

If you wish, press the *TC Buttoned* key to close your hatch. You'll see that the machine-gun can still be operated. That's all there is to things at the TC's position. Everything else the TC does with orders to other crewmen. We'll get to that later.

Driving

Our next job is to get onto the road. It runs right in front of the burning URAL and circles the gunnery range counter-clockwise.

First note the bearing to the burning truck. It's probably about 105°.

Next press the *Driver* key to become the tank driver. Moving the *Controller* to the right swings the tank right, onto the bearing you remember (turn until the "H" on the Facing Digital Readout shows the desired bearing). You'll notice that the driver has no magnification option (pressing the *Magnify Vision* key does nothing). Hence the need to note bearings — the driver can't see very far because he's so close to the ground.

Press the *Controller* forward to accelerate. Moving it left and right turns the vehicle. Pulling back on the *Controller* slows down the tank until you can go in reverse. To stop quickly, release the *Controller* and press *Selector #1*.

As you drive toward the burning URAL, the road comes into sight. Slow down and turn left onto the hardtop. Once on the road, don't accelerate to top speed.

facing east (i.e., C 90 and H 90). The turret will be cocked a bit left, facing northeast (T 35 to 40). This is because your gunner is on the job, keeping an eye on the most serious threat — that BMP-1 on the hill to the north!

Right now you're looking at things with the naked eye. As in real life, most of the interesting stuff is far away — it's time for binoculars. Press the *Magnify Vision* key. You get the same view through seven-power (x7) binoculars. Use the *Controller* to adjust the view up or down until you can see the horizon, then scan slowly to the right. That URAL

Watch your speedometer and cruise along at half speed (about 40-50 kph). It's easier to steer smoothly around curves if you're moving at a moderate speed.

After a few curves you'll cross a small stream. When you reach the other side stop and turn north (turn until your facing is "0°"). Now drive north with the stream at your left. You'll be moving toward a low ridge. Eventually you'll see a small splotch of color on the ridge — that's the BMP-1 you saw. Hit the brakes (*Selector #1*) to stop. It's time for a little gunnery practice.

Now climb up into the gunner's seat by pressing the *Gunner* key. The BMP-1 should be square in your sights: the crewman you took over from was watching it carefully!

Gunner's Primary Sight (GPS): Use the *Magnify Vision* key to try out the 3x and 10x options of the gunsight. Most gunners prefer using ten-power (10x). Use the *Controller* to rotate the turret left and right, and to raise or lower the sight (which also raises or lowers the main gun and the coaxial machine-gun mounted beside it).

Now press the *Smoke Grenade Salvo* key. This fires six smoke grenades a few meters in front of your tank. You'll find your view blocked by the smoke. Press the *Outside Tank* key to see what's going on if you're confused, then press the *Gunner* key again.

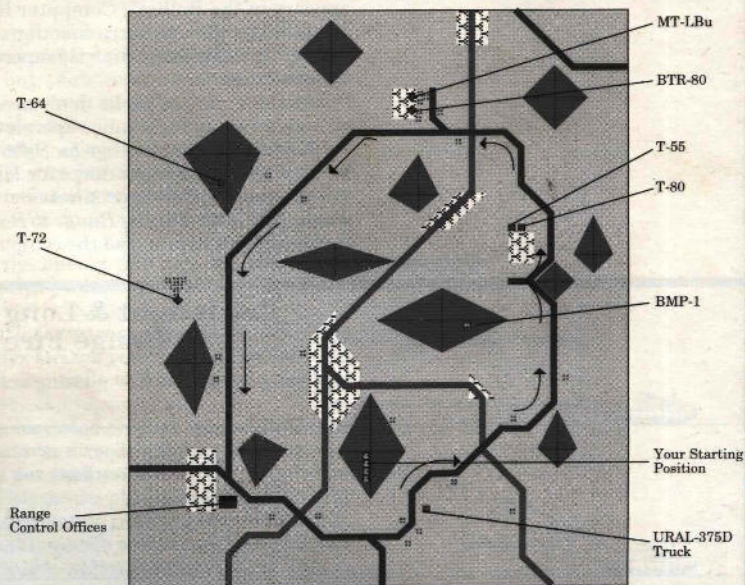
To see through the smoke, use your thermal viewer by pressing the *Night Vision* key. Unfortunately, your laser rangefinder doesn't work through smoke, so you'll have to wait until the smoke dissipates before continuing. It takes just a minute or two. Press *Night Vision* again to switch back to daylight viewing.

Select Your Weapon: The *Main-Coax* key switches between the 120mm main gun and the 7.62mm coaxial machine-gun. Make sure the toggle switch is set to "Main".

Select Your Ammunition: The *Sabot* key instructs the gunner to load a round of armor-piercing (AP) "sabot" into the main gun. The *HEAT* key instructs the gunner to load a round of high-explosive anti-tank (HEAT) into

Firing Gunnery

Map of the Narfenauer Gunnery Range



the main gun.

The Round-loaded Light is on whenever the gun is loaded. The light goes off while the gunner reloads. The gunner reloads after each shot and whenever you change the ammo type.

The Ammunition Switch shows which type of ammo is loaded (or being loaded) into the main gun. The HEP and WP markings are leftovers from the early-model 105mm-armed M1 — your 120mm-armed M1A1 cannot use those types.

Laser Rangefinding: When you're done experimenting, bring the sight back onto the BMP-1. Center the crosshairs on the middle of the vehicle and press *Selector #2*, not *Selector #1*. This "fires" your laser rangefinder at the target. The range in meters will appear in the sight. If you're too close, or you're aiming at the sky, you'll get a flashing "0". Try aiming lower, to make sure you're not lasing into the sky. If the result is still "0", try the ground beside the vehicle. If the result is still "0", you're within 200 meters of the target. Go to the driver's position and back up until the vehicle is just in sight, then return to the gunner's position and try again.

The Computer: When your laser finds a valid range (i.e., something other than a flashing "0"), it goes to the computer. The computer's range setting always appears in the Ballistic Computer Range Readout. The computer automatically elevates the gun an extra amount so that the shell will arc correctly to hit the target. This extra elevation is "superelevation". You don't see it happen; just trust the computer.

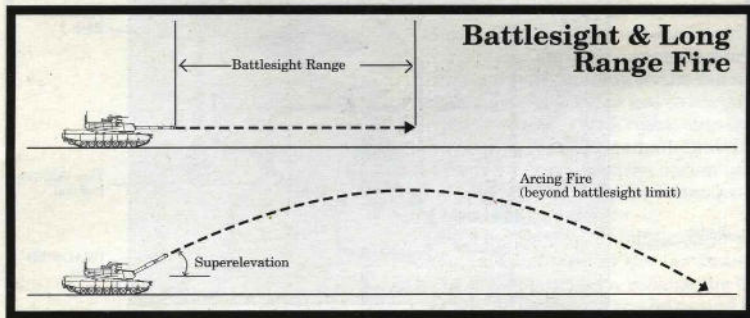
At short ranges shells don't need to arc: the path of the shell is virtually a straight line and there is no superelevation. This is termed "battlesight" range. On the M1A1 battlesight range for Sabot (AP or armor piercing) ammunition is 1500 meters. The battlesight range for HEAT is 800 meters.

You can send the appropriate battlesight range to the computer whenever you want. Just press the *Set Range to Battlesight* key. Either 800 or 1500 will appear in the computer (provided the computer is still operating!). With these values the

computer will put in no superelevation, causing the shell to fly directly toward the centerpoint on the sight. This is true at all shorter ranges as well.

Finally, if you're desperate, you can type a range number into the computer directly. The *Set Range* keys do this, one digit at a time. On most computers you must hold down the shift key while hitting the appropriate number keys across the top of the keyboard (not on the numeric keypad!). To clear a manual entry, type a series of zeroes.

Battlesight: If the computer is malfunctioning, or you just don't trust it,



you can switch it off and use just the battlesight (i.e., the markings on the gunsight itself). The *Computer/Battlesight* key toggles between these options. The *Computer/Battlesight* switch on the gunner's control panel is labeled "Norm" for computer operation (computer use is the "normal" mode of operation), and "BAT" for battlesight-only operation.

Obviously, if you select battlesight and the range is beyond the battlesight limit, then you must add superelevation yourself, manually, by raising the sight an appropriate distance above the target.

You should use the computer in training and first battles. Later you can return to the gunnery range and learn to judge superelevation while using the battlesight. This is a handy skill if the computer is knocked out. A broken computer shows "8888" in the Ballistic Computer Range Readout.

Open Fire: Firing the main gun (or the coaxial machine-gun) is quite simple. Just press *Selector #1*.

To blast the BMP-1, make sure the you're set to Main (not coax), get the gunsight onto the target, lase for range (press *Selector #2*), then fire (press *Selector #1*). Regardless of which ammo you use, BMP armor is so thin that any 120mm round will demolish it at a few hundred meters range. If you miss, try again. Not every shell flies perfectly.

You may have noticed a dark patch near the BMP. This is the position of infantrymen who dismounted (the BMP is an infantry-carrying vehicle). Most of the infantry are invisible on the ground, but their machine-guns or missile launchers are easier to find. Press *Main-Coax* once to switch to your coaxial machine-gun, and then open fire (press *Selector #1*).

Although you can use a rangefinder, it's often easier to watch the tracers hit and "walk" the bullets onto the target — the way you found and hit the truck earlier. HEAT ammunition is effective against infantry, but Sabot (armor piercing) has no effect.

Strong armor, high speed, and hitting the enemy first are the traditional defenses of a tank. However, your M1A1 has three additional devices to help you survive:

Laser Warning: Your M1A1 has a special laser warning light and alarm. This goes off whenever an enemy laser rangefinder strikes your tank. If you've been lased, it's likely that an enemy cannon shell or missile will be headed your way soon!

Smoke Grenade Launcher: These are mounted on your turret. Press the *Smoke Grenade Salvo* key to fire them in whatever direction the turret faces. You have only two (2) salvoes of smoke grenades per tank.

Engine Exhaust Smoke Generator: This device pumps raw fuel into your hot engine exhaust, which makes clouds of smoke come from the rear of the tank. Press the *Exhaust Smoke On* key to turn on this smoke screen, and the *Exhaust Smoke Off* key to turn it off. You have virtually unlimited amounts of engine exhaust smoke, but it only covers your rear.

Defenses

Orders

Vehicle Orders

You can observe the exhaust smoke effect by pressing the *Outside Tank* key and then using the *Controller* to rotate around your tank, seeing it and the smoke screen from all angles.

Instead of operating your tank personally, you can give orders to the crew and they'll operate it for you. The various keys for these orders are summarized on the keyboard overlay. The best place to observe the effect of the orders is outside the tank. Press the *Outside Tank* key.

Movement Orders: First press the *Advance Fast* orders key (usually "A"). This moves your tank forward at maximum speed. Now press the *Advance Slow* orders key (usually "S"). This slows your tank to half its normal speed. When your tank passes the burning BMP and almost reaches the crestline of the ridge (just behind the wrecked BMP) press the *Halt* orders key (usually "H"). If you went too far, press the *Backup* orders key (usually "B") to go in reverse, then order a halt.

Hull Facing Change: You can slew the tank's hull right or left. Press the *Left Turn* orders key (usually "L") to turn left, and the *Right Turn* orders key (usually "R") to turn right. Each press rotates the hull 30°. You can turn a tank when it's stationary or while it's moving.

Turret Facing Change: You can order the gunner to rotate the turret and look for targets in a certain direction. However, once he finds a target, he'll adjust the turret himself to track that target. Therefore you can direct the gunner to watch in some direction, but you can't force him to ignore a target he considers dangerous... unless you take his position.

Press the *Engage to Front* orders key (usually "E") to aim the turret straight ahead. This lines up the gun barrel with the hull. It's a VERY common order.

Press the *Engage to Left Side* orders key (usually "<") to aim the turret slightly to the left of the hull (about 45°). Press *Engage to Right Side* orders key (usually ">") to aim the turret slightly to the right instead. Press the *Engage to Rear* orders key (usually "D") to aim the turret to the rear; that is, facing directly over the engine deck.

Firing Orders: The *Fire at Will* orders key (usually "F") directs the gunner to open fire at any target he's been tracking. Try it. If the gunner's been tracking a target, he'll shoot almost immediately. Then it'll take a few seconds before the loader has another shell in the main gun. Once the gun is loaded, the gunner will fire again if he's still got a live target.

The gunner normally uses Sabot ammunition. However, you can ask for either ammo type by pressing the *Sabot* or *HEAT* keys, or ask for coaxial machine-gun fire by pressing the *Main-Coax* key.

The *Cease Fire* orders key (usually "C") directs the gunner to stop firing. He'll continue to track and range targets, but he won't shoot until you give "fire at will" again.

Experiment with these orders. Go to the mapboard (press the *Mapboard* key), press *Your Tank* key, and zoom in somewhat on your location. Give various orders and watch the effects. Experiment giving orders from various positions inside the

tank. You can literally "look over the shoulder" of the crewmen and watch them operate the vehicle!

You can issue vehicle orders from the Mapboard. In addition to all the normal orders, there are two orders only possible when using the mapboard. To try these, press the *Mapboard* key, then press *Your Tank*, then press *Zoom* a few times until you can see the situation.

Turn To: This order lets you face the vehicle in any direction. Move the mapboard crosshairs to any spot NOT occupied by a friend or enemy, then press *Selector #2*. Your vehicle will turn and face the crosshairs. To confirm that this happened, order an "Advance" and see your tank move in that new direction.

Move To: This order lets you direct the vehicle to any spot on the map. Move the crosshairs to the destination. It must be a location NOT occupied by any friend or enemy. Then press *Selector #1*. Your vehicle will turn toward the crosshairs (like a "turn to" order) and move at full speed toward that point. The vehicle moves in a straight line. If you want to dodge around terrain, use a series of shorter "move to" commands.

You'll have seen and probably destroyed the T-55 and T-80 just to the northeast, and perhaps the MT-LBu spotter and BTR-80 APC (armored personnel carrier) parked around the northern hamlet. Use your newfound command of vehicle orders to move up and destroy any of these still surviving. Watch at least some of the action on the mapboard.

A "hull down" position is vital in tank warfare. You'll practice it on a gentle hill just south of the northern hamlet (where the MT-LBu and BTR-80 were parked). Move onto the northeast section of this low hill. Your goal is to get close, but not over, the northern crestline. You want just the turret peeking over the crestline to the west (see the diagram). This conceals the lower part of your tank from the enemy, making you a difficult target.

Doing It: To get into a hull down position, guide your tank from the gunner's position. Press the *Gunner* key and rotate your turret (with the *Controller*) to aim in the direction you wish to travel. Next press the *Turn to This Facing* key. This lines up the hull with your turret. Now order *Advance Fast*. The tank moves in the direction your turret faces. To stop just order a *Halt*. To backup order a *Backup*. To change course, turn the turret to the new direction and press *Turn to This Facing* again. If the tank is already in motion, it turns smoothly and continues moving.

As you climb the hill, you'll see nothing but the crestline and the sky. As you get closer to the crestline, reduce speed to *Advance Slow*. As soon as you see terrain beyond the crestline order a *Halt*. A good driver stops quickly, keeping the hull behind the crest even though your turret is exposed.

To check if you're hull down, move to the driver's position (press the *Driver* key). If you can't see any terrain beyond the crestline, you're fine (when hull down)

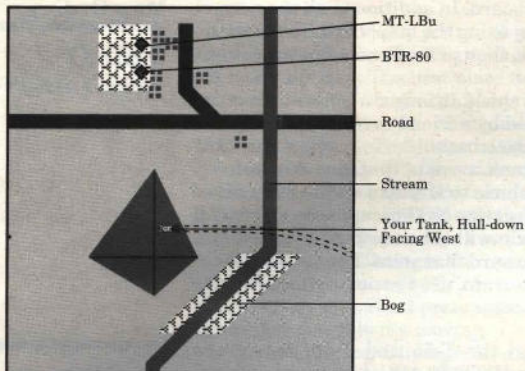
Map Orders

Tactics

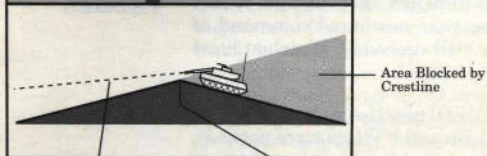
Hull Down

Hull-down Tank

Top View



Side View



Your Line of Sight from Turret

Crestline

the driver can't see anything!). If you can see terrain beyond, back up until it disappears behind the crest, then stop. Now switch back to the gunner's position to make sure the turret and gun-sights are still exposed.

In other words, when you're hull down, the gunner in the turret has a fine view of distant terrain, while the driver just sees crestline and sky.

Variations: Once you're hull down, check the mapboard and notice how far you are from the crestline. This distance varies depending on the steepness of the hill. The steeper the hill, the closer you must be to the crestline. Some hills are so steep that you can't depress the gun far enough to cover the slope on the other side!

Find hull-down positions on various hills. Get a feeling for what map position you need. Good tank commanders have a quick, accurate sense for hull-down positions. Also notice the blind spots caused by crestlines. If you're not careful the enemy could outflank your position and make a surprise attack over the crestline beside you!

Platoon Orders

You can give orders to your entire tank platoon as well as just your tank. In fact, you probably noticed how the other tanks in the platoon raced around, trying to stay in formation with your tank.

Mapboard Command: The only place you can issue platoon orders is on the mapboard. Go there (press the *Mapboard* key), press *Your Tank* to put the crosshairs on your position, then press *Next Platoon* to bring up your platoon's data window. Repeatedly press *Zoom* to see the exact platoon layout. Meanwhile, in the lower part of the data window is a menu of possible orders for the platoon.

Platoon Movement, Facing & Firing Orders: When you issue orders with this data window present, you're issuing orders to the platoon leader, who then instructs the rest of the platoon to follow him. Many platoon orders are just like individual vehicle orders. These include *Move To*, *Turn To*, *Advance Fast*, *Advance Slow*, *Halt*, *Backup*, *Left Turn*, *Right Turn*, *Fire at Will*, and *Cease Fire*.

In some cases the orders go to each individual tank. When you order *Fire at Will*, or *Cease Fire*, each individual vehicle in the platoon gets the order.

Platoon Formations: There are six standard battle formations for a tank platoon: *Wedge*, *Vee*, *In-Line*, *Column*, *Echelon Left*, and *Echelon Right*, illustrated on pages 60-61. When you issue the order to assume a formation, each tank moves to its appropriate spot. It doesn't matter which tank is the leader and/or which tank has your OP (described below), the tanks still go to their appropriate spots (for example, in a column the #1 tank is always at the front). If a tank is immobilized or destroyed, the formation has a gap there. Other tanks do not close up around a hole.

As shown on the platoon data window, formation commands are usually a two-key combination, such as Shift and "W" for *Wedge* formation, Shift and "C" for *Column* formation, etc.

Temporarily leave the mapboard and go to the driver's position. Adjust your facing until it is due north ("H 0" on the Digital Facing Readout). Then return to the mapboard.

Try each of the formations while watching the results on the map. Sometimes you must issue an "Advance" order before the formation "shakes out". Notice that the formation is "aimed" in the direction the leader faces when you issue the order. This is why it was useful to adjust the facing of your leader (#1) tank. Otherwise the formations would be aimed in some other direction, which is sometimes confusing.

Follow Me: Unless detached (explained in the next training run), every vehicle in the platoon always follows the leader's tank. In fact, just turning the leader's hull causes a move: the other tanks reorient their facing and formation based on the leader's facing.

For example, press *Mapboard* and *Next Platoon* keys to get your platoon's data window. Now give an *In-Line* formation order. You'll see your four tanks spread out to your right and left. Now press the *Your Tank* key to get the data window for the platoon leader vehicle. *Zoom* the map to the maximum, which shows the vehicle positions clearly. Now give your tank give a *Right Turn* facing order. As your tank rotates to the right you'll see the other tanks readjust their positions to change the facing of the line.

Experiment with the vehicle orders. Watch how the platoon reacts to them. After you've watched on the mapboard, press *Outside Tank* and repeat the experiments.

To finish the run, ignore the last couple targets on the range. Instead, order your platoon into a column and pull back onto the road and drive south to the southwestern road junction, where the Range Control office building is located. Take a right turn there (to the west) and drive off the road to the west.

The exercise ends when you destroy all targets or leave the battle area traveling east or west.

Ending the Run

C³ : Communications, Command & Control The Team

A "MOVING GUNNERY" TRAINING RUN

This training exercise is designed to teach rudimentary battlefield tactics. Here you can practice coordinating your tanks with mechanized infantry, artillery, and air power. You'll be doing this against an enemy who's rolling forward from the northeast to southwest, but who doesn't fire back.

In this exercise you have a small "Team" (Army term for a heterogeneous group of two or more platoons). Here the Team is always your tank platoon, a section of two M2 Bradley IFVs (Infantry Fighting Vehicles), each of which carries an infantry squad, a battery of 4.2" (107mm) mortars, and an OH-58 scout helicopter.

Examining the Team: To see your team and its components, go to the mapboard (press the *Mapboard* key). Now press *Next Platoon*. The data window for the first platoon — your own M1A1s — appears. Now press *Next Vehicle*. You'll see the first vehicle in the platoon — your tank #1. If you press *Next Vehicle* repeatedly the window changes to tank #2, #3, #4 and then cycles back to #1 again. This way you can see details for all four tanks. Return to your platoon data window by pressing *Next Platoon* once more.

Examining HQ Radio Net Support: Now press *Next Platoon* again. You'll go from your platoon's window to the HQ Radio Net window. This is a summary of "off battlefield" assets assigned to you for this battle. In this case it's a 4.2" mortar battery and a scout helicopter. The window gives the radio call letters for requesting mortar barrages and a helicopter sortie. Simply press the key listed to make the radio call.

Next press *Next Vehicle* repeatedly. This cycles through the various "vehicles" available on the HQ Radio Net. One is the mortar battery, the other is the helicopter. The data windows provide a status report about that asset, and repeat the radio call sign. When you're done looking at each individual asset, go back to the HQ Radio Net window by pressing *Next Platoon* again.

Examining Mechanized Infantry Support: Press *Next Platoon* once more. You'll see the data window for the M2 Section with its two Bradley IFVs and two infantry squads (one carried in each Bradley). When the IFVs are stationary the infantry automatically dismounts, becoming separate items on the mapboard.

Press *Next Vehicle* to examine each of the vehicles and each of the infantry squads in the unit. When you're done, press *Next Platoon* to return to the platoon window.

If you press *Next Platoon* one final time, you'll cycle back to the first platoon again — your own M1A1s.

Deploying Your Support

Maneuvering your platoon and its supports is simply a matter of deciding what to do, then issuing appropriate orders. In this case, you know that an enemy force of tanks and BMPs is moving fast from point Red-2 to Blue-1. Take a look at the mapboard and find both points.

A Simple Plan: A simple strategy would be to set up hull-down defensive positions on the hills near Blue-1. The obvious place to put your defensive forces is on the hill to the northeast and the hill to the northwest of Blue-1.

In this case, we'll put the two M2s hull-down on the northeast hill, one covering the north and one the east. Then two of the M1s will go hull-down on the northwest hill, covering the east. The remaining two M1s will be held in reserve, hidden on the reverse slope behind the hull-down M1s. The scout helicopter will be used to scout the enemy's movements (to prevent unpleasant surprises), and the mortars will be held in reserve, to bombard targets of opportunity.

Hills A and B: To simplify the explanation below, we'll call the hill to the northeast of Blue-1 "Hill A" and the hill to the northwest "Hill B".

Call the Helo: The first step is to call in the scout helicopter. He's the early-warning, so it's important to get him on his way as soon as possible. Use the *Next Platoon* key to reach the HQ Radio Net, and then issue the radio call for the OH-58 Scout Helo, listed in the lower part of the data window (usually it's the "O" key).

Rough Deployments: The next step is to get your vehicles moving in the right directions, fast! Press the *Next Platoon* key again to get your M2 Section. Use the *Controller* to move the crosshairs into the middle of the southwest quarter of Hill A, then press *Selector #1*. This is a "move to" platoon order. The IFVs will shortly begin moving in that direction.

Next press *Next Platoon* until your M1A1 Platoon of MBTs appears. Give them a "move to" platoon order to the southwest part of Hill B.

Specific Deployments for Your IFVs: Once your vehicles are on the move you can refine their movements and destinations. Some wait until vehicles reach the initial objective, but we'll do it on the move to save time.

Press *Next Platoon* until you get the M2 IFV Section. Now press *Next Vehicle* once. This brings you to the first (leader) vehicle of the section. Move the crosshairs to a hull-down position just south of Hill A's western crestline and press *Selector #1*. This orders the first IFV to "move to" that location.

If you zoom the map, you'll notice that the other IFV tags along with the first one. This is because the second vehicle normally follows the unit leader. However, we want to deploy it separately, so press *Next Vehicle* again. The crosshairs will shift to this second vehicle. Use the controller to move the crosshairs to a hull-down position just west of Hill A's southern crestline and press *Selector #1*. The second IFV should split off and head in that direction.

Specific Deployments for Your Tanks: Now back to your tanks. Press *Next Platoon* until you get the M1A1 Platoon, then press *Next Vehicle* until you get tank #3. Give him a "move to" order to a hull-down position just west of the southern crestline of Hill B. Then hit *Next Vehicle* again and order tank #4 to move to a hull-down position beside #3. Now press *Next Vehicle* again for tank #1 and move it to

a position well behind the other two.

What you've done is "split off" tanks #3 and #4 from the platoon leader, sending them to hull-down positions. Meanwhile the leader (tank #1), with tank #2 still following, is moving to position behind the hull-down tanks, where he and tank #2 can stay concealed.

Adjusting Facing: As your IFVs and tanks reach their destinations, you'll find that they continue to face in the last direction moved. However, all armored vehicles have their strongest armor to the front. Therefore you'll want them to face toward the crestline and the enemy.

When a vehicle stops use the *Controller* to move the crosshairs to the vehicle and press *Selector #1*. If the crosshairs are directly over the vehicle, that vehicle's data window will appear immediately. For example, the IFV leader usually reaches his destination first. Move the crosshairs over him, zoom in to make sure you've got the vehicle (not the infantry squad) and press *Selector #1*. The data window for the vehicle should appear. You want this vehicle facing north, so move the crosshairs until they are in open terrain due north of the vehicle. Then press *Selector #2*, (not *Selector #1*). This issues a "turn to" (turn toward the crosshairs) order.

Go from vehicle to vehicle, giving "turn to" orders. Have the first IFV face north and the other to the east. Have all your tanks face to the east. You must give tanks #1, #3 and #4 individual "turn to" orders. This is because tanks #3 and #4 are independent of the platoon (and thus platoon orders no longer apply to them). Do not give #2 an order. He'll continue to stay in formation with #1.

Moving Your OP Between Tanks

Right now your tank (#1) is hidden behind a crestline, unable to see anything. If you press *TC Unbuttoned* you'll see nothing but ridgeline and the two other tanks ahead of you. You'll want to shift "yourself" — the observation point (OP) — to tank #3 or #4, who has a better view (and a chance of firing).

Press the *OP to Next Tank* key once and you're moved from tank #1 to #2. Press *OP to Next Tank* again and you're moved from #2 to #3. Now you can see out over the crestline to the area beyond. Get out the binoculars (*Magnify Vision* key) and look for the enemy!

Note that moving your OP ("yourself", the spirit of the platoon) does NOT move the platoon leader. You can move into a subordinate tank and operate things there. There is an entirely separate key (*Ldr to This Tank*) for changing the platoon leader position. Right now you don't want to do that, since it might mess up your battle plan.

The first time on this training run you'll probably discover the targets reach Blue-1 long before your vehicles finish deploying. That's OK. Just use the *End Battle* key to exit the exercise, then start over again. Hopefully you'll get into position fast enough this time. Quick decisions and efficient order-giving are skills you'll have to learn.

By the time you're done positioning the tanks and IFVs, the scout helicopter should be overhead. With luck he'll spot some enemy vehicles, so you can see what's headed your direction.

Go to mapboard and use *Next Platoon* to access your M1A1 tank platoon. They all start with "cease fire" orders. Press the *Fire at Will* platoon order. Now they'll shoot at any enemy in sight. If you aren't in tank #3 or #4 yet, you'll probably want to go there, get into the Gunner's position, and start hitting targets yourself.

Calling Artillery Support: At some point in the action you might want to fire your mortars. Like all artillery, mortars are not very good at destroying armored vehicles, although they're somewhat effective against lighter vehicles (like BMPs, BTRs, BRDMs, and BRMs).

To fire the mortars, go to the mapboard and use *Next Platoon* to reach the HQ Radio Net data window. Now position the map crosshairs where you want the mortar fire. Press the appropriate radio call key and the mortars will fire at the crosshairs location.

Warning: When calling artillery, always position the crosshair BEFORE you press the radio call key. A common error is making the radio call first, then positioning the crosshairs. Unfortunately, the artillery aims for the original crosshairs position (the position it occupied when you called). If this position is on top of your vehicles (as is commonly the case), then you've just called down artillery onto your own position!!!

When the enemy struggles past your hilltop defenses toward Blue-1, it's time to swoop down and take them in the rear, while they're still moving. For maximum firepower, combine your two-vehicle platoon with the two independent tanks.

Moving The Platoon Leader: The first step is to reassign tank #3 or #4 as the platoon leader. The logical choice is #4, since that is the second-in-command's tank anyway.

First go to the mapboard. Press *Your Tank* to reach the data window for your current OP tank. Now press *OP to Next Tank* repeatedly until you've moved the OP to tank #4. Finally press *Ldr to OP Tank*. This makes tank #4 the new platoon leader. You'll see the "LDR" on the top line of the data window.

Reforming: Your next task is to get everybody back together again. First press *Next Platoon* to return to the platoon data window. Now issue any formation order. *Form In-Line* (usually the Shift and "I" keys) is suggested, although *Form Echelon Right* (usually the Shift and "R" keys) is also appropriate.

Formation orders are the ONLY way to regroup a platoon. Any formation order immediately causes all tanks in the platoon to move into formation around the current leader. Each tank takes his appropriate position. For example Tank #1

Conducting the Battle

Engage the Enemy

Counterattack:

Regrouping a Platoon

always is the first tank of a column, regardless of which tank is the leader.

When you issue the order above, you should see tanks #1, #2 and #3 move to the appropriate formation around tank #4. You can even have tank #4 moving already. In this case, the other tanks will try to catch up and get in formation as fast as possible.

Watching the Action

You can shift your external viewpoint to a vehicle outside your tank platoon. This lets you ride along and watch your OH-58, your M-2s, or any other support vehicle.

To do this, press the *Mapboard* key to see the map. Then use *Next Platoon* and *Next Vehicle* until you've selected the vehicle you wish to watch. Then press the *Outside Any* key. You'll be transported to the outside view from that vehicle. To leave this mode and return to your original (OP) tank, press *Outside Any* again.

Finishing the Exercise

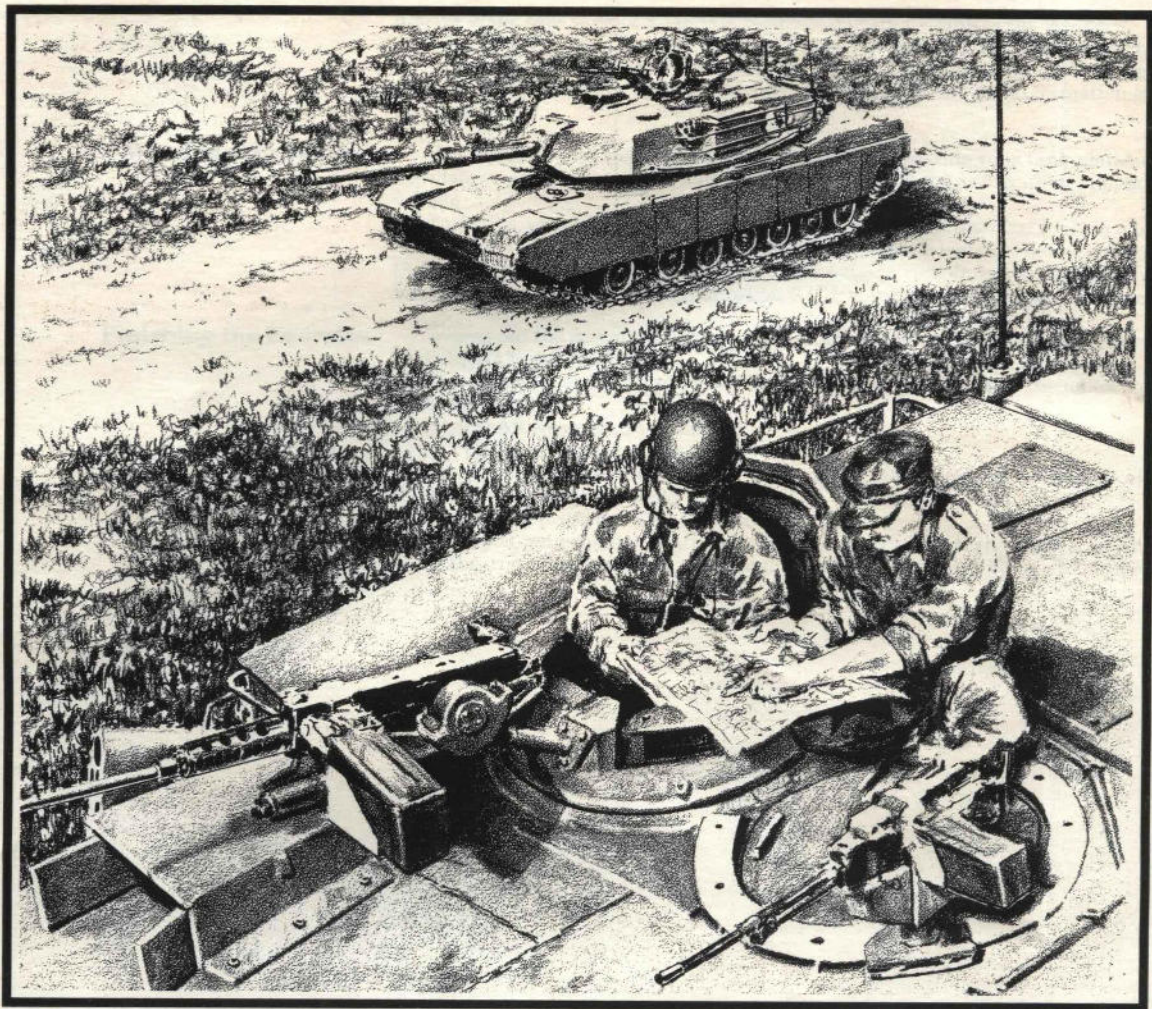
Wiping out the rest of the targets is left as an exercise to you, the commander. It shouldn't be too hard.

This exercise, and any battle for that matter, end when one of the following conditions occurs:

- (1) All enemies are destroyed.
- (2) Your forces are destroyed.
- (3) Your forces retreat off the west edge of the battlefield, or advance off the east edge of the battlefield.
- (4) You press the *End Battle* key.

Note that you cannot end the battle by exiting the battle area to the north or south.

In the case of this exercise, you should try to end it by destroying all targets.



2. OPERATING INSTRUCTIONS

PREPARE FOR BATTLE

M1 Tank Platoon has a variety of training and battle environments. To make a choice, first use the *Controller* to move the highlight up and down. Then press *Selector #1* to choose that option.

First you may be asked questions about your computer hardware. See the Technical Supplement for information, including details about various trade-offs.

Hardware Options

You can create and keep records of numerous different M1 tank platoons. Here you select which platoon you'll command.

Creating or Selecting a Platoon

To create a new platoon select an appropriate nickname. But be warned, creating a new platoon automatically erases the previous platoon's record.

Combat Assignments

First-time platoon commanders are urged to select "Static Gunnery" for their first assignment and "Moving Gunnery" as their second. This permits training that may save lives in real battle.

Static Gunnery is a training exercise that acquaints you with terrain, vehicle performance, and how to identify enemies. All targets are stationary, at the positions shown on the map. No enemies will fire.

The exercise is best conducted with the tutorial (pages 13-28). However, you can just "run" the range as you wish, examining targets and shooting them up. On real ranges you're supposed to drive along the road (counterclockwise here), hitting targets as soon as you spot them.

Moving Gunnery is a training exercise that acquaints you with engaging moving targets. The "enemy" has one platoon of three (3) T-80 tanks, and two platoons of infantry,

Terminology

For compatibility across a wide variety of computers and control mechanisms, standard terms are used throughout. See the Technical Supplement and Keyboard overlay to interpret each for your computer.

Controller: A two-dimensional control device, normally a joystick, mouse, or four-directional cursor keys.

Selector #1: The first (left) button on a joystick or mouse. On the keyboard it is always the Return or Enter key.

Selector #2: The second (right) button on a joystick or mouse. On the keyboard it is always the Space Bar.

Keys: Each is referred to by an *italicized name*, which is shown on the keyboard overlay. In addition, a master list of names and keys for your computer is given in the Technical Supplement.

Controls and Commands

Controls are specific dials, switches, etc. used to operate a tank. .

Commands are general orders given to a tank crewman, an entire tank, or an entire platoon (or section) of vehicles.

Controls: The controls for a single tank are all on the keyboard, using keys labeled on the keyboard overlay. These controls include driving, operating the turret and guns, and using the various vision devices available.

Whenever you touch one of these controls, you have "taken over" at that crew position. The "real" crewman there will stop functioning and let you run things. Whenever you leave that view, the "real" crewman takes over again.

Commands: These are general instructions to either a specific vehicle ("vehicle orders"), or to a group of vehicles ("platoon orders"). Whenever you issue a command, all crewmen of all affected vehicles immediately do whatever's required to carry out your order. The only exception is the position you occupy — if you've already "taken over", then the crewman there remains aside, letting you run things at that position. However, if you issue commands while at the mapboard, then nobody has "stepped aside", so every crewman will obey.

The type of commands available depend on what's on the screen. Generally, you're restricted to "vehicle orders" — orders to the crew of the vehicle you occupy (or the last vehicle you occupied, when on the mapboard or outside the tank). You can only issue "platoon orders" on the mapboard, and then only when a platoon data window is showing (see page 58).

Follow Me: All tanks in the platoon will follow the leader's tank. They will keep formation on his hull. They will cover various fields of view and fields of fire, depending on the formation.

If you jump to another tank, you automatically transfer platoon leadership to that tank. Therefore, the platoon follows whichever tank you occupy.

each mounted in three (3) BMP-2 IFVs (infantry fighting vehicles). The enemy company commander is in another BMP-2, with the first platoon. Thus the total enemy force is three T-80s and seven BMP-2s. They're moving from Red-2 in the northeast toward Blue-1 southwest.

You have your platoon of four M1A1 tanks, plus a section of two M2 IFVs, each with an infantry squad aboard. In support you have a battery of 4.2" (107mm) mortars and an OH-58D "Kiowa" scout helicopter.

Your job is to engage and destroy the enemy tanks and IFVs before they reach Blue-1. You have plenty of freedom to experiment, since the enemy isn't shooting back!

Single Engagement gives you a choice of six battle situations. You select the type of battle and objectives, but the battlefield terrain and specific enemy forces are generated anew each time, resulting in millions of different situations.

Start Campaign: This sends your platoon into a conventional war. Your men and tanks will fight one battle after another until either the war ends or your platoon is destroyed. Your victories and defeats have an effect on upcoming battles, and ultimately determine the outcome of the war. For example, if you lose a battle you'll probably be on the defensive next time, and if you lose enough battles you'll lose the war.

Continue Campaign: If the platoon previously started a campaign, use this option to return to the campaign in progress. You'll arrive at the bivouac.

Abandoning a Campaign: When a platoon is currently involved in a campaign, if you select either a training exercise or a single engagement, then the campaign is abandoned. The platoon *may not* resume the campaign at a later date.

Platoon Records: You can save permanent records of your platoon fights, with a running total of kills, casualties, and overall score. Unfortunately, army psychologists won't let you fight forever. After 99 battles you're rotated back to the home front, like it or not! Try to do your best while you have the chance.

Vehicle Identification Quiz

In real battles and campaigns, you must pass a vehicle identification quiz before taking command. Look through the vehicle illustrations in this manual (pages 127-134 and 150-162) and find the drawing which matches the screen illustration. Observe carefully details such as the shape of the turret and the arrangement of the bogie wheels. Use the *Controller* to highlight the correct name, and press *Selector #1* to confirm your choice.

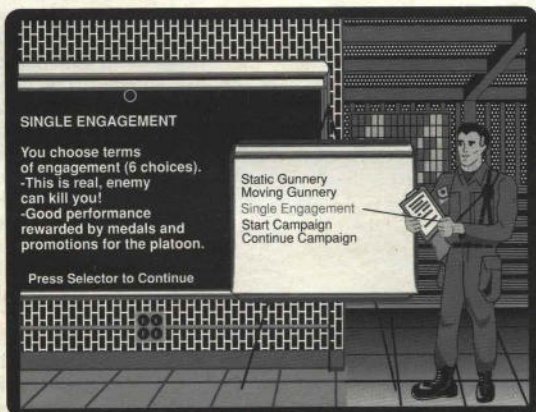
Single Engagement Options

This option appears only if you select a single engagement. Select the type of battle you prefer.

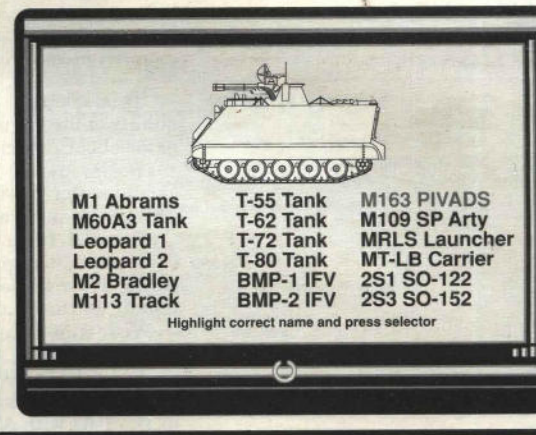
Your selection determines the overall objectives of the engagement. However, the battlefield, weather and forces on each side will vary. There are billions of different possibilities.

In general, the engagements are listed in order of difficulty, from Blitzkrieg (the easiest) to Rearguard (the most difficult). However, luck plays a role too. Terrain and

Staff Briefing



Vehicle Identification



forces can make some rearguards easy, while a blitzkrieg could be quite challenging. As in real war, you're never quite sure what can happen.

Blitzkrieg: Your forces have broken through the line and are plunging deep into enemy territory. You might find yourself overrunning enemy headquarters and other rear-area forces, or suddenly confronted with fresh reserves brought up to block you. Your goal is to overrun Red-2, leave a small garrison (one or two vehicles), then drive off the eastern side of the battle area. Meanwhile you should inflict the maximum damage possible on the enemy.

Meeting Engagement: Your force leads an advancing task force, probing for the enemy. Your opponents are doing the same, causing that classic military situation: a meeting engagement. Your primary mission is to seize and hold position Red-2, then find the enemy and destroy him. It's likely that his goals are the same, although he's probably headed for Blue-1.

Hasty Attack: Your force is on the move, maneuvering to the attack while the enemy moves to block and hold you. Your goal is to capture Red-2. You usually have less support than an assault (see below), but usually the enemy is weaker too.

Assault: Your force at Blue-1 is ordered to assault Red-2. The enemy has heavily reinforced his defenses, perhaps with flank ambushes. You must capture the objective at all cost.

Defend Position: Your force is ordered to protect Blue-1 from enemy attack. As long as you have intact, combat-worthy troops within a few dozen meters of Blue-1, you'll fulfill your orders. However, you'll probably be outnumbered and outgunned. Therefore it's unwise to "plant" your entire force on the objective and slug it out.

Rearguard Action: You're the rearguard, holding off the enemy so other troops can escape. Your job is to inflict heavy casualties, then retire before losing too many vehicles yourself. Holding Blue-1 is of minor value — keeping the majority of your force intact is vital.

Enemy Quality

This selection determines the overall skill of the enemy soldiers and the quality of their equipment. It also adjusts the amount of "optimism" built into the game about American equipment and personnel.

Beginners are urged to try "second line" troops, while experienced players should select "first line" or "veterans", depending on their opinion of American equipment and training. Only the most experienced should try "guard (elite)".

Second Line (Very Green): These troops are inept, slow reacting, and equipped with obsolete equipment such as T-62 tanks, BMP-1 IFVs, and BTR-70 APCs. Their leaders are very unimaginative, with a tendency to drive forward blindly on the attack.

Your American equipment performs perfectly and the tank crews are generally well-trained.

First Line (Well Trained): These troops are adequately skilled in their tasks. Their equipment is similar to second line, but includes better tanks, such as the T-64 with AT-8 missiles and the T-72. Their officers show tactical compe-

tence, but are slow to react to new situations.

As in "second line", equipment is good and crewmen are well trained.

Veterans (Combat Experience): These troops are well skilled and combat experienced, often with Afghanistan service. They also use T-64 and T-72 tanks, as well as the new BMP-2s and BTR-80s. Their officers are also tactically competent.

The rating of American equipment is pessimistic, rather than optimistic. Similarly, crew training is adequate, but hardly noteworthy.

Guards (Elite): These troops are top-notch experts. They're veterans with the very latest equipment, including T-80 tanks outfitted with AT-8 missiles, BMP-2s, BTR-80s, etc. Their leadership is the best available in the Russian Army.

Here the rating of American equipment remains pessimistic. New crew training has little relevance to combat: you'll have to train them all yourself!

Bivouac - Outfitting

There is no bivouac before gunnery range training exercises. But before each "real" battle the bivouac provides important options.

Here you can examine the status of each tank and the record of each crewman. You can switch crewmen between tanks and adjust the ammunition load of each vehicle.

The outfitting table has four columns across the top, one for each tank. Each column shows the tank's name, its four crewmen, and its ammo load.

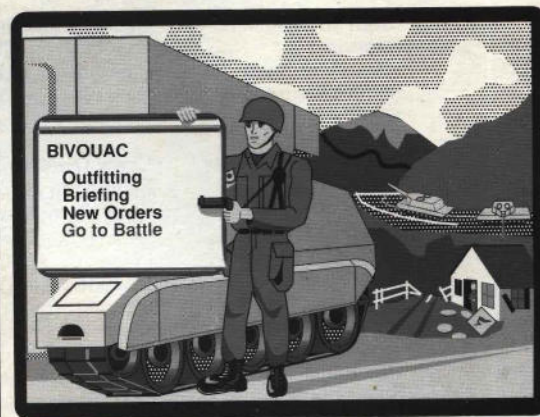
Tank & Crew Status: To see detailed data about a tank or crewman, highlight that word (use the *Controller* to move the highlight) and press *Selector #1*.

The tank status gives a maintenance report about the vehicle. In most cases the tank is in full working order. However, after a particularly destructive battle you may find some tanks with a few things not working.

The crew status chart gives the name, rank, decorations, skill, and current job of a crewman.

Changing Ammo Loads: M1A1 tanks carry 40 rounds of 120mm ammunition. The normal load is half M830 HEAT-MP-T shells and half M827 APFSDS-T Sabot (armor-piercing) shells. However, you can adjust this mix by highlighting an ammo type, then pressing *Selector #1*.

Bivouac Briefing



Bivouac Outfitting

Bill's Bombers

M1-A1	1	M1-A1	2	M1-A1	3	M1-A1	4
C:2Lt Meier	Pr	C:2Lt Knoll	Fr	C:2Lt Meier	Fr	C:Sfg Ciola	Fr
G:Sgt Jules	In	G:Sgt Oliver	Fr	G:Sgt Chap	In	G:Sgt Leigh	Fr
D:Sgt Koefler	In	D:Sgt Koefler	In	D:Sgt Pflum	In	D:Sgt Milton	In
L:Cpl May	Gd	L:Cpl May	Gd	L:Cpl Gletch	Gd	L:Cpl Kogi	Fr
Ammo:HEAT=20		Ammo:HEAT=20		Ammo:HEAT=20		Ammo:HEAT=20	
SABOT(AP)=20		SABOT(AP)=20		SABOT(AP)=20		SABOT(AP)=20	

Repairs Completed, Replacements Received.

Data: Highlight vehicle or name,
press Return (fire button 1).
Switch Crewmen: Highlight first name,
press Space Bar (fire button 2),
highlight other name, press Space(2) again.
Adjusting Ammo: Highlight ammo name,
press Return (Fire button 1) to
increase ammo of that type.

Press Escape (ESC) when done.

Tank Crew Abbreviations

Crew Ranks (high to low)

Cpt	Captain
1Lt	First Lieutenant
2Lt	Second Lieutenant
1Sg	First Sergeant
MSg	Master Sergeant
SFg	Sergeant First Class
SSg	Staff Sergeant
Sgt	Sergeant
Cpl	Corporal
PFC	Private First Class
Pv2	Private (E2)

Crew Positions

C or TC	Tank Commander
G or GN	Gunner
D or DR	Driver
L or LD	Loader

Crew Quality (best to worst)

Ex or Expt	Expert
Sp or Supr	Superior
Gd	Good
Fr	Fair
Pr	Poor

Medals and Decorations

CMOH	Congressional Medal of Honor
DSC	Distinguished Service Cross
SS	Silver Star
BSV	Bronze Star for Valor

Crewmen & Ranks

Certain positions in an M1 require more training and responsibility than others. Therefore, the military assigns men of higher rank to these positions. Assigning higher ranking personnel to low-importance positions within a tank not only violates standard procedure, it also demoralizes the crew, reducing their proficiency. The importance of crew positions is:

Tank Commander: highest ranking crewman
 Gunner: second highest crewman
 Driver: third highest crewman
 Loader: lowest ranking crewman

Equal ranks do not cause problems. For example, if the Gunner and Driver are both Corporals, there are no problems. But if the Gunner is a Corporal and the Driver is a Sergeant, then the tank's crew performance may suffer.

Moving Crewmen: You can move crewmen between positions and/or between tanks. Use the *Controller* to highlight a crewman and press *Selector #2* to start the move. Now move the highlight to the man he'll switch with and press *Selector #2* again. To cancel a move after you've started, move the highlight back to the man you initially selected and press *Selector #1*. This aborts the transfer.

There is a disadvantage to transferring crewmen — their quality drops. This is because a transfer must learn a new job and/or learn how to fit into a new team.

Bivouac - Briefing

Here the battalion HQ staff briefs you on the upcoming battle. You get "the big picture" background, your orders, initial dispositions, and intelligence on the enemy. A weather report is provided also.

Bivouac - Other Options

You can't leave the bivouac until you've seen the briefing. Then you have two new options:

New Orders: If you don't like the upcoming operation, you can request new orders. In reality, tank platoon commanders have little choice in such matters. This option is meant for gamers who think the upcoming battle looks too difficult or too easy.

Go to Battle: This means you'll leave bivouac and go to the battle area. You'll see the battlefield from the mapboard and start in the platoon command tank (tank #1).

THE M1A1

Viewpoints

Each of the four M1A1 tanks in your platoon has six viewpoints. Four of these are views from inside a tank. The fifth is the mapboard, and the sixth a view from outside a tank.

TC Unbuttoned gives the view from the tank commander's (TC's) hatch when open. This position provides the best view of the battlefield. You can control directly the caliber .50 heavy machine-gun and the turret-side smoke grenade launchers.

TC Buttoned gives the view through vision blocks around the closed commander's hatch. This view is poorer than unbuttoned and lacks night-vision aids, but the TC is safe from nearby explosions. As before, you control the heavy machine-gun and smoke grenade launchers.

Gunner gives the view from the Gunner's Primary Sight (GPS). The field of view is limited, but magnification and night vision devices are the best on the tank. The gunner controls the turret, including the laser rangefinder, 120mm main gun and the coaxial machine-gun.

Driver gives the view from the driver's seat. This perspective is less useful because it's lower to the ground and lacks magnification. It does have a night-viewer (an image intensifier). The driver controls the direction and speed of the tank hull.

The Mapboard gives an overview of the entire battlefield. The view can be zoomed in and out for more detail. Windows of data about friendly and enemy forces appear to the right. You must use the map to exercise platoon command functions; see "Orders & The Mapboard" (pages 54-67) for details.

Outside places you outside the vehicle, on the battlefield, looking at your tank. It lets you watch what's happening as if it were a movie. See "Simulation Controls" (pages 68-69) for details.

Your controls are divided into four categories:

Vehicle Controls: These control the internal functions of a single tank. They are equivalent to pressing buttons, turning dials, and moving handgrips in the real vehicle. When using these controls you are "overriding" the crewman at that position, taking over his job. Hopefully you'll do better than he.

Viewpoint Controls: These move you from one viewpoint to another. If you move to a viewpoint inside the vehicle, you can watch the crewman operating the controls. If you touch a vehicle control, the crewman stops and you take over. When you leave a viewpoint the crewman takes over from you.

Vehicle Orders: These direct a single vehicle to perform some action, such as move forward, open fire, cease fire, etc. The vehicle crew does what's necessary to execute your orders, although their speed and accuracy depends on their individual skill.

Platoon Orders: Platoon orders allow you to tell an entire group of vehicles

Controls

Standard Vehicle Controls

These controls function in any of the four vehicle interior viewpoints. If the controls are directly accessible from that viewpoint, it's assumed that you personally operate them. If the controls are elsewhere in the vehicle, it's assumed that you're telling another crewman what to do.

Magnify Vision: The *Magnify Vision* key toggles between low and high magnification optics. Everyone but the driver has two different optics settings (although the specific levels of magnification vary). The driver has only one setting, so this switch has no effect there.

Night Vision: The *Night Vision* key toggles between normal "daylight" viewers and special nighttime viewing aids. Night vision aids are not available in certain TC (tank commander) viewpoints.

Smoke Grenades Controls: Each press of the *Smoke Grenades* key fires a salvo of six smoke grenades. Each tank only has two salvos of smoke grenades.

Sabot (AP) Switch: The *Sabot (AP)* key switches the gunlaying system (including the ballistic computer) to "sabot" armor piercing ammunition. The loader makes sure the 120mm main gun is always loaded with a round of M827 APFSDS-T "sabot" ammunition.

HEAT Switch: The *HEAT* key switches the gunlaying system (including the ballistic computer) to HEAT (high explosive anti-tank) ammunition. The loader makes sure the 120mm main gun is always loaded with a round of M830 HEAT-MP-T ammunition.

Main-Coax Switch: The *Main-Coax* key switches the gunner's controls between the 120mm main gun and the 7.62mm coaxial machinegun. The gunner can fire one or the other, but not both at the same time.

Normal/Battlesight Switch: The *Normal-Battlesight* key switches the gunner's controls between "normal" operation using the ballistic computer and "battlesight". Ballistic computer operation is the "normal" mode. "Battlesight" only operation requires the gunner to determine the range himself, then adjust superelevation and lead manually.

Battlesight Range Input: The *Input Battlesight Range* key sends the battlesight range for the current ammunition to the ballistic computer. If the 120mm main gun is switched to "sabot" the input is 1500 meters; if the gun is switched to "HEAT" the input is 800 meters.

Manual Range Input: The *Manual Range Input* keys allow you to type a range into the ballistic computer. This is useful if you can't get a useful reading from the laser rangefinder, and the distance is beyond battlesight range.

Smoke Generator On: The *Smoke On* key turns on the exhaust smoke generator. The tank's exhaust will emit clouds of smoke from its rear. This continues until you turn it off.

what to do. These only function on the Mapboard viewpoint, and then only in certain circumstances. See "Orders & The Mapboard" (pages 54-67) for details.

TC (Tank Commander) Position

TC Unbuttoned Position

This is the viewpoint from the Tank Commander's cupola hatch when it's open ("unbuttoned"). Your view and the TC's controls are described below. Also see the illustration below.

Turret Roof: You are looking out over the tank's turret roof.

Outside View of the Countryside: When looking out, you see the countryside around your tank. You could be viewing the countryside with normal eyesight, or with 7x35 (seven-power) military binoculars. The binoculars have an image-intensifier option for night vision.

To rotate your view left-right and/or up-down, use the *Controller*.

The speed of movement depends on how far you've moved the *Controller*. Unless the *Controller* is self-centering (most joysticks are self-centering), the

movement continues until you make a single entry in the opposite direction. The *Controller Position* gauges are very useful for understanding what direction in which you're looking, or why your view is spinning left or right.

Magnify Vision Key: This key toggles between normal and high magnification. Normal magnification is always one-power (1x), equivalent to normal eyesight. High magnification is seven-power (7x) using your 7x35 military binoculars.

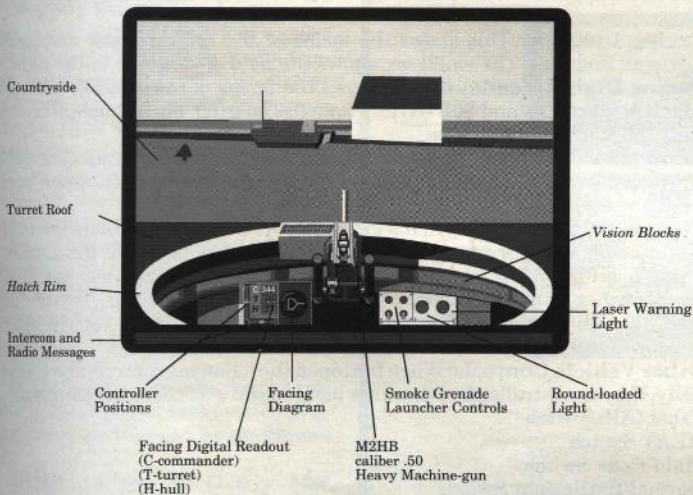
Note that at low-power (1x) your viewpoint rotates faster than at higher magnifications. Use the low-power to quickly scan for trouble or reach a direction, then switch to high-power to see the details.

Night Vision Key: To toggle on and off the image-intensifiers in your binoculars, press the *Night Vision* key. This option is only effective when you're unbuttoned and using binoculars (7x magnification). There are no night vision aids for low-power (1x) unbuttoned vision, and no aids whatsoever for viewing while buttoned up.

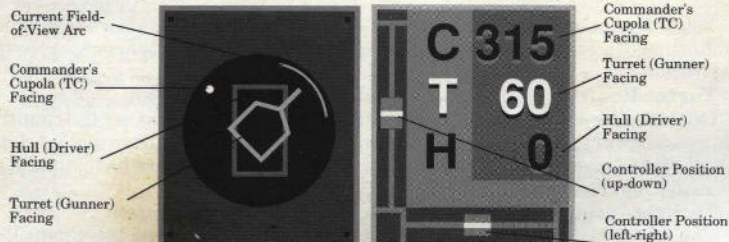
M2HB caliber .50 heavy machine-gun: In front of you is the TC's

TC Unbuttoned View

Items labeled in italics are for background information only



Tank Facing Diagram



roof weapon, for use against aircraft, helicopters, and ground targets with little or no armor. The gun aims at the middle of your view. Use your *Controller* to aim left/right and up/down.

To fire the gun press *Selector #1*. Each press fires a burst of machine-gun bullets, including a tracer that makes the burst visible.

Laser Warning Light: This light turns on and a warning message appears if an enemy laser "bounces" off your tank. This means the enemy is aiming a gun or missile at your tank, and is probably about to fire.

Smoke Grenades Salvo Controls: Each tap of the *Smoke Grenades* key fires a salvo of smoke grenades in whatever direction your turret faces. Each tank only has two salvos of smoke grenades available.

A tank has two smoke grenades salvos. If the control panel toggle switch is "up" and the light is on, that smoke salvo has been fired.

Round-loaded Light: This light is on if the 120mm main gun is loaded. The light is off if the gun is not loaded (i.e., the loader hasn't finished loading another shell).

Facing Diagram: This shows the facing of the vehicle's tank commander (TC), turret, and hull. The small arc shows the field of view now in the sight.

Facing Digital Readout: This shows the facing of the vehicle's tank commander (C), turret (T), and hull (H) as a compass bearing. For example, 0 is north, 90 east, 180 south and 270 west.

Controller Positions: These two "sliding bar" gauges show your *Controller's* up-down position and left-right position. This is especially useful when cursor keys are the *Controller*.

Turn to this Facing Key: This key instructs the driver to rotate the hull to the TC's facing. The turret will also rotate to this facing only if the gunner is currently looking for targets straight ahead, but hasn't found any yet. If he's looking elsewhere (i.e., has orders to "engage" left, right or the rear), or is tracking a target, then the turret won't come around. The "engage front" vehicle order is needed for that (see page 58).

Other Vehicle Controls: When buttoned the following controls also operate. Actually, they're controlled by other crewmen, so you won't see any controls move.

- Sabot (AP) Switch
- HEAT Switch
- Main-Coax Switch
- Normal/Battlesight Switch
- Battlesight Range Input

Manual Range Input
Smoke Generator On
Smoke Generator Off

See the "Standard Vehicle Controls" box on page 38 for more information on these.

This is the viewpoint from the Tank Commander's cupola hatch when it's closed ("buttoned up"). Here the TC sits directly behind the gunner, so he sees the gunner's console as well as his own vision block and controls. Your view and the TC's controls are described below. Also see the illustration below.

Outside View of the Countryside: (The area around your tank) You're viewing the countryside through the forward vision block and commander's machine-gun sight. This has normal and 3x (three-power) magnification options.

As in the TC Unbuttoned view, use the *Controller* to rotate your view left-right and/or up-down. The speed of movement depends on how far you've moved the *Controller*. Unless the *Controller* is self-centering (most joysticks are self-centering), the movement continues until you make a single entry in the opposite direction. The *Controller* Position gauges are very useful for understanding what direction you're looking, or why your view is spinning left or right.

Magnify Vision Key: As in the TC Unbuttoned position, this key toggles between normal and high magnification. Normal magnification is always one-power (1x), equivalent to normal eyesight. High magnification is three-power (3x), not seven-power. Because with the hatch closed you cannot use binoculars. Instead you use the high-power option on the caliber .50 gunsight.

Note that at low-power (1x) your viewpoint rotates faster than at higher magnifications. Use the low-power to quickly scan for trouble or reach a direction, then switch to high-power to see the details.

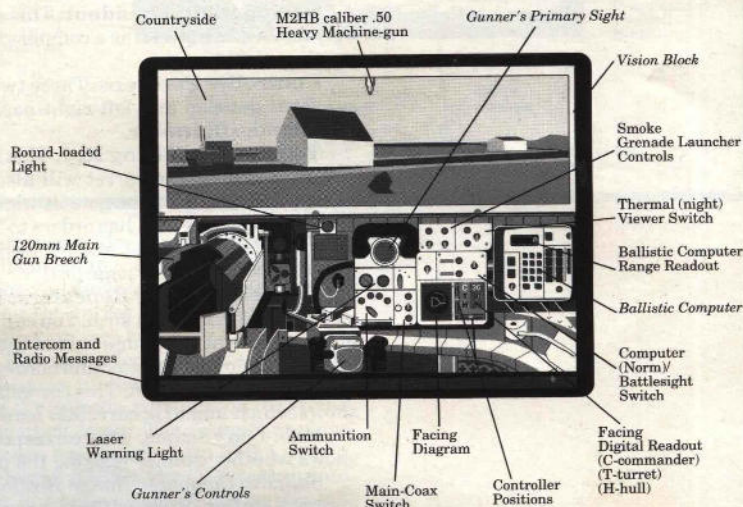
Night Vision Key: This key has no effect — there are no night-vision aids available to the TC when he's buttoned up.

M2HB caliber .50 Heavy Ma-

TC Buttoned Position

TC Buttoned View

Items labeled in italics are for background information only



chine-gun: Here you see the barrel tip of the commander's weapon. This machine-gun is useful against aircraft, helicopters, and ground targets with little or no armor.

The gun is lined up to the middle of your vision block gunsight. Therefore use the *Controller* to aim left/right and up/down.

To fire the gun press *Selector #1*. Each press fires a burst of machine-gun bullets, including a tracer that makes the burst visible.

Laser Warning Light: This light turns on and a warning message appears if an enemy laser "bounces" off your tank. This means the enemy is aiming a gun or missile at your tank, and is probably about to fire.

Smoke Grenades Salvo Controls: Each tap of the *Smoke Grenades* key fires a salvo of smoke grenades in whatever direction your turret faces. Each tank only has two salvos of smoke grenades available.

A tank has two smoke grenades salvos. If the control panel toggle switch is "up" and the light is on, that smoke salvo has been fired.

Round-loaded Light: This light is on if the 120mm main gun is loaded. The light is off if the gun is not loaded (i.e., the loader hasn't finished loading another shell).

Facing Diagram: This shows the facing of the vehicle's tank commander (TC), turret, and hull. The small arc shows the field of view now in the sight.

Facing Digital Readout: This shows the facing of the tank commander (C), turret (T), and hull (H) as a compass bearing. For example, 0 is north, 90 east, 180 south and 270 west.

Controller Positions: These two "sliding bar" gauges show your *Controller's* up-down position and left-right position. This is especially useful when cursor keys are the *Controller*.

Turn to this Facing Key: This key instructs the driver to rotate the hull to the TC's facing. The turret will also rotate to this facing only if the gunner is currently looking for targets straight ahead, but hasn't found any yet. If he's looking elsewhere (i.e., has orders to "engage" left, right or the rear), or is tracking a target, then the turret won't come around too. The "engage front" vehicle order is needed for that (see page 38).

Gunner Position Repeaters: Indicators on the gunner's console are also visible here, in reduced form. You can give instructions to the gunner and see some of the results here. A summary of these repeaters is given below; see the Gunner Position (below) for more information.

Ammunition Switch: This corresponds to the switch at the gunner's station. It shows which ammo is currently loaded.

Main-Coax Switch: This corresponds to the switch at the gunner's station. It shows whether gunner is using the main gun or coaxial machine-gun.

Ballistic Computer Range Readout: This corresponds to the readout at the gunner's station. It shows the last range entered into the ballistic computer, either manually or automatically by the laser rangefinder.

Computer/Battlesight Gunlaying Switch: This corresponds to the switch at

the gunner's station. It shows whether the gunlaying system is using the ballistic computer (normal) or the battlesight (i.e., no computer aid).

Thermal Viewer Switch: This corresponds to the switch at the gunner's station. It shows whether the gunner's thermal (night) viewer is on or off.

Gunner Position

This is the view from the gunner's seat. This position includes the Gunner's Primary Sight (GPS), the ballistic computer, and controls for both the 120mm main gun and the 7.62mm coaxial machine-gun

Turret Control and Optics

Turret Rotation: Moving the *Controller* left or right rotates the turret. The amount of *Controller* input determines the rotation speed (watch the *Controller* positions on the facing diagram if you're not sure how fast it's turning). Unless the *Controller* automatically centers (on most joysticks), to stop turret rotation you must hit either the centering control for the *Controller*, or tap once in the opposite direction.

The gunner's sights and equipment are all built into the turret. Therefore, as you rotate the turret, your view and your weapon all move together. Note that the TC's and driver's views do NOT change when the turret turns. Also note that turret rotation speeds vary with GPS magnification (see below).

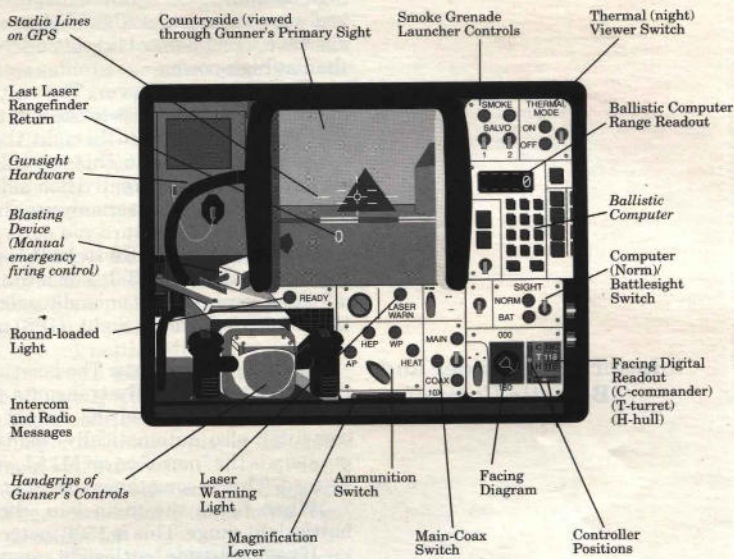
Elevation & Depression: Moving the *Controller* forward lowers or back raises the gunner's sights and weapons. Just as in rotation, the amount of *Controller* input determines the speed (watch the Selector positions on the facing diagram if you're not sure how fast it's moving up or down). The system has stops at 20 degrees elevation up (+20°) and 10 degrees depression down (-10°).

View through the Gunner's Primary Sight (GPS): The GPS is built into the tank turret. It provides a magnified view in whatever direction you aim the turret and its weapons.

Stadia Lines on the GPS help the gunner align the center of the sight onto

Gunner's View

Items labeled in italics are for background information only



a target. The lines are arranged in 'mil' increments to aid in visual range estimation.

Magnify Vision Key: The *Magnify Vision* key toggles between normal and high magnification. Normal magnification in the Gunner's Primary Sight (GPS) is always three-power (3x). High magnification is ten-power (10x). The GPS does not have a one-power (1x) setting. Note that at low-power you can rotate faster than at high-power.

Magnification Lever: The control panel lever shows which magnification is in use. When the lever is to the left, the GPS is set to three-power (3x) magnification. When the lever is to the right, the GPS is set to ten-power (10x) magnification.

Night Vision Key: This toggles on and off the thermal viewer. The thermal viewer is a superior night-vision aid that also sees through most smoke screens. Since the thermal viewer only sees heat signatures, friendly and enemy vehicles look the same. Make sure you don't fire at a friend by mistake!

Thermal Viewer Switch: This panel switch with lights shows if the thermal (night) sight is on or off. It's on if the upper light is on and toggle switch is up. It's off if the lower light is on and toggle switch is down. If the thermal viewer is off, the Gunner's Primary Sight (GPS) uses the normal optical system instead.

Laser Rangefinder and Ballistic Computer

Gunnery Concepts: The laser's sole purpose is to measure the distance to a target. It automatically transmits the result to the ballistic computer, which elevates the gun barrel the correct amount for an accurate shot. The ballistic computer also automatically "leads" moving targets. Although computerized gunnery is the "norm" on an M1A1, you can use the non-computerized battlesight instead. This is sometimes useful at shorter ranges.

When firing the main gun, the critical issue is whether you are within battlesight range. This is 1500 meters for Sabot (AP) ammo, 800 for HEAT ammo.

If you're outside battlesight range, the shell drops down enough while in flight to force you to aim above the target to "arc" your fire. This aiming above the target is termed "superelevation". If you tell the ballistic computer the correct range, it will compute the superelevation for you. Therefore it's important to use the rangefinder just before each shot, so the computer has the correct range. If the computer is broken, you must superelevate the gun by your own eyeball estimate. Otherwise the shell will almost surely land short.

If you're within battlesight range, shells travel virtually straight to the target. If you switch from computer to battlesight, you can simply put the gunsight onto a target and fire. However, it's wiser to simply enter the battlesight range into the computer and leave it on (just in case the gunner needs the computer again later!). In fact, this is so common that there's a special control that automatically enters the battlesight range for the current ammo type!

Laser Rangefinder: The laser rangefinder "fires" its beam at whatever is in the center of your GPS gunsight. Press *Selector #2* to fire the laser. The result appears directly on the gunsight.

The laser only "reads" returns between 200 and 8000 meters. Any return less

than 200 or more than 8,000 returns a flashing zero ("0") instead. All valid returns (values between 200 and 8,000) are sent automatically to the ballistic computer. Flashing "0" results are not sent to the computer.

When the laser is broken the gunsight readout is always a flashing "0".

Ballistic Computer Range Readout: This LED readout shows the last range entered into the ballistic computer. Normally it comes from the laser rangefinder, but you can manually override this value in one of two ways: ballistic range input, or true manual range input.

If the computer is broken, the readout is always "8888".

Battlesight Range Input: The *Input Battlesight Range* key sends the battlesight range for the current ammunition to the ballistic computer. If the 120mm main gun is switched to Sabot (AP) ammo, the input is 1500 meters. If the gun is switched to HEAT ammo the input is automatically 800 meters. These values override any previous input.

Manual Range Input: The *Manual Range Input* keys allow you to type a range into the ballistic computer. In most cases you must hold down the "Shift" key to type in the numbers. Use the numbers across the top of the keyboard, not the numeric keypad.

Manual input is handy if the range is beyond battlesight and your laser rangefinder is broken, but you know the range (or can make a good guess).

Normal/Battlesight Switch: The *Normal-Battlesight* key toggles the gunner's controls between "normal" operation using the ballistic computer and "battlesight" operation where gunlaying requires gunner estimation (using the stadia lines) and then manual adjustment for lead and superelevation.

The control panel switch is up (with the upper "Norm" light on) if the "normal" ballistic computer is controlling the system. The switch is down (with lower "Bat" light on) if you're using the battlesight and no computer.

Firing from a Moving Tank: If you're firing from a moving tank, the turret stabilization system automatically corrects for tank motion. That is, the turret counter-rotates to remain facing in the same direction. Stabilization also keeps the turret steady as you move over bumps and through gullies.

However, stabilization isn't perfect. You'll still need to make some compensations when tracking targets from a moving tank, and bumps can still throw you off.

Leading a Moving Target: If you're firing at a moving target, simply keep the gunsight on the target. Smoothly and slowly rotate the turret left or right as the target moves. The ballistic computer will automatically sense the turret rotation and apply sufficient "lead" to score a hit. Of course, the computer must have an accurate range to the target, otherwise its lead calculations will be in error.

To turn "off" the computer's automatic-lead function, just make sure the turret is stationary for about a half second before you fire.

Some M1A1 crewmen believe that the computer's lead calculations for HEAT are insufficient. If your HEAT shells fall behind a moving target, try adding a little

extra lead yourself for the next shot.

Ammo & Firing Controls

Main-Coax Switch: The *Main-Coax* key toggles the gunner's weapon control between the 120mm main gun and the coaxial machine-gun. The sight and ballistic computer automatically adjusts lead and superelevation depending on the weapon selected.

The control panel switch toggle is up (and the upper "Main" light on) if the 120mm main gun is selected. The toggle is down and the lower "Coax" light on if the coaxial machine-gun is selected.

The default setting is "main". If you switch to "coax" it's wise to switch back immediately afterward. Otherwise you might find your gunner trying to machine-gun an enemy tank, a remarkably futile activity.

Ammunition Switch: This panel switch with lights shows which type of ammunition is loaded in the gun (or being loaded, if the ready light is off). If the switch is to the left, the choice is armor piercing (AP) Sabot. If the switch is to the right, the choice is HEAT (High Explosive, Anti-Tank).

Sabot (AP) Ammunition Switch: The *Sabot (AP)* key switches the gunlaying system (including the ballistic computer) to "sabot" (armor-piercing) ammunition. The loader will make sure the 120mm main gun is always loaded with a round of M827 APFSDS-T "sabot" ammunition.

You'll see the ammunition switch on the control panel move to "AP".

HEAT Ammunition Switch: The *HEAT* key switches the gunlaying system (including the ballistic computer) to HEAT (high explosive anti-tank) ammunition. The loader will make sure the 120mm main gun is always loaded with a round of M830 HEAT-MP-T ammunition.

You'll see the ammunition switch on the control panel move to "HEAT".

Other Ammunition: The ammunition switch has HEP and WP settings. These are for the earlier 105mm gunned M1 tank. No 120mm HEP or WP ammunition is manufactured.

Round-loaded Light: This light is on if the 120mm main gun is loaded and "ready" to fire. The light is off if the gun is not loaded (i.e., the loader hasn't finished loading another shell).

Firing Controls: Press *Selector #1* to fire either the 120mm main gun or the 7.62mm coaxial machine-gun (whichever is selected, see the Main-Coax switch).

You can't fire the main gun unless it's loaded. If the gun isn't ready yet, the ready light is off and you'll get a "still loading" message from the loader. Furthermore, firing the main gun accurately requires that you understand how the rangefinder and computer operate.

Other Controls

Laser Warning Light: This light turns on and a warning message appears if an enemy laser "bounces" off your tank. This means the enemy is aiming a gun or missile at your tank, and is probably about to fire.

Smoke Grenades Salvo Controls: Each tap of the *Smoke Grenades* key fires a salvo of smoke grenades in whatever direction your turret faces. Each tank only

has two salvos of smoke grenades available.

A tank has two smoke grenades salvos. If control panel the toggle switch is "up" and the light is on, that smoke salvo has been fired.

Facing Diagram: This shows the facing of the vehicle's tank commander (TC), turret, and hull. The small arc shows the field of view now in the sight.

Facing Digital Readout: This shows the facing of the vehicle's tank commander (C), turret (T), and hull (H) as a compass bearing. For example, 0 is north, 90 east, 180 south and 270 west.

Controller Positions: These two "sliding bar" gauges show your *Controller's* up-down position and left-right position. This is especially useful when cursor keys are the *Controller*.

Turn to this Facing : This key instructs the driver to rotate the hull to the turret's facing. The TC's position above you does not change.

Other Vehicle Controls: The other standard vehicle controls also operate, but are performed by other crewman. These controls are:

Smoke Generator On
Smoke Generator Off

See the "Standard Vehicle Controls" box on page 38 for more information on these. When these controls are used, a verbal confirmation appears as text across the bottom of the screen.

Driver Position Driving the Tank

This is the viewpoint from the driver's seat. The tank is steered from this position. Your view and the driver's controls are described below. Also see the illustration to the right.

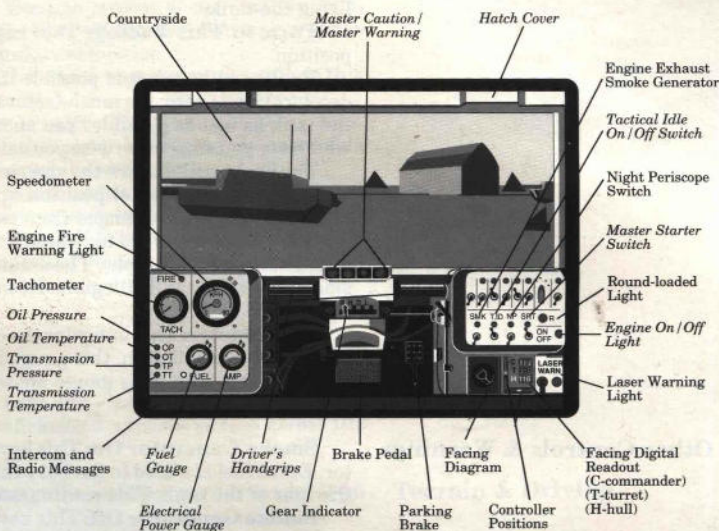
View through the Driver's Periscope: The driver's periscope is built into his hatch cover and always faces forward. Since the driver sits in the hull, the periscope faces in the direction the tank can move.

Magnify Vision: The driver has no magnification; this control has no effect at the driver's position.

Night Vision: This key toggles on and off the night periscope system. When it is on, the image intensifier

Driver's View

Items labeled in italics are for background information only.



within the periscope is switched on, providing a clear view at night.

Night Periscope (NP) Switch on the right side control panel indicates whether the night vision image intensifier is on (toggle is up) or off (toggle is down).

Acceleration/Deceleration/Reverse: Moving the *Controller* forward or back increases or decreases speed, just like a car accelerator. If the speed is zero and the *Controller* is held back, the tank moves into reverse (the driver automatically changes gears).

The amount of *Controller* input determines the current speed (watch the Selector positions on the facing diagram if you're not sure). Unless the *Controller* automatically centers (mainly on certain joysticks), to stop accelerating/reversing you must enter a tiny amount in the opposite direction.

Gear Indicator: This device on the steering column shows the gear in use. Because the tank has an automatic transmission, the most common gears are "drive" (D) and "reverse" (R). The other settings are neutral (N) and low (L).

Turn Left/Right: Moving the *Controller* left or right turns the vehicle in that direction. As with acceleration, the amount of *Controller* input determines the tightness of the turn.

Be careful with your driving. A very tight turn at very high speed, especially when you're off the road and/or on a slope, can "throw" or break a track, immobilizing the tank.

Turn to This Facing: This key has no effect while you're in the driver's position.

Brake: Although it is possible to stop by releasing the accelerator and thus decelerating to zero, it's much faster to "hit the brake". Pressing *Selector* #1 stops the tank as fast as possible. You should release the accelerator and stop turning whenever you stop, otherwise you can burn out the transmission or throw a track.

The brake pedal below the steering column shows whether the brake is on (up) or off (down). The pedal position appears backwards because it's hinged from above (car pedals are hinged from below).

Speedometer: This indicates the tank's current speed across the ground in kilometers per hour (kph). The secondary miles per hour (mph) markings are so small they're virtually illegible. However, 90 kph (maximum speed on the gauge) is about 55 mph.

Tachometer: This indicates the current engine RPMs. Since the M1A1 has an automatic transmission, this gauge is rarely important. However, on a slope too steep for the tank, this gauge shows a high value even though the tank isn't moving!

Other Controls & Warnings

Smoke Generator On: This key turns on the engine exhaust smoke generator. Extra fuel is added to the hot exhaust, which generates a cloud of smoke from the rear of the tank. This continues until the generator is turned off.

Smoke Generator Off: This key turns off the engine exhaust smoke generator.

Smoke Generator (SMK) Switch: This control panel switch shows if the

engine exhaust smoke generator is on (light on and toggle switch up) or off (light off and toggle switch down).

Round-loaded Ready Light: This light is on if the 120mm main gun is loaded and ready to fire. The light is off if the gun is not loaded (i.e., the loader hasn't finished loading another shell).

Facing Diagram: This shows the facing of the vehicle's tank commander (TC), turret, and hull. The small arc shows the field of view now in the sight.

Facing Digital Readout: This shows the facing of the vehicle's tank commander (C), turret (T), and hull (H) as a compass bearing. For example, 0 is north, 90 east, 180 south and 270 west.

Controller Positions: These two "sliding bar" gauges show your *Controller's* up-down position and left-right position. This is especially useful when cursor keys are the *Controller*.

Laser Warning Light: This light turns on and a warning message appears if an enemy laser "bounces" off your tank. This means the enemy is aiming a gun or missile at your tank, and is probably about to fire.

Master Caution/Master Warning Lights: These light up if the tank engine or transmission is in critical condition. In battle this occurs if there's engine damage.

Note: In real life, the yellow Master Caution warns of any malfunction, including trivial equipment failures, while the red Master Warning applies strictly to critical problems in the engine and transmission.

Engine Fire Warning Light: A fire in the engine compartment turns on this light. In general such a fire immobilizes the tank.

Oil Warning Lights: The oil pressure (OP) and oil temperature (OT) lights, when lit, warn the driver of a serious fault in the engine lubrication. In battle this means serious damage that probably has immobilized the tank.

Transmission Warning Lights: The transmission pressure (TP) and temperature (TT) lights, when lit, warn the driver of a serious fault in the transmission. In battle this means serious damage that probably has immobilized the tank.

Other Vehicle Controls: The other standard vehicle controls also operate, but are performed by other crewman. These controls are:

- Smoke Grenades Controls
- Sabot (AP) Switch
- HEAT Switch
- Main-Coax Switch

See the "Standard Vehicle Controls" box on page 38 for more information on these. When these controls are used, a verbal confirmation appears as text across the bottom of the screen.

The type of terrain you drive across has a significant effect on your acceleration and maximum speed.

In open, flat country your tank has a top speed of 44 kph.

If you follow a blacktop road, your tank can reach speeds exceeding 70 kph.

Terrain & Driving

Bogs and plowed fields slow you down considerably, while water barriers slow you down most of all.

Hill slopes vary in steepness. The steeper the slope, the lower your acceleration and top speed. Moving down steep slopes can also be slow too.

Giving Orders inside a Tank

Vehicle Orders

These orders can be given from any position within the tank, or from the mapboard (see pages 54-63). If given within a tank, the orders only apply to that tank. If given from the mapboard, the orders apply to whatever vehicle data window is showing (including supporting vehicles).

Once you give a vehicle order, the crewmen take over and do their jobs as best they can. Among other things, the gunner invariably has his own ideas about which target to engage, although he will first seek targets in the general direction indicated.

Vehicle orders include the following commands:

- A ADV FAST (advance fast)
- S ADV SLOW (advance slowly)
- H HALT (halt movement)
- B BACKUP (back up the tank)
- L LEFT TURN (turn left 30°)
- R RIGHT TURN (turn right 30°)
- F FIRE AT WILL (fire weapons at will)
- C CEASE FIRE (cease fire with all weapons)
- E ENG FRONT (gunner engage enemies in the front)
- D ENG REAR (gunner engage enemies in the rear)
- < ENG LEFT (gunner engage enemies to the left)
- > ENG RIGHT (gunner engage enemies to the right)
- + SMOKE ON (turn on engine exhaust smoke)
- SMOKE OFF (turn off engine exhaust smoke)

In addition there are two other vehicle orders only available on the mapboard: "Move to" and "Turn to". This is because you must use the map to point out the direction the vehicle should move or turn toward!

See pages 56-58 for more information about vehicle orders.

Platoon Orders

These cannot be given from within a tank. You must be at the mapboard to issue platoon orders. See pages 58-63 for more information.

Damage and Destruction Damage

Vehicle Armor: Armored vehicles do not have equal armor in all places. As a general rule the turret has more armor than the hull (although sometimes by a rather small amount). Furthermore, the front armor is always much heavier than the side or rear armor.

M1A1 tanks are especially difficult to penetrate from the front. However, like all tanks, they are much more vulnerable to the sides, and fatally weak to the rear.

Categories of Damage: Shells or missiles fired at a target have one of four general categories of effect:

(1) *Miss*: The shell or missile does not physically hit the target, nor land close enough to do damage with its explosion or shrapnel.

(2) *Non-Penetrating Hit*: The shell or missile hits the target (or lands extremely close), but doesn't blow a hole through the target's armor. As a result, only unarmored exterior items, or items vulnerable to shock and concussion, can be damaged.

(3) *Penetrating Hit*: The shell or missile hits the target and penetrates the armor — just barely. The amount of residual energy and other effects that come through may disable certain equipment or crewmen, but isn't enough to destroy the target.

(4) *Catastrophic Destruction*: This shell or missile hits and penetrates with plenty of energy to spare. A huge amount of damage instantly occurs inside the tank, causing a massive explosion and fire. M1A1s rarely suffer this unless penetrated in the side by a powerful gun, or in the rear by most guns and missiles.

Note that you can hit an enemy tank, maybe even penetrate it, and but not achieve destructive penetration. Similarly, enemy shells and missiles can hit you but not destroy you. However, these hits can cause a variety of damage anyway.

Tracks (Trk): Damage to one or both tracks of a tank immobilizes it. Changing or repairing tracks is a long, brutal job impossible to perform in combat.

Laser (Las): The laser rangefinder is a delicate piece of equipment whose external lens is protected by a thin armored box. Concussion or fragments from a non-penetrating hit can easily disable it. A disabled laser constantly shows the flashing "0" on the gunsight.

Computer (Cmp): The ballistic computer is a complex piece of electronic equipment with electrical connections to the laser, sights, turret rotation and gun barrel. Although buried under the turret armor, shock and concussion from a non-penetrating hit can disable it. A disabled computer constantly shows "8888" on its readout.

TC Crewman: If the tank commander (TC) has his hatch unbuttoned, blasts or shrapnel can easily disable him. When the TC is disabled you cannot operate anything from the TC Buttoned or TC Unbuttoned viewpoints.

Smoke Grenade Launchers (Smk): The smoke grenade launchers are unprotected on the outside of the turret. A nearby blast could wreck them.

Engine (Eng): The engine is in the rear of the M1's hull. A hit here immobilizes the vehicle. A number of indicators in the driver's position indicate this, including the *Engine Fire Warning* light and *Master Caution/Master Warning* lights.

Magazine (Mag): The main magazine is in the rear of the M1's turret. A hit here eliminates most of the ammunition. There are only six rounds stored in special racks elsewhere in the tank.

Driver: If the driver is a casualty the tank cannot move.

Non-Penetrating Hit Effects on a M1A1 Tank

Penetrating Hit Effects on a M1A1 Tank

Turret Crew: These three men can trade jobs as necessary to keep the armament functional. However, reduced manpower slows everything, especially at the injured crewman's specialty. For example, if the loader is missing, reloading is slower. If the gunner is missing, gunlaying takes longer and the main gun is less likely to hit. If the TC is missing, it takes longer to spot new targets.

In addition, if the TC is disabled you cannot operate anything from the TC Unbuttoned or TC Buttoned viewpoints.

If the gunner is disabled you cannot operate anything from the Gunner's viewpoint.

Catastrophic Destruction: Very powerful penetrations of the hull or turret may cause an explosion that demolishes the tank. Repeated penetrations can ignite fires that exhausted fire suppression systems cannot stop. In any case, don't expect crewmen to survive if their vehicle is destroyed.

Indirect Damage

If you selected an optimistic view of American equipment ("2nd Line" or "1st Line" opponents), no indirect damage occurs.

If you selected a pessimistic view of American equipment ("Veteran" or "Elite" opponents), then occasionally non-penetrating hits will do damage inside the vehicle, killing crewmen, knocking out the engine or magazine, etc. Shock and concussion can shatter components, spall armor, etc.

Crew Casualties & Loss of Control

Crew Casualties: If a tank crewman is a casualty, you can access his position but nothing operates. Often a crewman is wounded or killed, but you don't notice until you try something at his position — and find you can't! You can use the data windows on the mapboard to determine who is out of action (see page 55).

Other crewmen on board the tank will take over the incapacitated man's job. You must issue vehicle orders to perform this.

On some computer systems with special graphic capabilities, a knocked-out position is indicated by a color change (see the Technical Supplement).

Destroyed Vehicles: If an entire tank is destroyed then all the crewmen are dead. In this case nothing in the tank functions. The only areas still operative are the mapboard and the outside view. To transfer yourself into an operative tank use the *OP to Next Tank* key (see page 66 for details).

All Tank Platoon Vehicles Lost: If all four crewmen in all four of your M1A1 tanks are killed (i.e., all four tanks are destroyed), then your platoon is wiped out. The battle will end and the platoon's history stops. You'll have to start a new platoon.

Hit Effects on Other Vehicles

A simplified reporting system is used for hit effects on other vehicles (friendly or enemy). To get a detailed report of damage to your vehicle, go to the mapboard (press the *mapboard* key), use the *Controller* to move the crosshairs directly onto the vehicle, and press *Selector #1*. A data window for that vehicle will appear. See page 55 for details.

No Mobility: This occurs when a vehicle loses either its tracks or wheels, or

a hit penetrates the driver's or engine compartment. Immobilized vehicles cannot move for the duration of the battle, since almost any mobility repair requires 30 to 60 minutes of safety and various pieces of heavy equipment from rear areas.

No Weapons: This occurs when a vehicle loses its weapons systems. Typically this happens when the turret is penetrated. Sometimes, however, exposed missiles, delicate fire control devices, etc., are destroyed by a non-penetrating hit.

Infantry: APCs (armored personnel carriers) and IFVs (infantry fighting vehicles) can carry an infantry squad. This squad dismounts whenever the vehicle is stationary, and remounts when the vehicle is ordered to move elsewhere.

Dismounted infantry is much less vulnerable to high-velocity shells and missiles, but it's much more vulnerable to mortars and artillery, as well as machine-guns.

In reality, infantry squads are almost never destroyed. It's quite hard to kill all those small, hard-to-see targets hiding in the grass, bushes and ditches! However, the shock of heavy casualties, massive explosions, whining bullets and buzzing shrapnel will stun and demoralize the survivors, making them dysfunctional for the next hour or two. In terms of the current battle they're destroyed, even though individual men usually survive.

ORDERS & THE MAPBOARD

Orders

As you've probably noticed, it's virtually impossible for one person to control all positions in all four tanks of a platoon. Therefore *M1 Tank Platoon* allows you to issue orders to an entire vehicle, or to an entire platoon, just as real officers must. You'll find orders faster and easier than direct control, but you'll have less control over the vehicle.

Most orders require a single mnemonic keystroke. That is, a single alphabetic key corresponds to a key letter in the orders, such as "F" for Fire at Will, "H" for Halt, etc. Others may require a two-key combination, such as "Shift" and a mnemonic letter.

Vehicle orders give facing, movement or firing instructions to an individual vehicle. This can be done on the mapboard or within a vehicle. Inside a vehicle the orders always apply to that vehicle. When using the mapboard, orders can be given to any friendly vehicle, even single vehicles outside your platoon.

Platoon orders give facing, movement or firing instructions to an entire "unit" (a group of vehicles). This unit could be your own M1 tank platoon, or any supporting unit, including other tank platoons, mechanized infantry sections, missile sections, or AA gun sections.

Support orders call up air and artillery support. Obviously, these are only available if you have air and/or artillery support.

The Mapboard

Press the *Mapboard* key to see the mapboard with the its symbol key. The mapboard shows the current position of all friendly forces. It also shows the position of all enemy forces currently visible. If an enemy disappears from the map, it's because he's disappeared from view. This occurs because either (a) they move out of sight, (b) all the friendlies who saw them moved away, and/or (c) all friendlies who saw them are knocked out.

Vehicle Symbols: On the mapboard all vehicles have a unique symbol. In addition each type of vehicle has a flashing ID number to aid recognition. Destroyed vehicles exchange their normal symbol for a solid, burning color, but continue to flash their ID number.

Finding Your Tank: When you press the *Your Tank* key, the crosshairs moves to the location of your tank and displays its data window.

Crosshairs Pointer: The *Controller* (joystick, mouse or cursor keys — see the Technical Supplement) moves the crosshairs pointer on the map. If you position the crosshairs over a friendly or enemy vehicle and press *Selector #1*, a data window describing that vehicle appears.

Warning: if you position the crosshairs over empty terrain and press either *Selector*, the platoon or vehicle listed in the data window turns or moves toward that point. Of course, if the vehicle is an enemy or there's no data window present, nothing happens.

Zoom Control: The *Zoom Map* and *Unzoom Map* keys enlarge and reduce the mapboard. Initially the mapboard starts at the highest level of unzoom, showing

the full battlefield. You can zoom down sixteen levels for extremely fine detail.

The *Max Zoom* key instantly zooms you to the lowest level of detail, while the *Max Unzoom* key instantly returns you to the overview.

Hide Objectives: This key toggles on and off the glowing marks showing the two objective points (Blue-1 and Red-2). This feature is included because some find the map markings distracting.

Data Windows

To get information about a specific friendly vehicle, you can either move the crosshairs to the vehicle and press *Selector #1*, or you can repeatedly press the *Next Platoon* key until the correct platoon is listed, then repeatedly press the *Next Vehicle* key until the correct vehicle appears.

Platoon Descriptions: The *Next Platoon* key shows data windows for your various platoons (or sections). The first window is always your M1A1 tank platoon. Each subsequent keypress shows the next platoon's data window. After the last it cycles back to the first unit again.

A platoon description includes basic statistics on the vehicles in the unit, the status of each vehicle, its last orders, and a menu of the possible platoon orders. For more information about any vehicle in the platoon, press the *Next Vehicle* key.

There is a special "HQ Radio Net" platoon data window for air and artillery support. It lists available support and their radio call signs. For more information about a particular item, press the *Next Vehicle* key.

Vehicle Descriptions: The *Next Vehicle* key shows data windows for the specific vehicles (or other sub-elements) within a platoon. Each keypress shows the next vehicle or other sub-element within the platoon. After the last it cycles you to the first vehicle again.

A vehicle description includes statistics for that vehicle, details on its crew, damage (if any), ammunition, and men carried. It also shows the last orders and a menu of possible vehicle orders.

Infantry squads are considered separate "vehicles" when unloaded from a stationary IFV or APC which carried them. If infantry is loaded they are not a separate item (but an appropriate note appears in the vehicle's data window).

Mapbard Data Window Abbreviations

Adv	Advance
APC	Armored Personnel Carrier
ATGM	Anti-tank Guided Missile
CFV	Cavalry Fighting Vehicle
Chbm	Chobham
CLOS	Command-Line-of-Sight missile guidance
Ech	Echelon (a diagonal line)
Eng	Engage (turn weapons in that direction)
Fm	Form (adopt a formation)
IFV	Infantry Fighting Vehicle
Inf	Infantry
Iron	No special sighting devices
ITV	Improved TOW Vehicle
Mblty	Mobility
MBT	Main Battle Tank
Msls	Missiles
Nxt	Next
Rctv	Reactive
SAM	Surface-to-Air Missile
Stad	Stadiametric, often called "stadia"
VADS	Vulcan Air-Defense System

Vehicle Orders Issuing Orders

These orders are given to a specific, individual vehicle. They can be issued while inside one of your M1 tanks, or using the mapboard.

Within a Tank: If you issue an order from within a tank (see page 37), the order applies just to that tank. The tank crewmen take over and execute the order as best they can. Of course, their methods may be different than yours. In particular, the gunner will concern himself with targets he considers most important — and his priorities may be different from yours!

From the Outside View: If you select the *Outside Tank* view, your viewpoint is always “looking over” the last tank you occupied (your OP tank). Vehicle orders can be issued from this view.

On the Mapboard: To issue orders from the mapboard, you must have a vehicle data window present (NOT a platoon window). To bring up a vehicle data window, you can use either of two methods. One is to use the *Controller* to move the crosshairs onto a vehicle and press *Selector #1*. The other is to press the *Next Platoon* and *Next Vehicle* keys until you reach the desired vehicle.

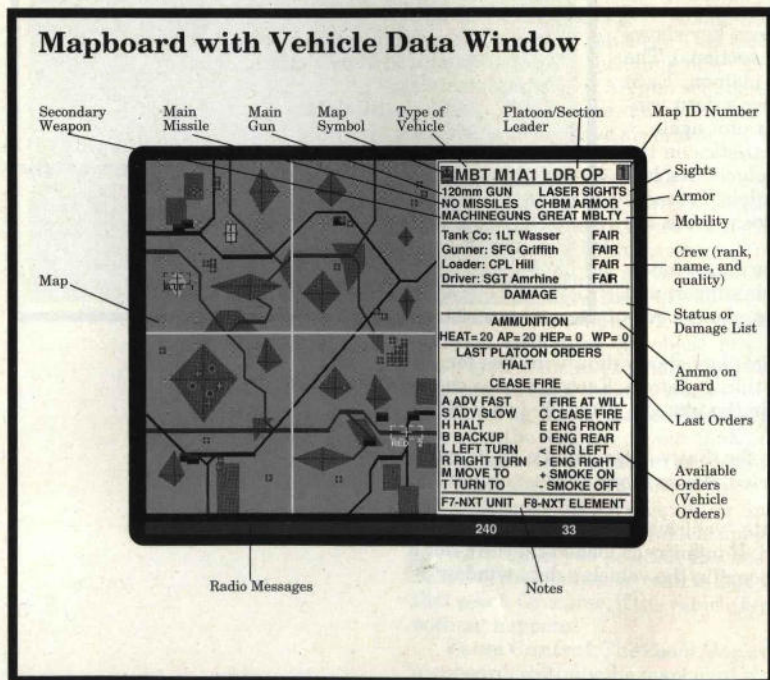
Mapboard vehicle orders are the only way to control individual vehicles outside your tank platoon.

The vehicle orders only apply to that vehicle. Any conflicting prior orders (including platoon orders for the vehicle) are cancelled. However, if the vehicle selected is the platoon or section leader, other vehicles in that unit will usually follow him.

Effect of Crew Quality: A vehicle's crew quality significantly affects its response speed. A better crew will perform their orders faster than a poor crew. TC (tank commander) quality determines how fast a tank spots enemies. Gunner quality determines how quickly and accurately the tank fires. Loader quality determines how fast the main gun is loaded. Driver quality determines how long it takes a tank to start executing a new movement order.

Vehicle Orders — Facing

Left Turn (L): The vehicle rotates on its tracks 30° to the left. Unless the turret crew has spotted and is tracking



a target, the turret rotates with the hull.

Right Turn (R): The vehicle rotates on its tracks 30° to the right. As in other turns, the turret rotates with the hull unless the turret crew is tracking a target.

Turn To (Controller & Selector #2): To issue this order, you must be on the mapboard and have the crosshairs on open terrain, then press *Selector #2*. The vehicle turns to face the crosshairs. As in other turns, the turret rotates with the hull unless the turret crew is tracking a target.

Infantry faces in all directions simultaneously (i.e., someone's always looking in the necessary direction). Facing orders have no effect for them.

Advance Fast (A): The vehicle moves straight ahead at high speed. Weapon accuracy is reduced when the vehicle is moving, especially if the weapon is unstabilized (M1A1s have stabilized turrets). It's very difficult to guide a missile from a moving vehicle, so missile-armed vehicles usually slow or stop to fire.

Advance Slow (S): The vehicle moves straight ahead at low (about 40%) speed. Weapon accuracy is better than vehicles advancing fast, especially for vehicles with missiles or unstabilized guns.

Halt (H): The vehicle stops as fast as possible. Because armored vehicles like tanks have considerable momentum, it may take a second or two before the vehicle finally comes to rest.

Backup (B): The vehicle moves in reverse (backwards). Reverse is much slower than moving forward.

Move to (Controller & Selector #1): To issue this order, you must be on the mapboard and have the crosshairs on open terrain, then press *Selector #1*. The vehicle will turn and move at full speed to that point.

Note that it's impossible to move onto another vehicle. If you position the crosshairs on another vehicle, pressing *Selector #1* shows the data for that vehicle, instead of issuing the "move to" order.

Infantry: Movement orders have no effect on infantry. This is because (a) infantry is trained to fall prone and take cover in battle, and (b) infantry travels very slowly in comparison to vehicles.

To move infantry, issue a movement order to the M113 APC (armored personnel carrier) or M2 IFV (infantry fighting vehicle) that carried them. The transport automatically embarks its infantry before moving and automatically debarks the infantry when it stops. If the transport is immobilized or destroyed the infantry is immobilized for the remainder of the battle.

About Drivers: The skill of a driver determines how quickly he grasps your order and gets the tank moving. Less skillful drivers often pause a bit, then move. This represents the confusion and uncertainty of inexperienced crewmen.

Fire at Will (F): The vehicle is free to open fire. The vehicle's crew select their own targets. They usually select the nearest, most dangerous enemy.

Cease Fire (C): The vehicle immediately stops firing. It will reload, but will not fire again until "Fire at Will" is ordered. However, the gunner does seek targets

Vehicle Orders — Movement

Vehicle Orders — Combat

and range them, in preparation for firing.

Engage to Front (E): The vehicle's turret rotates to face forward. The gunner then seeks the most dangerous enemy in that arc.

Engage to Rear (D): The vehicle's turret rotates to face the rear. The gunner then seeks the most dangerous enemy in that arc.

Engage to Left (<): The vehicle's turret rotates 45° to the left. The gunner then seeks the most dangerous enemy in that arc.

Engage to Right (>): The vehicle's turret rotates 45° to the right. The gunner then seeks the most dangerous enemy in that arc.

Smoke Generator On (+): The vehicle's engine exhaust smoke generator is turned on. It remains on until the "smoke off" order is given. This order has no effect if a vehicle lacks an engine exhaust smoke generator.

Smoke Generator Off (-): The vehicle's engine exhaust smoke generator is turned off.

Infantry can perform all combat orders except smoke generators, which they lack. Of course, engagement direction orders have little effect, since infantry looks in all directions at once!

Gunners & Engagement Orders:

A gunner normally tracks the most dangerous threat in the engagement direction. He may change his mind periodically. Furthermore, if a really serious threat appears from another direction, he may decide to deal with that instead.

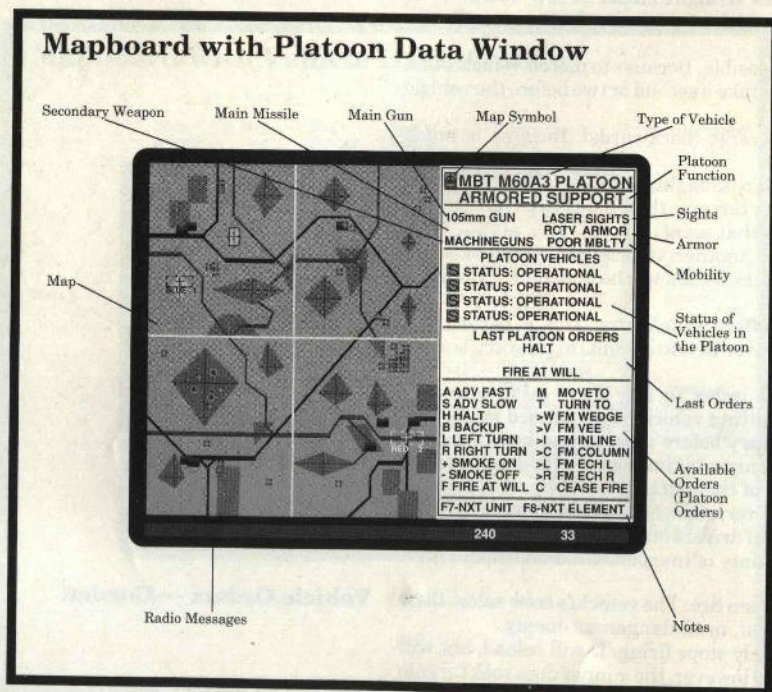
A gunner will never disobey "cease fire" orders, no matter how bad the situation. He'll always wait patiently for you to issue "Fire at Will."

Platoon Orders Issuing Orders

On Mapboard Only: To issue a platoon order, you must be at the mapboard (use the *Mapboard* key) and have selected a platoon data window (use the *Next Platoon* key).

You cannot issue platoon orders from within a tank, nor can you issue them from the outside views.

Effect of Crew Quality: A vehicle's crew quality affects the speed of its



response. The better the crew, the faster it follows orders. Different vehicles may react at slightly different speeds, causing the platoon to take action in a slightly disjointed fashion.

Left Turn (L): The leader's vehicle rotates on its tracks 30° to the left. The other vehicles maneuver to realign the formation. Unless the turret crews have spotted and are tracking a target, the turret rotates with the hull.

Right Turn (R): The leader's vehicle rotates on its tracks 30° to the right. The other vehicles maneuver to realign the formation. Unless the turret crews have spotted and are tracking a target, the turret rotates with the hull.

Turn To (Controller & Selector #2): To issue this order move the mapboard crosshairs into unoccupied terrain, then press *Selector #2*. The leader's vehicle turns to face the crosshairs. The other vehicles maneuver to realign the formation. As in other turns, the turrets rotate with the hulls unless a turret crew is tracking a target.

Formation orders usually require a combination of keys, such as "shift" and "w" for "form wedge". The "^" symbol on the data window serves to remind you that a "modifier" key is needed along with the mnemonic key.

When a platoon gets a formation order, the leader's vehicle remains in place (or on course if moving). The other vehicles adjust their positions around the leader to create the new formation.

Formations assign a particular location to each vehicle, and in addition assign a particular viewing arc to each turret. While in formation a vehicle's turret and TC face their assigned arc. Once a vehicle spots a target it will track that target for a while.

Form Wedge (^W): The platoon's vehicles adopt a wedge-shaped formation around the leader.

Form Vee (^V): The platoon's vehicles adopt a "V" shaped formation around the leader.

Form In-Line (^I): The platoon's vehicles adopt a line-abreast (side-by-side) formation next to the leader.

Form Column (^C): The platoon's vehicles adopt a line-ahead (one-behind-another) formation. If you want your platoon to move in column, make sure the platoon leader is in the lowest numbered mobile vehicle (the #1 tank if it can still move, otherwise the #2 tank if it can move, etc.). Your leader begins in the #1 tank, but could be moved to another tank if you gave the *LDR to OP Tank* transfer (see page 66).

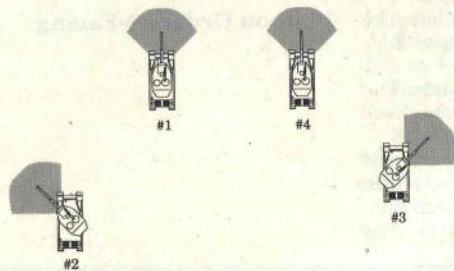
Form Echelon Left (^L): The platoon's vehicles adopt a diagonal line formation angling back to the left.

Form Echelon Right (^R): The platoon's vehicles adopt a diagonal line formation angling back to the right.

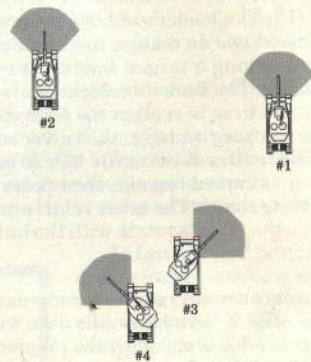
Platoon Orders —Facing

Platoon Orders —Formations

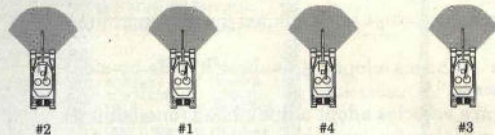
Form Wedge



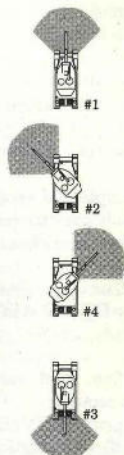
Form Vee



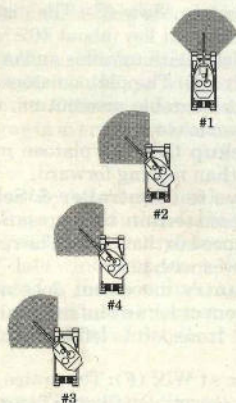
Form In Line



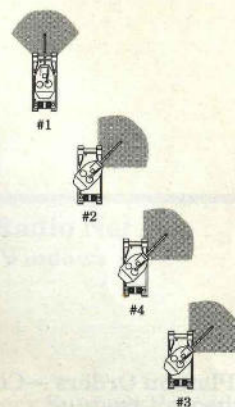
Form Column



Form Echelon Left



Form Echelon Right



Platoon Orders —Movement

Advance Fast (A): The platoon moves straight ahead (in the direction the leader faces) at high speed. Weapon accuracy is reduced when vehicles are moving, especially unstabilized weapons. It's very difficult to guide missiles from a moving vehicle.

Advance Slow (S): The platoon moves straight ahead (in the direction the leader faces) at low (about 40%) speed. Weapon accuracy is improved, especially for vehicles with missiles and/or unstabilized guns.

Halt (H): The platoon stops as soon as possible. Because armored vehicles have considerable momentum, it may take a second or two before the vehicle finally comes to rest.

Backup (B): The platoon moves in reverse (backwards). Reverse is much slower than moving forward.

Move to (Controller & Selector #1): Move the mapboard crosshairs into unoccupied terrain, then press *Selector #1*. The platoon's leader turns and moves at full speed to that point. The remainder of the platoon reorients their formation and moves with him.

Infantry movement does not occur separately. When you give a platoon movement order any infantry automatically boards their IFVs or APCs. Infantry without transport is left behind.

Platoon Orders —Combat

Fire at Will (F): The entire platoon is free to open fire. Each vehicle selects its own target, usually the nearest and most dangerous enemy.

Cease Fire (C): The entire platoon immediately stops firing. Vehicles reload and gunners continue to track targets, ready to resume fire whenever ordered.

Smoke Generator On (+): The platoon turns on all their engine exhaust smoke generators, if they have them. They leave the generators on until ordered to turn them off, either individually or as a platoon.

Smoke Generator Off (-): All vehicles in the platoon turn off their engine exhaust smoke generators.

Detached and Rejoining Vehicles

Detaching a Vehicle: In any platoon, you can detach a vehicle by giving it a specific vehicle movement order.

For example, if you give a movement order to some vehicle other than the leader, that lone vehicle moves off (or just halts). The rest of the platoon will continue following their leader normally.

Note that if your OP (Observation Point) is in a non-leader tank and you move it in any way (or issue any sort of movement order), then that tank is out of formation and is no longer part of the platoon.

You cannot detach a leader of a platoon—because everybody else follows him! Instead, you must individually detach all the other vehicles. For example, if you want just the leader's #1 tank to move up to a crestline and look over, issue "halt" vehicle orders to #2, #3 and #4 tanks. They are now all detached and stopped, allowing the leader to go forward on his own. In such cases you may find it more useful to switch your OP or switch leaders, see "Transferring OPs, Tanks &

Leaders" on page 66.

Rejoining Detachments & Reforming Platoons: Once a platoon or section is "fragmented" by separate vehicle orders, you can reform it by issuing any formation order. All mobile vehicles of the platoon will try to reform the proper formation around the leader. They will move into formation using the fastest possible route.

If your OP (observation point — the tank "you" currently occupy) is not the leader tank, or you frequently give vehicle orders, it's always wise to issue a formation order before each platoon movement order. Otherwise somebody might be unwittingly left behind (there's always some guy in every army who never gets the word!).

You may be allowed artillery and/or air support by your battalion headquarters (HQ). You can "call in" this support by radioing appropriate codes to the HQ.

HQ Data Window: The HQ radio net appears as one of your platoons. Press the *Next Platoon* key until the "HQ RADIO NET" data window appears. You'll see a summary of your support and radio code key used to summon that support.

Individual Supports Data Windows: You can get more information about each support by pressing the *Next Vehicle* key. This shows more details about each individual support.

The 107mm (4.2") mortars, 155mm artillery, and 227mm MRLS rockets are all "artillery". To summon artillery fire, follow these steps:

- (1) **Go to the Mapboard** by pressing the *Mapboard* key.
- (2) **Get onto the HQ Radio Net** by pressing the *Next Platoon* key until that data window appears.
- (3) **Position the Crosshairs** at the exact point you wish to bombard.
- (4) **Send the Radio Call** using the appropriate key. Your call is processed through a nearby FO (forward observer). It takes a few seconds for the message to be relayed and for the guns to find the range. Then a steady rain of projectiles will land near target point for a short period.

Don't Bombard Yourself: A common error is to forget the crosshairs position and just send the radio call. This is extremely dangerous, since often the crosshairs are over one of your own vehicles. The result is calling artillery onto your own position!

Additional Requests: After each artillery bombardment you must wait a short period before another bombardment is possible. The artillery must "displace" (move to a new firing position) to avoid counter-battery fire.

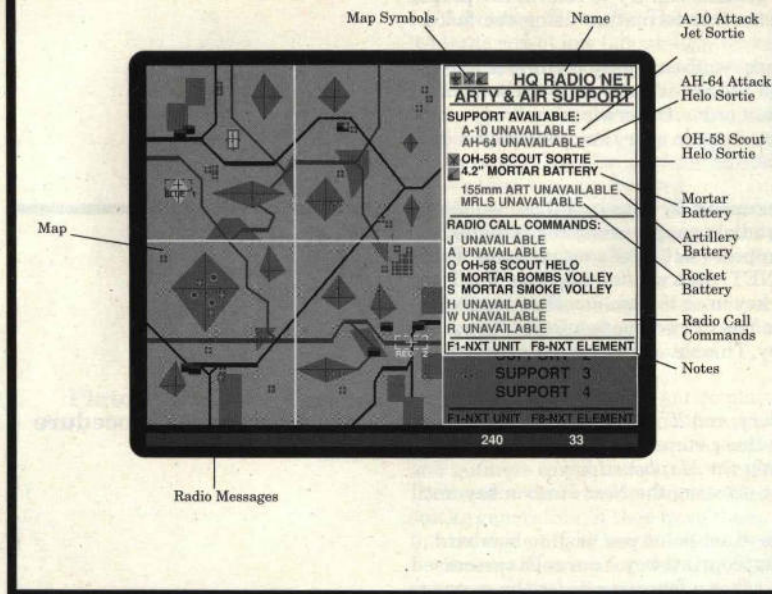
Furthermore, additional bombardment requests make take longer to come through, and/or result in shorter bombardments. The artillery may have other duties and/or have limited ammunition.

Artillery Location: All artillery weapons are sited to the rear, out of sight of your current battalion. You can never request the artillery pieces to actually move into the battle (no sane artillerymen would obey anyway!).

HQ Radio Net Data Windows

Artillery Support Procedure

Mapboard with HQ Radio Net



Air Support Procedure

"Air Support" includes Army AH-64A and OH-58D helicopters and Air Force A-10A close-support attack jets. Air support gives you the use of that aircraft for the duration of the battle. This means you can call the aircraft back again and again, provided it remains intact and flyable. Summoning air support is easy:

- (1) **Go to the Mapboard** by pressing the *Mapboard* key.
- (2) **Get onto the HQ Radio Net** by pressing the *Next Platoon* key until that data window appears.
- (3) **Send the Radio Call** using the appropriate key.

Your call is processed through the local Forward Air Controller (FAC), who assigns the helicopter or jet to your area.

Targeting Air Support: When an aircraft arrives it selects its own flight path and targets. It will make a number of attacks, until it is out of fuel or ammo, or is damaged or shot down by enemy fire. Then it returns home to rearm and refuel. If the plane returned intact, it can be called again.

Artillery Types

Mortars: The 107mm (4.2") mortars are the most common artillery support available. They have both high explosive mortar bombs and smoke screen ammunition (the latter uses white phosphorous warheads). These smoke shells are considerably more effective than your turret-launched smoke grenades.

Field Artillery: The M109 self-propelled 155mm gun-howitzer battery is the standard artillery piece of the US Army. Like mortars, they can fire either high explosive (HE) or white phosphorous (WP) smoke. Their shells are bigger and more powerful than the mortars, and can be fired much farther, but they don't fire quite as fast.

Rockets: The 227mm MRLS rocket launchers are the new "heavy artillery" of the US Army. Each launcher has a dozen rocket tubes, which are fired one after another in quick succession (a "ripple"). There is only one type of rocket ammunition available: high explosive submunitions useful against infantry or very lightly armored vehicles. Rockets are less accurate than either mortars or field artillery.

In other words, you have no control over airpower except when to call it.

Air to Air Battles: Pilots always view equivalent enemy craft as top-priority targets. They want to stop the enemy aircraft before they get to your tanks! However, helicopters will tend to hide from jets, and jets often have trouble finding them. Therefore, helicopter vs. jet battles are uncommon.

Your most effective anti-aircraft weapon is almost always your own airpower. If an enemy Su-25 Frogfoot jet or Mi-24 Hind helicopter appears, quickly call your own A-10 or helicopter (AH-64 or OH-58) if you have one.

OH-58D "Kiowa" Scout Helicopter: This helicopter dashes from hill to hill, popping up to spot the enemy, then disappearing again. It's extremely useful for sniffing out enemy defenses, or revealing enemies massing for an attack.

To get maximum advantage from this type of support, watch the mapboard closely while the scout is overhead. Whenever it spots the enemy, appropriate symbols appear on the mapboard. However, whenever it ducks out of sight the symbols disappear again. If you ignore the mapboard you'll be wasting your scout!

The Kiowa is only armed with a machine-gun. It's unlikely to do much damage, although it can distract an Mi-24 Hind. Unfortunately, the Kiowa is unarmored, so it's frequently shot down.

AH-64A "Apache" Attack Helicopter: Like the scout, this helo also dashes from hill to hill, popping up briefly. However, it carries Hellfire anti-tank missiles and a 30mm Chain Gun, both of which can inflict substantial damage.

The Apache always attracts enemy gun and missile fire. The helicopter is armored, and therefore resists a certain amount of damage. However, it can and will be shot down if the pilot is too bold.

Apaches report enemy positions as they discover them, just like a Kiowa. Therefore it's wise to have the mapboard up when the Apache is overhead. You might discover hidden enemy positions!

A-10A "Thunderbolt II" Attack Jet: This plane carries high-accuracy Maverick missiles and a powerful GAU 30mm cannon. The "warthog" (its unofficial nickname) circles low over the battlefield, firing guns and/or missiles at targets of opportunity.

Naturally a jet attracts a lot of enemy attention. The A-10A is much faster than any helicopter, making it harder to hit with guns. However, its armor is lighter and it can't hover behind hills for cover.

Like helicopters, "warthog drivers" (attack jet pilots) report enemy positions as they discover them. You'll see these on the mapboard, but the jets move so fast that map symbols can appear and disappear very quickly.

Types of Air Support

Transferring OPs, Tanks & Leaders

Moving Your Viewpoint *OP to Next Tank*

Changing the Platoon Leader *LDR to OP Tank*

Transferring the Observation Point: The *OP to Next Tank* key moves your personal observation point ("OP") from one tank to another. Initially you start in tank #1. One press of the key moves you to tank #2; another press to tank #3, another press to tank #4, and then back to tank #1 again.

Changing the OP allows you to move from one tank to another. Whenever you press *TC Unbuttoned*, *TC Buttoned*, *Gunner* or *Driver*, the tank position you "move into" is the current OP tank.

Initially the OP tank and the platoon leader tank are the same — tank #1. Remember that if you move the OP to another tank, you're no longer the platoon leader. The rest of the platoon will continue following the leader tank while you split off and go your own way.

Destroyed Tanks: If the OP tank is destroyed all of the crew positions in that tank are inoperative. Only the outside views and the Mapboard still function. Use *OP to Next Tank* to find a functioning tank.

The *LDR to OP Tank* key shifts the platoon leadership to your OP tank. It doesn't matter whether you're on the mapboard, in a tank, or the outside views.

You cannot shift leaders in supporting units. The first mobile vehicle in any supporting platoons and sections is always the leader.

Disorganization —Shifting Leadership to a Detached Vehicle: If your OP has moved away from the platoon (as is commonly the case!), when you press *LDR to OP Tank* the entire platoon becomes confused and halts in place. The reason for this is simple: tanks that used to be in formation about the leader aren't sure whether they should form up on the new leader, or continue in their current formation. And if the latter, should they keep moving or stop? It's all very confusing.

As a safety measure, whenever you change leaders it's wise to issue a new formation order to the entire platoon. This reorganizes everyone. Then if there are vehicles you wish to remain detached, give them individual vehicle orders.

Disabled M1A1 Leaders: If a leader vehicle is immobilized or destroyed, the platoon cannot move until you shift platoon leadership to a new tank.

To assign a new leader to your platoon, go to the mapboard (press the *Mapboard* key) and press *OP to Next Tank* repeatedly until you select the new leader tank. Then press *LDR to OP tank* to transfer leadership to that tank.

For example, say you detach tank #2 to a distant hill, while #3 and #4 remain in formation with tank #1. If tank #1 should be immobilized, your immediate impulse is to transfer leadership to tank #2. However, since he's detached a transfer of leadership will automatically halt and disorganize the platoon (because nobody is in formation with him). A wiser choice would be tank #3 or #4. In fact, since #4 is the platoon sergeant and normally the second best tank in the outfit, it's really the logical choice.

Other Disabled US Leaders: If other friendly sections or platoons a new leader takes over after a short period of time. This occurs automatically, you have no control over which vehicle is selected as the new leader.

Enemy platoons do not detach vehicles. Pact platoons are much more rigid in their tactics and maneuvering.

Enemy platoons who lose their leader stop in confusion for a short period. Then they too will find a new leader and continue.

Enemy Platoon Leadership

SIMULATION CONTROLS

Outside Tank View

When you press this key, you're placed outside the OP tank (the last tank you occupied). The *Controller* (typically your joystick, mouse or cursor keys — see the Technical Supplement) rotates and tilts your view, but it's always aligned with the tank. This view has a zoom lens. Use the *Zoom* and *Unzoom* keys to get close-ups of distant objects, then return to your normal viewpoint. *Max Zoom* and *Max Unzoom* keys also work here.

Automatic Tracking: You can “lock” this view onto a distant object by adjusting the view until the object is in the screen's center, then press *Selector #1*. Once locked the view automatically moves to keep the object in the center of the screen.

This feature is especially useful for watching fast-moving jets or helicopters. It can even be used to follow the flight path of a missile or shell, although locking onto something that fast is difficult.

To end automatic tracking, just move the *Controller* or leave the outside view.

Orders: You can give vehicle orders on the Outside View.

Notes: Displaying this view requires more computer “horsepower” than any other part of the simulation — use it sparingly on machines with low horsepower. You'll might feel that this view allows you to “see” things from an advantageous position... but in reality tank crewmen will dismount to examine things in more detail while on foot.

Outside Any View

This view allows you to see the battlefield from outside any friendly vehicle, including helicopters and jets (if they're currently over the battlefield). It's popularly known as the “movie director's view”.

Selecting the Vehicle: To use this view, go to the mapboard (press the *Mapboard* key) and use *Next Platoon* and then *Next Vehicle* to select the specific vehicle you desire. You must have the vehicle's data window on the map. You cannot select artillery or enemy vehicles.

The Outside View: After the vehicle is selected on the mapboard, press Outside Any once. You are now outside that vehicle. The *Controller*, *Zoom* and *Unzoom*, *Max Zoom* and *Max Unzoom*, all function like the Outside Tank view.

If you're outside view is from a helicopter or jet and the craft flies out of the battle area, the view automatically jumps back to your OP tank. This can happen rather easily if the aircraft attacks enemies near the edge of the battle area.

Returning to your OP: To exit this view, press Outside Any again. You are returned to the mapboard. If you press other keys, the results may be somewhat unexpected and confusing.

Pause

The *Pause* key immediately and instantly freezes the simulation. To resume action press any key. Some computers have a special “break”, “pause” or “hold” key. Depending on the internal design of your machine, this may or may not work correctly.

The *Accelerated Time* key is a toggle. One press doubles the rate at which time passes. Another press resets the speed of time to normal.

Warning: There is no "automatic shut-off" for accelerated time. Once set, the entire battle moves at double-rate until you shut things down. If the enemy surprises you, you could find your entire command being shot up twice as fast as normal.

The "*Boss*" *Hide Game* key is like the pause, with two additional features:

First, the computer screen is cleared, concealing the software currently running.

Second, the only way to resume is to press the "*Boss*" *Hide Game* key again. No other keys work.

The *Quit* key immediately ends the simulation. It does not save any information to disk. Any accomplishments since the last save are lost.

The *Detail Adjust* key allows you to change the amount and depth of ground detail in the world outside your tank. In general, use lower detail on computers with less horsepower. See the Technical Supplement for details.

The *Volume Adjust* key may allow you to change the type and variety of sounds. See the Technical Supplement for details.

The *Joystick Reset* key allows you to re-center your joystick at any time. Obviously, it only does something if you're using a joystick.

To use this, press the *Joystick Reset* key combination then immediately "stir" the joystick. To "stir" the stick, move it in a circle that contacts all the directions but never moves through the center position.

Accelerated Time

Boss

Quit

Adjust Detail

Adjust Volume

Reset Joystick

Boundaries, Breakthroughs & Withdrawals

THE AFTERMATH

Breakthroughs: Vehicles can "breakthrough" into the enemy rear area. American vehicles do this by moving off the east edge of the battlefield; Pact vehicles by moving off the west edge.

Breakthrough vehicles disappear from the battle area and cannot be recalled. They count as survivors for victory purposes. In some cases, the mission for that side rewards a breakthrough, but only if the majority of the force breaks through.

Withdrawals: Vehicles can "withdraw" from the battlefield to the rear. Like breakthrough vehicles, those which withdraw are out of the battle but still considered survivors.

American vehicles withdraw off the west edge of the battlefield. Pact vehicles withdraw off the east edge.

HQ Boundaries: The north and south edges of the battlefield are organizational boundaries imposed by higher headquarters. No vehicles (of either side) can cross these boundaries. Separate actions involving other units are in progress there.

Ending the Battle

A battle ends when either one side is destroyed, or when you deliberately end the engagement.

Destruction: If all Pact vehicles are destroyed the battle ends. If your entire M1A1 platoon is destroyed (i.e., all sixteen men are killed) the battle ends.

Deliberate Conclusion: The *End Battle* key does just that — it ends the battle. The computer projects the current situation into the immediate future, then determines the results. Therefore you can't use this key to escape from impending disaster, but you can use it to end a stalemate.

Training Exercises

When a "static gunnery" or "moving gunnery" exercise ends, you return immediately to the starting options. You never score any points or receive awards for training.

Platoon Stats

After the battle ends you'll return to the bivouac area and see an updated record of your platoon.

Engagement # shows the number of battles your platoon survived.

Kills shows your platoon's "lifetime score" of enemy vehicles destroyed.

Casualties indicates the number of tanks you've lost.

Rating is a numerical indication of how well you performed in this battle. It's based on the combat power of each enemy vehicle (or infantry squad) destroyed. The quality of enemy troops and how well you fulfilled your mission are factored into this value.

Efficiency lets you know how close your rating was to the maximum possible for that situation. Of course it's a lot easier to get 100% efficiency against inept 2nd Line troops in a hasty defense than it is to get 100% withstanding the assault of an elite Guards unit!

Total Rating is the accumulated rating of all your battles to date.
Awards lists the total number of promotions and decorations received.

After the platoon stats are summarized there's a statement about the success of your mission, and about the success of the enemy mission. Your goal is to please your own HQ and frustrate the enemy.

It is possible for both you and the enemy to succeed; it's also possible for you to both fail, just as in real life.

Success and failure is measured by who holds Blue-1 and Red-2, whether a sizeable force broke through, by the proportion of fighting power lost, and by the ratio of casualties inflicted to casualties received. The exact importance of each varies with each side's initial orders. It pays to listen to your briefing. In fact, it's virtually impossible to fail if you accomplish the task considered "most important" in the briefing. However, you can go beyond modest success if you accomplish the other tasks mentioned in the briefing.

Fighting power and casualty assessment are not based on a simple count of vehicles. Instead, each vehicle has a point value (the same value used for platoon ratings). Some vehicles are more valuable than others, based on their combat power. First rate tanks are worth the most, while low quality tanks (like the T-62 or T-55) are worth about as much as first rate IFVs (such as the M2 or BMP-2). Old APCs and armored cars with machine-guns are worth less than the infantry they carry, especially if that infantry has anti-tank missiles such as the American Dragon III.

After the results are displayed you have three or four options:

Platoon Awards: This lets you use the outfitting screen to give promotions and medals to your surviving crewmen. See "Awards: Promotions & Decorations" below for details.

Save Platoon: This saves the latest copy of your platoon's record to disk. If you're on campaign it also saves the current campaign situation. Of course, it overwrites all earlier records of that platoon.

New Orders: This option returns you to the prebattle options for another battle, or to start a new campaign.

End Campaign: This option appears only if you're currently involved in a campaign. It immediately exits the current campaign and returns you to the prebattle options. Unless you've saved your platoon all campaign records are lost.

Continue Campaign: This option starts another battle. You bypass the prebattle options, stay in the bivouac and get your new orders.

Results & Victory

Ending Options

Awards & Replacements

Promotions & Decorations

You're often allotted promotions and decorations to give to the surviving crewmen in your platoon. Each crewman may receive only one promotion and one decoration after a battle. Each promotion or decoration improves his quality one level. It's assumed that men of greater skill are those who deserve a promotion or decoration. Skill levels, from highest to lowest, are:

EX	Expert
SP	Superior
GD	Good
FR	Fair
PR	Poor
IN	Inept
†	Killed in action

Giving Awards: To give an award, use the *Controller* to move the highlight to a man's name. Then press the "p" key to promote him, or the "d" key to decorate him. You can use *Selector #1* to examine his record. You can also examine the final status of his tank, and adjust the standard ammo-mix of that tank.

Promotions move a crewman one slot up the rank ladder. Each promotion improves a crewman's quality one level. Ranks possible, in order from highest to lowest, are:

Cpt	Captain
1 Lt	First Lieutenant
2 Lt	Second Lieutenant
1 SG	First Sergeant
MSG	Master Sergeant
SFG	Sergeant First Class
SSG	Staff Sergeant
Cpl	Corporal (e4)
PFC	Private First Class (e3)
Pv2	Private (e2)

Promotions are limited by the current duty of the tank crewmen. Crewmen within a tank have a hierarchy. The top man in each tank (the commander) must also be the highest ranking man. The second man from the top (the gunner) must be the second highest rank, etc. Lower level men can have equal rank to the man above, but cannot exceed his rank. This sometimes prevents promotions.

Decorations also improve quality one level. You do not control the exact decoration received. Instead the crewman may receive another of the same, or a slightly more prestigious medal, depending on the whims of higher headquarters. To see the exact medal awarded, after pressing "d" to decorate the man, press *Selector #1* to view his record.

There are four different types of medals awarded. From rarest to most common these are:

CMOH	Congressional Medal of Honor
DSC	Distinguished Service Cross
SS	Silver Star
BSV	Bronze Star for Valor

Current rank and hierarchy within a tank have no effect on decorations. Any man can receive a decoration, even if his superiors don't.

Posthumous Awards are allowed. They have no effect on platoon quality, since awards won't bring the dead back to life.

Dead crewmen and damaged or wrecked vehicles are replaced automatically. As a point of information, the following occurs "behind the scenes":

Replacement Crewmen: When you leave the awards, the surviving crewmen of each tank automatically consolidate to the most important position available, given their rank. For example, if a tank lost its commander, but the other three crewmen survived, then the gunner automatically moves to the commander's spot, the driver becomes the gunner, and the loader becomes the driver. This leaves the loader's spot (the lowest) vacant.

After the survivors have consolidated, new replacements arrive to take over the bottom slots now vacant. Although these replacements have a very low rank, their skills vary widely.

Replacement Tanks: If an entire tank crew is wiped out, the surviving crews may renumber their tanks. This reorganization depends on the rank of each tank commander. The surviving commander with the highest rank is always the platoon leader in tank #1. The next highest surviving commander becomes the second-in-command in tank #4.

After the survivors renumber their vehicles, whole new vehicles are brought up from depots along with entire new crews. Since these are trained crews rather than individual replacements, they have ranks appropriate to their duties. However, their skills still vary widely.

When you select "single engagement" you fight just one battle, then return to the starting options again. However, your platoon record is ongoing. You can fight engagement after engagement with the same platoon. You can even combine single engagements with campaigns. However, you cannot interrupt a campaign for a single engagement, then return to the same campaign. If you interrupt a campaign, you end it.

Single engagements can be in any weather, and sometimes are at night.

Casualties & Replacements

Conclusions

Single Engagements

Campaigns

A campaign is a series of battles. The results of each battle strongly affects what orders each side gets for the next battle. However, random factors representing events elsewhere also play a role. The numerical rating of your platoon has *no* effect on the campaign. Events are determined solely by how well you fulfill your orders and how well you frustrate the Pact's plans.

Night & Weather: There are two types of campaigns, summer and winter. The introductory briefing to the first engagement tells you which applies. Needless to say, weather is much worse in winter campaigns.

The Pact forces are aware of your night-fighting advantages. They only attack in daytime. American forces will mount day or night operations in roughly equal proportions.

Duration & Quality Changes: Unless your platoon is wiped out or retired, a campaign lasts at least five or six battles, often much longer. You'll discover that if the enemy consistently loses battles then they'll reorganize and send in better equipment, making your job harder. On the other hand, if you're constantly losing the enemy will transfer their modern formations elsewhere and use older material on your front.

Victory & Defeat: Ultimately a campaign ends in a NATO or Warsaw Pact victory. You'll win if you put together a "winning streak" of engagements that pleases your superiors and defeats the Pact. Conversely, you'll lose if the Pact puts together a series of victories against your platoon. Remember, the numerical rating of your platoon does not effect the course of the war.

A special graphic display appears when a campaign ends. If you're victorious, your platoon history can continue. You could even start another campaign. If you're defeated, your platoon becomes prisoners of war. The platoon history ends. If you wish to continue you must create a new platoon.

Losing the Platoon

If all sixteen men of your platoon are killed in battle, the platoon's history ends. When a platoon is completely wiped out the US Army does not send more replacements. Instead they disband the unit. Therefore you cannot continue with that platoon, you must create a new one. An ongoing campaign immediately ends when your platoon is wiped out.

Mandatory Retirement

With great reluctance the US Army recognized that men can bear only so much combat action before their minds break. Therefore, after about 99 battles they retire a platoon to non-combat duties. This ends the platoon's combat record. Make the most of your combat opportunities while you can.

Just surviving 99 battles is quite an achievement. In real life it's doubtful that many platoons could do that.

Once you've survived, you'll want to measure your career accomplishments. The platoon's rating after 99 battles reflects this:

Career Rating Under 50,000: This is a mediocre showing. Obviously you've been very cautious. The platoon's crewmen may think you're a fine fellow, since casualties were probably light.

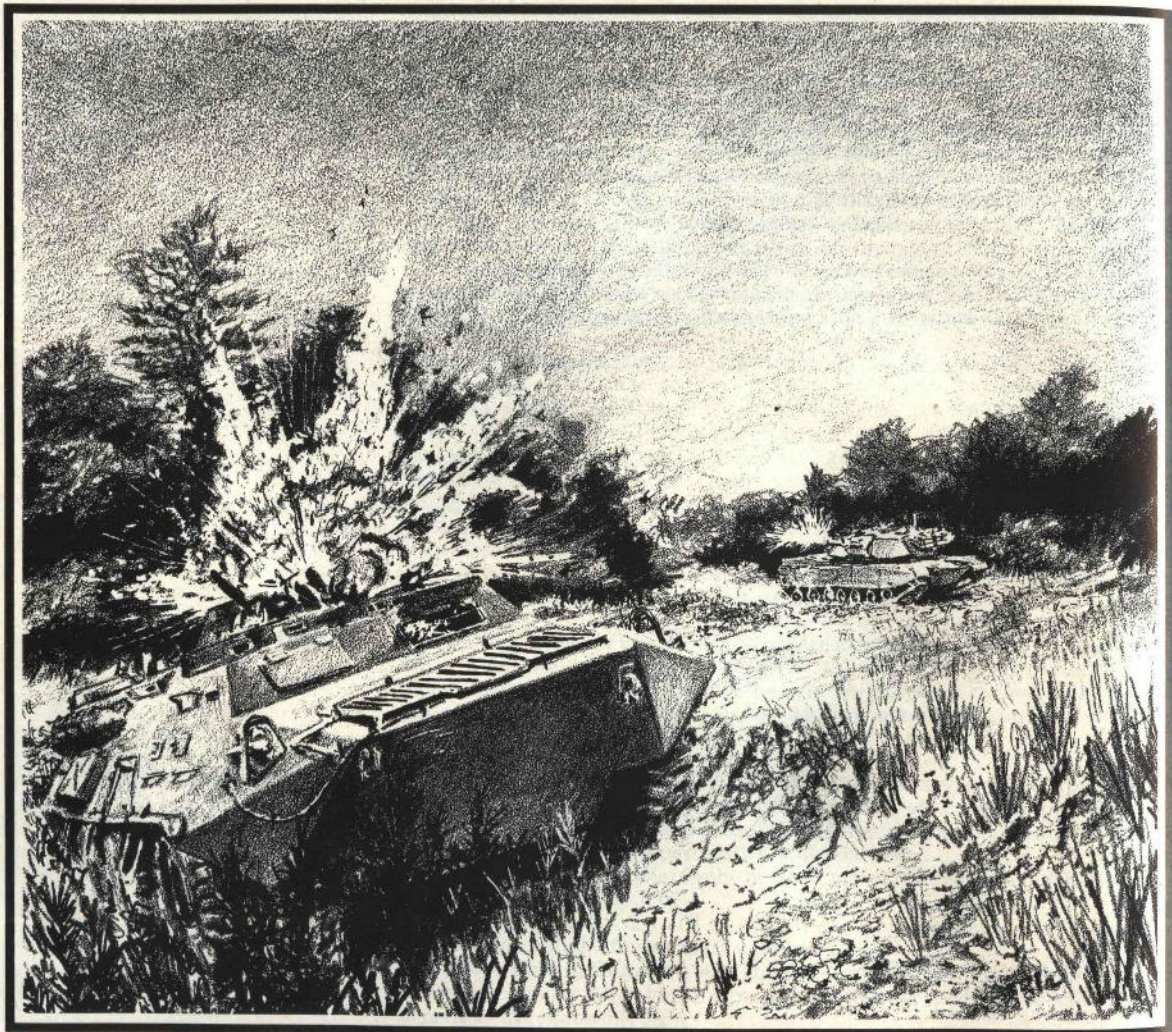
Career Rating 50-100,000: A solid, professional performance. Military men would be satisfied with this level of performance. Expect a score in this range, since it's rather difficult to surpass.

Career Rating 100-140,000: This is a superior record that only the more daring and successful commanders reach. Your record has attracted attention and favorable comment. You'll go far in the US Army.

Career Rating 140-170,000: This is a remarkable record that very few commanders would ever achieve. Your exploits are famous throughout the army.

Career Rating Over 170,000: This is an almost unbelievable record. You've probably won a number of campaigns single-handed! Your exploits are legend in the army and famous throughout the world. Erwin Rommel, George Patton, and Morshe Dayan all step aside. You're now the top tanker in world history!

Tie Breakers: If two platoons have similar ratings, the platoon with the fewer losses is the best militarily. You can even divide the career rating by the platoon's casualties.



3. TECHNOLOGY & TACTICS

GUNS & ARMOR

Modern guns are rated by their bore diameter (the diameter of the inside of the barrel, which matches the diameter of the shell or bullet). Rifles are commonly 5.56mm or 7.62mm, machine-guns are 7.62mm to 14.5mm, automatic cannons are 20mm to 30mm, light cannons are 75mm to 100mm, heavy cannons are 105mm to 125mm, and artillery is 152mm to 203mm.

Some guns are still rated in "calibers". This is the bore diameter as measured in inches, rather than millimeters. A "caliber .50" weapon is 0.5" wide, or 12.7mm.

Heavy cannons are the classic weapons of tanks and artillery. In WWII some tanks carried low velocity artillery-type cannons, while others had higher velocity armor piercing cannons. The latter were invariably more effective. All modern tanks now use large caliber, high velocity guns.

Sizes: Light tanks and heavy armored cars commonly use 75mm or 90mm guns, along with old medium tanks from the 1950s. Medium tanks of the 1960s and 70s used 100mm, 105mm and 115mm guns. The big 120mm and 125mm guns were introduced by Britain and Russia in the 1970s, then became common in the 1980s.

Rifled Guns: These weapons are designed like traditional rifles: they have barrel grooves that "grip" the base of a shell. The grooves have a spiral pattern, causing the shell to rotate as it moves down the barrel. This rotation gives the shell stability in flight, which improves accuracy.

The main rifled guns used today are British and Russian designs. The British 105mm gun was standardized for NATO in the 1960s and is still commonly found. The other common rifled weapon is the Russian 100mm used in the now obsolete T-55 series.

Smoothbore Guns: These weapons have no grooves in the barrel. Instead, the ammunition has "pop-out" or built-in fins that provide stability in flight. The USSR was the first to popularize this type of weapon, making smoothbores their standard tank gun in the 1960s.

There are three main smoothbore weapons used today. The German Rhein-

Modern Weaponry Size Ratings

Heavy Cannons

metall 120mm smoothbore is used by the Leopard 2 and the M1A1, with a variant planned for the new French Leclerc. An older Russian 115mm smoothbore is used in T-62s, heavily exported for the last twenty years. The newer Russian 125mm smoothbore arms the T-64, T-72, T-74 and T-80. It too is finding its way abroad in the T-72.

ATGMs: Anti-tank Guided Missiles

Invented by the French in the 1950s, wire-guided anti-tank missiles were a revolutionary anti-tank weapon. The missiles are "flown" by the gunner to ranges of 3,000 or 4,000 meters with very high accuracy. The heavier vehicle- or tripod-launched missiles have HEAT warheads that penetrate two or three times the maximum armor of main battle tanks. At least, they did until composite and reactive armors made HEAT less effective. Most missiles cannot penetrate the new armors unless they hit a weak point, or score multiple hits on the same spot. Of course, even a non-penetrating hit can inflict significant damage.

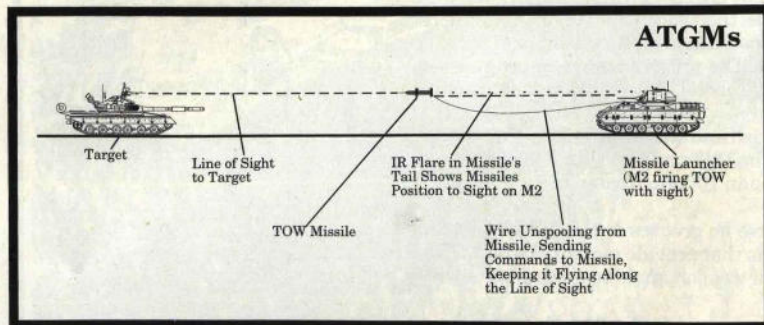
The main difference among ATGMs is their size and their guidance.

ATGM Sizes: Light ATGMs are designed to be carried by infantrymen. These include the 32 pound American "Dragon III", the French 14.6 pound "Milan" and the 35+ pound Russian AT-3 "Suitcase Sagger". These missile have smaller warheads and/or limited range (1,500 to 2,500 meters), which keeps the overall weight within portable limits.

Heavy ATGMs are designed to be fired from vehicles or large tripods. The missile alone usually weighs 25 to 50 pounds, while the launcher and guidance equipment weighs about twice as much. The American TOW and Hellfire, European HOT, and Russian AT-5 "Spandrel" and AT-6 "Spiral" are all examples of this weapon.

Manual Guidance: The first ATGMs were controlled manually. After launching the missile trailed a fine wire back to the gunner. The gunner used a small box with a joystick control to literally "fly" the missile to the target. Needless to say, this took considerable skill. However, both the Egyptians and Syrians mastered it and performed credibly in the 1973 Yom Kippur war firing Soviet manual-guidance AT-3 "Sagger" missiles against the Israelis.

Optical Guidance: The second generation of ATGMs replaced the joystick controller with a complicated sight mechanism. Using this system, the missile flies in whatever direction the sight is aimed. This is achieved by the sight sensing the missile's location (using IR emitters in the missile's tail and IR sensors in the sight), and then sending course corrections back along the wire trailed by the missile. These



missiles are much easier to operate than first-generation manual weapons. Virtually all NATO and Russian missiles now use this system.

Laser Guidance: This third generation of ATGMs separates the missile from the guidance system. The missile is launched, then another man (possibly far away) fires a laser at the target. The missile flies at whatever the laser hits ("illuminates") using special light frequency sensors mounted in its nose.

Fiber-Optic Guidance (FOG): This future generation of ATGMs actually mounts a TV camera in the nose of the missile. The gunner has a video monitor that shows him the view from the missile nose. Using joystick or similar controls, the gunner flies the missile as if he were riding it. This is possible because small, light fiber-optic "cables" can carry vastly more data than conventional wires. In this case, full-frame video data. The US Army is experimenting with "FOG" missiles. Deployment in quantity to frontline troops is about five to ten years away (given peacetime development schedules and funding levels).

Defeating ATGMs: The main weakness of all ATGMs is their speed. Cannon shells take one to three seconds to travel 2,000 to 4,000 meters. No vehicle can react fast enough to prevent a shell from hitting if it's aimed correctly. Missiles, however, take 20 to 60 seconds to travel the same distance. A vehicle crew can see a missile's launch, see its approach, and take appropriate countermeasures.

Appropriate countermeasures are disabling the missile's gunner and hiding. To hide, the vehicle need only pull behind a building or crestline, concealing itself from the gunner and missile, which then flies harmlessly overhead. Smoke screens can also be used to hide the vehicle.

In many cases the gunner is at the missile launch site. If the target vehicle can use cannon or machine-guns to fire back, the shells and bullets will arrive while the missile is still airborne. If the gunner or sights are damaged or destroyed, the missile will "go stupid" and usually miss. Even if the shells don't hit, the gunner may flinch or duck, throwing the missile off course temporarily.

Large cannons must be loaded one shell at a time. Loading can take 5 to 10 seconds, depending on the size of shell and the position of the ammunition and loader in relation to the breech, for a rate of fire of 6 to 12 rounds a minute.

Auto-cannons reload automatically, using a belt or clip like a machine-gun. This increases their rate of fire to hundreds of rounds per minute. Of course, auto-cannons are limited to smaller sizes, and even then the loading mechanisms and ammunition bins can be huge.

For example, the American M163A2 PIVADS has a six-barrelled 20mm auto-cannon mounted on its roof. It has an 1100-round linkless belt feed attached to the gun, and a spare 1000-round belt carried inside. This massive amount of ammo is sufficient for just 42 seconds of firing against aircraft, since in its designed role as AA gun the 20mm shoots 3000 rounds per minute!

Chain Guns: Traditional auto-cannons reload from the recoil or blowback of the previous round, just like a machine-gun. And just like a machine-gun, if a round is a dud or misfires, there isn't sufficient recoil or gas to clear the shell and

Auto-Cannons

reload the gun, causing a jam. The "chain gun" was created to solve this problem. Chain guns use a separate electric motor to pull the ammunition belt through the gun breech. If a shell doesn't fire, no problem, the motor just pulls that round out and pulls a new one in. Jams are still possible, but the frequency is greatly reduced.

Chain guns cannot fire as fast as traditional automatic weapons, but the lower rate of fire is sometimes an advantage in conserving ammo. The US Army uses a 25mm Chain Gun in the turret of its M2 IFV and M3 CFV vehicles, and a 30mm gun on its AH-64A attack helicopter.

Infantry Weapons

Traditional infantry weapons include rifles, machine-guns, mortars and grenades. None of these weapons has sufficient explosive power to hurt an armored fighting vehicle. In fact, tank and other AFV armor is designed to stop standard infantry weapons. Otherwise an AFV isn't much better than a truck!

Rocket Launchers: Man-portable rockets with HEAT warheads have been a common anti-tank weapon since the "bazooka" and "panzerfaust" of late World War II. However, the strength of tank armor has grown much faster than the size of these rockets, making them less and less effective, and now doubly ineffective because composite and reactive armors degrade the HEAT warhead.

Infantrymen are no fools. They use their LAW (American) or RPG (Russian) rockets by sneaking up and firing into vulnerable spots, such as the rear. Here the rocket could penetrate and do serious damage. Firing from a tall building, tree or cliff onto the thinner top decks of a tank is also effective.

The major weakness of infantry rockets is their inaccuracy. After 50 to 100 yards most rockets wobble or sway in the wind, often missing the tank entirely. Preferred firing range is 10 to 20 meters.

Tanks defend against infantry rockets by having an infantry escort. The friendly infantry eliminates enemy rocket launchers, while the tank provides cover and fire support to the infantry. This "team" tactic, developed during WWII, is still extremely popular. Some tanks even have telephones on their rear, allowing the infantry escort to talk to the crew while both remain under cover (the infantry behind the tank, the crew buttoned up inside the tank). The M60 has this feature, but unfortunately the M1 lacks it.

Artillery

Traditional Artillery is composed of guns and howitzers. The difference is the length of gun tube. Guns have longer tubes to fire longer ranges, howitzers are shorter. Most modern artillery is "gun-howitzers", which are halfway between categories and able to serve in either role. In all cases the guns are sited miles behind the front line. Modern artillery is mounted on a tracked chassis, so they can quickly move after firing ("shoot and scoot"). Most guns also are protected with light armor, to protect the weapon and crew in case they're caught by counter-battery fire (enemy artillery fire aimed at them) or overrun by mechanized infantry.

Artillery normally fires high explosive shells. These shells have casings designed to shatter into hundreds of jagged steel fragments ("shrapnel"). Shells

can be fused to explode above the ground ("air bursts") or on contact ("ground bursts"). In either case, the shrapnel almost always inflicts more damage than the explosion. In fact, artillery shrapnel caused between 70% and 90% of all battlefield casualties in World War I! The original reason for APCs and IFVs was to protect infantry from artillery, allowing them to advance through artillery fire, riding inside an armored vehicles that was proof against shrapnel.

Special Artillery Rounds: Most artillery carries a small number of HEAT rounds for self-defense against armored vehicles. In addition, modern artillery can fire laser-guided shells that fall onto targets illuminated by infantrymen and spotters using hand-held lasers. The most famous of these are the "Copperhead" rounds used by the US Army.

Laser-guided shells have numerous problems. First, each shell is quite expensive, making them in short supply. Second, shells sometimes don't pick up the laser, especially in bad weather, and therefore automatically miss. Finally, the enemy can use smoke screens to deflect and "fool" the laser, which automatically throws the shell off course. This last tactic is more common as vehicles acquire laser warning systems.

Western artillery also uses "submunition" rounds whose warheads crack open a few hundred feet above the ground. Some warheads carry tiny explosive bomblets, others small self-forging armor-penetrating missiles, and yet others have tiny mines. This ammunition is proving more and more effective, although most of the types now available are "first generation" experiments that aren't always reliable or effective. Russian technology lags behind the West in this area, since submunitions require tiny, precise design and manufacturing made possible by computers.

Rocket Artillery is a special variation of regular artillery, first used in mass by the Russian Army during WWII (the famous the "Katyusha", or "Stalin's Organ" launchers). A battery of rocket launchers can fire dozens of 220-227mm rockets in a single volley, while a battery of artillery only fires eight 152-155mm shells. The rockets arrive with a terrifying scream and saturate an area hundreds of meters on a side with explosions and shrapnel. The latest generation of rockets and launchers are larger than standard artillery, and therefore well suited to submunition warheads.

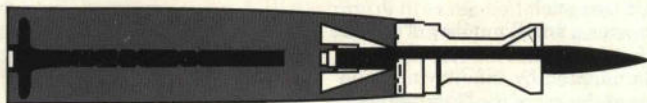
All cannons operate on the same general principle. A shell and an explosive charge are placed in the bottom of a long, strong gun tube. The base of the tube is closed off, but the muzzle left open. The explosive charge creates a hot, expanding gas. This pushes the shell out the muzzle of the barrel at a high rate of speed. Modern high-velocity tank guns have a muzzle velocity of 1,000 to 2,000 meters/second.

The "old fashioned" 1940s and 50s vintage armor-piercing shell for such cannon had a very strong nose. It was designed to hit armor with sufficient force to punch through to the inside and explode the small charge at the base of its armored nose. Then ballistic research showed that the fragmenting armor and

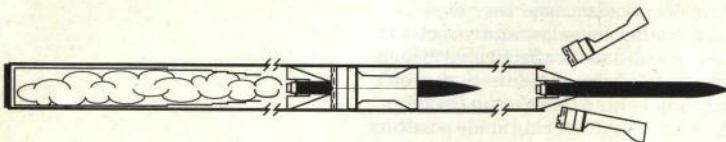
Warheads & Armor Penetration

Kinetic Energy & "Sabot" Shells

Sabot Shell



Firing Sabot



nosecone were far more destructive than the explosive following behind. In other words, the damage was done by kinetic energy transfer from shell to armor. As a result, modern armor piercing rounds are made entirely of a super-hard metal, with no interior explosive charge. When it penetrates, bits of broken armor, plus what parts of the shell survive penetration, go flying around inside the tank, ruining equipment and crewmen.

More research and creative thinking resulted in the ultimate armor-piercing round: "discarding sabot". This multi-piece round is assembled around a long, narrow "bolt" of very hard, dense metal. The bolt is surrounded by a multi-piece "sabot" so it can be mounted in the front of the shell casing. When the gun fires, the charge in the casing explodes, pushing the sabot-and-bolt pair down the barrel. The sabots fall apart once they are outside the muzzle, so the bolt alone flies onward at an extremely high speed. Originally Sabot rounds were fired from rifled cannons with groves that spun the sabots and the bolt (which had no fins). Most modern tank guns are smooth-bores, so the bolts have small fins for flight stability.

Bolts are usually made of a tungsten alloy (such as tungsten carbide), which is harder than steel. However, the US Army is now introducing bolts with a depleted uranium ("DU") core. This material is about 2.5 times denser than steel, so it concentrates greater power at the point of penetration. A metal jacket on the bolt stops the slight radioactivity from the depleted uranium.

HEAT Shells & Warheads

High Explosive Anti-Tank (HEAT) warheads, also known as "shaped charge" or "chemical energy" warheads, were developed during World War II for low-velocity artillery, and almost immediately used for lightweight anti-tank rockets as well.

Shaped charge explosives have their warhead explosives formed in a concave or inverted conical form. The walls and bottom of the warhead are made of strong metal, while the nose is very light metal. When the warhead hits the target, a contact exploder in the nose sets off the warhead. This explodes along the path of

least resistance — straight forward through the nose. The explosion is really nothing more than hot gases formed into a jet that emerges through the nose of the shell. But this jet is so hot it literally melts through armor, spraying around pieces of molten steel and the dissipating hot gasses. Whatever isn't wrecked is almost certainly set afire. Modern HEAT warheads have small tubes in their noses to further concentrate the explosions into extremely narrow and hot jets.

HEAT warheads function the same regardless of their velocity. This gives relatively slow rockets and missiles penetrating power similar to high-velocity kinetic energy ammo. In fact, most heavy HEAT shells or large missiles can penetrate much more steel than the most powerful high-velocity tank gun.

HEAT was so useful that some tank guns were redesigned to fire just that. HEAT warheads function better if they're not rotating, giving missiles and rockets another advantage over shells fired from rifled cannon. One nationality even went so far as to build a counter-rotating HEAT shell for their rifled gun. The warhead counter-rotated on a ball-bearing race inside the rotating case! Ultimately, though, this was another reason to switch from rifled cannons to smoothbores.

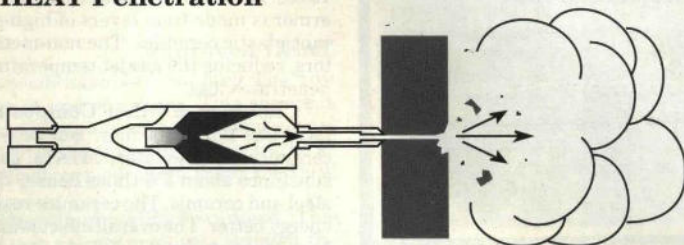
Steel: In the early decades of the 20th Century steel armor was rolled in sheets at the great steel mills, cut to shape, then bolted and riveted together. However, in the small wars of the 1930s and the early years of WWII (1939-45), military forces discovered that concussions from near-miss explosions and non-penetrating hits often popped bolts and rivets. These ricocheted around the vehicle's interior with deadly effect. Thereafter plates were welded together, or preferably cast in one large piece.

Today steel armor for tanks is cast in a few large, multi-ton pieces. The casting and treating process produces special hardening on the outer surface. This hard face can reflect shells, or shatter those with weak warheads. The slightly softer

HEAT Shell

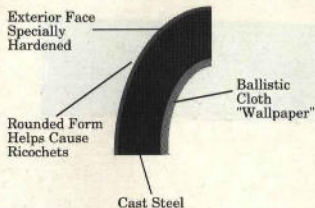


HEAT Penetration

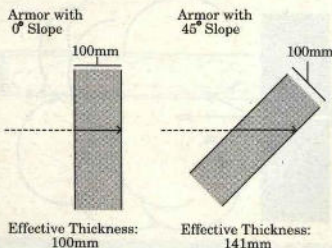


Armor

Steel Armor



Sloped Armor



Tilting (sloping) armor increases the effective thickness of a shell travelling horizontally. A 30° tilt adds 15.5% to the thickness, 45° adds 41.5%, and 60° doubles the thickness. Furthermore, the steeper the slope, the greater the chance that a round will deflect off the surface. Rounded, sloped surfaces are best of all, since a three-dimensional slope means that the surface is always curving away from the point of impact.

interior steel insures that a penetration of the face doesn't crack the entire casting. The very inside of the casting is commonly "wallpapered" with Kevlar or a similar ballistic fabric. This is because armor penetrations frequently spray small fragments of armor (spalling) and shell into the interior. The ballistic cloth is intended to "catch" all but the largest and heaviest fragments, thus reducing the amount of injury and damage caused by a penetration.

Sloped & Rounded Armor: Since the famous T-34 (first produced in 1941) tanks have used sloped armor to increase the effective thickness of their armor, not to mention encouraging ricochets.

One of the first remedies for HEAT warheads was to further change the shape of armor plate. Instead of using flat plates, during the 1950s new tank hulls and turrets were cast in rounded shapes. Rounded armor increased the chance of rounds bouncing off, or at the least causing the HEAT gas jet to strike the armor at an angle, so the jet would bleed off into the open air, rather than burning through the armor. Of course, a dead-on HEAT hit remained fatal.

Composite Armor: Chobham and composite armors were invented in the late 1970s. Although the materials and manufacture are secret, it appears that this armor is made from layers of high-strength/high-density metals and heat-resistant plastic ceramics. The non-metal layers probably act as heat sinks or reflectors, reducing the gas jet temperature much faster than steel. This means the jet penetrates less.

Chobham & Other Composites: Composite armor has a hard steel outer face, like normal armor. But below that are successive layers of metals and ceramics. On the latest M1A1s, the first interior layer is depleted uranium, a substance about 2.5 times denser than steel. Below this are successive layers of steel and ceramic. The ceramics resist heat better, while the steel absorbs kinetic energy better. The overall effect is armor that resists kinetic energy at least as well as conventional steel, and which absorbs the hot gas jets of HEAT ammunition so well that most of those weapons are useless. The final inner layer of the armor is undoubtedly a special metal or plastic that resists spalling much like the ballistic cloth "wallpaper".

The exact makeup of Chobham armor is probably more complex than simple layering. The ceramics may be locked within steel honeycombs, or vice versa. The layers may overlap or wrap around each other in complex patterns. The West is careful about its secrets: both the industries that manufacture this armor and soldiers who repair it must have appropriate security clearances.

All composite armors have one feature in common: they are created as flat plates. Tanks "wearing" these newer armors must abandon rounded shapes and return to flat plates. Hence the slab-sided look of the M1, the Leopard, and the front hull of the T-72/T-80 series.

Reactive Armor: Meanwhile the Israelis developed a much simpler defense against HEAT. They attached small, lightly armored boxes of explosive to the outside of the vehicle. Impervious to shrapnel and bullets, a box is set off by a HEAT hit, whereupon it explodes outward, breaking up the HEAT gas jet. This

greatly reduces armor penetration. The Israelis call it "blazer" armor.

Reactive armor can be bolted onto almost any existing armor, giving vehicles a good measure of HEAT protection. However, reactive armor has disadvantages. First, the box-coverings can form "shell traps" that encourage ricochets down into other parts of the tank — sometimes directly into weak points! Second, once a box explodes, that part of the tank loses its protection. It will probably "die" if another hit occurs in the same place. Third, the tank cannot carry equipment or personnel on the outside near those boxes. Finally, reactive armor has no effect against high-velocity shells. It simply explodes harmlessly as the bolt bores through.

Lightweight Alloys: A few light tanks and most lighter AFVs have abandoned steel for lighter metal alloys. Aluminum is the most popular. For example, the USA uses aluminum armor in the M113 series and M2/M3 series. The USSR even used magnesium alloys for parts of the BMP series. In both cases the choices were unfortunate. These metals have a much lower burning point than steel. When powerfully penetrated, fragments of armor actually ignited, spraying burning metal around the vehicle. In the Afghanistan war, furiously burning BMPs were quite common. Of course, badly sited fuel tanks also contribute to the torch-like nature of the BMP.

Improved HEAT

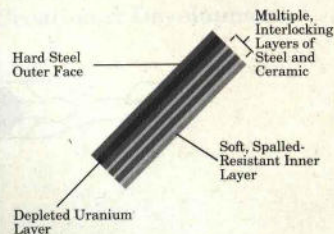
To combat reactive armor, new HEAT warheads have been invented. The "two stage" warhead has a small explosive charge at end of a probe. This charge is supposed to set off reactive armor. Meanwhile, the main warhead is following up, and explodes against the now naked armor. Of course, whether all this works as well on the battlefield as the firing range is still an open question. Today the TOW 2 missile uses such a warhead.

Another technique is to increase the diameter of a HEAT warhead. This creates an even more powerful jet, which in turn means more gets through the reactive explosion, or a deeper penetration into composites. The Hellfire missile's warhead was designed on this principle.

One largely unknown factor is the amount of damage a non-penetrating shell will do. In WWII a non-penetrating hit sometimes injured or killed the crew, especially in tanks that used riveted construction. Well-made welded or cast tanks survived better, although crewmen were still seriously injured by concussions, interior armor flaking and flying around the turret at the impact point, etc. More to the point, WWII tank gun shells were 50mm to 85mm. Modern shells are 120mm to 125mm and pack triple or more the power. Even with anti-spall liners and new composite armors, a square hit that partly penetrates armor could cause very destructive secondary effects.

Indirect damage is especially important for the M1A1 because of ATGMs and HEAT. If indirect damage is not a problem then the M1A1 can largely ignore missiles fired against its front because they have virtually no chance of penetrating. However, if indirect damage does occur, then those ATGM hits will sometimes

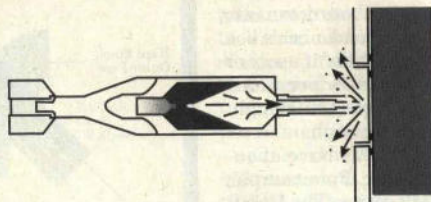
Composite Armor



Composite armors, of which Chobham is the most famous and probably most effective, are secret. This diagram and explanation are speculative. The only absolute fact is that composite armors must be formed in flat sheets. They cannot be curved or rounded. Hence the "slab-sided" appearance of all vehicles using composite armor.

Indirect Damage

HEAT vs Reactive



kill crewmen or cause other damage. This has a powerful effect on your tactics.

M1 Tank Platoon lets you decide whether indirect damage is a significant factor. The opponent quality level controls whether indirect damage occurs. "Veteran" and "Elite" opponents cause indirect damage. Needless to say, if indirect damage is a factor, then your job becomes much, much harder.

AFV DESIGN

The First Tanks: The tank was created during World War I (1914-1918) to help break the deadlock of trench warfare. That war proved that infantry could not assault strongpoints defended by machine-guns and supported by artillery, even if the attacker had his own machine-guns and artillery. This was because defenders in trenches and foxholes were fairly immune to fire, while attackers trying to crawl or run were cut down by thousands of bullets and shrapnel fragments.

Incidentally, artillery shell explosions throw out thousands of pieces of metal ("shrapnel") for hundreds of feet. This effect is far more destructive to infantry than the explosion itself.

First invented by the British, the tank was a vehicle designed to advance straight into and through both artillery and machine-gun fire. This meant it was covered with heavy armor, and needed treads to travel over trenches and irregular ground pock-marked with shellholes. Furthermore, the vehicle carried its own light artillery and machine-gun weapons, bringing these heavy weapons directly into the enemy defenses, where they could do great destruction at point-blank range.

Tanks proved effective and terrifying. Unfortunately, they were (and are) mechanical nightmares very prone to breakdowns. Most early tank attacks fizzled out after a few miles because the tanks broke down.

The first and best defense against tanks proved to be heavy cannons — weapons big enough to punch through the tank's armor. Throughout WWI and the following interwar years tanks were organized and assigned individually or in small groups as support to infantry formations.

The Blitzkrieg: World War II (1939-1945) saw the first large, organized units with hundreds of tanks used as a coordinated military force. The German and Russian armies pioneered these concepts, and were quickly imitated by the Americans and British Commonwealth. In a "blitzkrieg" (lightning war), entire Armored Divisions of 15,000 to 20,000 men were fully motorized with tanks, armored cars, half-tracks, and trucks. These units had the power to punch large holes in the enemy lines. They also had the speed to pass through and completely disorganize an army before the enemy high command realized what had happened.

To counter this, all WWII armies developed better and better anti-tank weapons. These included groups of special lightweight anti-tank cannons, as well as new "HEAT" warheads for shells and rockets. Small, short-range HEAT rockets carried by infantrymen (such as the "bazooka") proved very effective. Tanks now attacked with infantrymen following closely behind, to "mop up" the enemy infantry before they could reorganize and attack the tanks with rockets. But the most effective weapon to stop a tank was a fast, fully mobile, heavily armored vehicle carrying a powerful, armor-piercing cannon. In other words, another tank.

Tanks

Creation & Development

Tank Evolution

A Case Study of USSR Tanks



1922: the KS-1

<i>weight:</i>	6.9 tons
<i>main gun:</i>	37mm
<i>armor:</i>	16mm
<i>engine:</i>	33.5 hp
<i>crew:</i>	2

This was the first tank designed and built by the Soviet Union. It was closely modelled after a Renault design first used in 1916 (during WWI) and still popular throughout Europe. Less than 100 were built during the early 1920s.

Tank Evolution

A Case Study of USSR Tanks



1942: the T-34

<i>weight:</i>	28.0 tons
<i>main gun:</i>	76mm
<i>armor:</i>	45mm
<i>engine:</i>	500 hp
<i>crew:</i>	4

First developed in 1939 with a slightly less powerful 76mm gun, the T-34 became the most famous tank of WWII, as well as the first tank design to use sloped armor. In 1944 the turret was redesigned to fit a more powerful 85mm gun. The most common Russian AFV of the war, tens of thousands of T-34s were produced by 1945.

Postwar Developments: During the 1950s the French developed a new, tank-killing weapon: the guided missile. The missile had a warhead and a rocket engine, like the bazooka. The crucial difference is that it trailed a fine wire back to the launcher. There the gunner used a joystick (or later just a sight) to guide the missile into contact with the tank. With a good rocket motor the anti-tank guided missile (ATGM) became capable of hitting tanks 3,000 meters away — compared to the 25 to 250 meter effective range of bazooka-style rockets. In fact, since conventional kinetic energy penetrators lose effectiveness between 1,000 and 2,000 meters, many tank guns used HEAT rounds as their primary anti-tank ammunition. Some even tried using ATGMs fired through a tank's gun barrel.

Meanwhile, WWII experience indicated that Armored Divisions needed new and better vehicles to carry the infantrymen into battle. First the Armored Personnel Carrier (APC) appeared, a lightly armored "battlefield taxi" that carried infantrymen safely and quickly right up to the enemy lines. Then in the late 1960s the USSR invented the Infantry Fighting Vehicle (IFV), which added a light gun and an ATGM launcher, giving an infantry squad its own "light tank" for direct support. The bigger, more powerful, and more expensive main battle tanks (MBTs) supported the IFVs!

Modern Tanks: Tanks and other armored fighting vehicles (AFVs) have three universal features: weaponry, armor and mobility. Tanks are the largest, most powerful and most expensive AFVs on the modern battlefield. They are invariably the most heavily armored, and carry the most powerful guns. Their mobility varies, depending on amount of armor and size of gun.

Main Guns

There is universal agreement among tank designers that a tank's main armament should be a large, high-velocity cannon. Inexpensive "light tanks" have 75 to 90mm (bore diameter) guns, while the larger, heavier "main battle tanks" (MBTs) have 100mm to 125mm guns.

The standard NATO gun from the 1960s to the early 1980s was a British-designed 105mm rifled cannon still favored by the Israeli army. However, the West Germans and the US Army have adopted the Rheinmetall 120mm smoothbore for their latest MBTs: the Leopard 2 and the M1A1 respectively.

The Russians pioneered the use of smoothbore guns firing both HEAT and Sabot in the 1960s with a 115mm smoothbore in their T-62. A more powerful 125mm smoothbore equips the T-72 and T-80 types. Smoothbores are sensible weapons because the finned bolts on a Sabot round eliminate the need for rotational stability, while rotating HEAT rounds suffered reduced penetration. Of course, the lack of rifling does reduce the accuracy of a HEAT round, despite the inclusion of fins. But what good is higher accuracy if the round is too weak to be effective?

During the late 1960s and early 1970s the US Army experimented with a low-velocity 152mm gun that fired HEAT shells and guided missiles. Unfortunately,

neither the gun nor the missile really worked correctly. In fact, in certain cases it exploded rather spectacularly. All those vehicles either were retired from active duty or rearmed with a conventional cannon.

In the early 1980s the Russians became dissatisfied with their 125mm guns. The accuracy and power of the weapon was considerably inferior to Western weapons of the same caliber. Their solution was to develop a missile that could be fired from the 125mm smoothbore: the AT-8 "Songster". Hopefully their designers benefited from the disastrous experiences of the USA fifteen years earlier. It is rumored that the USSR's ultimate solution to this problem is a new 130mm smoothbore gun that is fabricated using computer-controlled processes common in the West for the last decade.

Aside from these experiments, main battle tanks do not carry missiles. The general opinion is that the main gun should be powerful enough to do the job. After all, what's the point of having a main gun if it's ineffective?

Secondary Weapons

Since the early days of tanks the universal secondary weapon is the machine-gun, although the number has varied. Since WWI military designers have known that machine-guns must have a fixed, stable firing platform to hit anything beyond 500 meters range. In tanks, this platform is a coaxial mount — with and alongside the mount for the main gun. This extremely stable firing platform yields accurate fire to 1000-1500 meters.

Other machine-guns are mounted on the turret roof. These mountings are normally flexible, allowing the crewmen to use the guns at close range in any direction against hostile infantry. They were also intended for defense against aircraft, but today helicopter armor is often stronger than the bullets from the US 12.7mm (caliber .50) or Soviet 14.5mm rooftop guns.

Machine-guns are very ineffective against jet aircraft. A jet traveling overhead at 450 to 550 knots is seen only for a few seconds. To hit it, you must aim at a spot a few hundred yards in front of its position. Worse, the plane is traveling so fast that it sometimes literally flies between one bullet and the next! Still, a lucky hit is always possible on any aircraft.

Fire Control

There are many problems in firing tank guns. During WWII the fire control systems were so primitive that most tank battles were fought at 500 meters range or less, by vehicles which halted to shoot. Although many tank guns could penetrate at longer ranges, it was difficult to score an accurate hit!

Stabilization: The first problem in tank gunnery is having a stable platform. A tank moving over open terrain bounces and bucks in most appalling ways. Until suspension technology was improved in the 1950s and 1960s, maximum cross-country speed was 12 to 18 mph — any faster and the crewmen frequently suffered cracked or broken bones! Even today the maximum speed cross-country is about

Tank Evolution

A Case Study of USSR Tanks



1962: the T-62

<i>weight:</i>	37.5 tons
<i>main gun:</i>	115mm
<i>armor:</i>	100mm
<i>engine:</i>	700 hp
<i>crew:</i>	4

The first MBT to use a smooth-bore gun firing both Sabot and HEAT ammunition, the T-62 was low, fast, and innovative. Its main weakness was light armor: the designers relied on rounded, sloping armor to deflect shells and HEAT warheads, a sensible idea when battlefield missiles could defeat over 600mm of steel plate! As originally built, the turret had stabilization, but the rangefinder was an antiquated stadiametric system. About 20,000 were built, with many exported to Soviet allies and clients. T-62s were common in Syrian and Egyptian forces during the 1973 war with Israel.

Tank Evolution

A Case Study of USSR Tanks



1982: the T-80

<i>weight:</i>	47.4 tons
<i>main gun:</i>	125mm
<i>armor:</i>	200mm+
<i>engine:</i>	985 hp
<i>crew:</i>	3

Russia's most modern frontline tank has a mechanical loader that reduces the crew to just three, as well as keeping the turret small and low despite the large gun. The hull front uses composite armor while the turret is still a small, rounded steel form, but with much heavier armor. Reactive armor boxes cover the front and flanks. A laser rangefinder and AT-8 gun-tube launched missile are standard. The engine is a gas turbine, the first such in any Soviet tank. About 8,000 are now in service with USSR forces in Western Europe.

30 mph, and the results can be rather rough on the vehicle occupants.

Stabilization systems were designed to reduce this problem by keeping the turret steady, regardless of what direction the tank's hull was traveling. With the stabilization running, if the driver turned left, the tank's turret rotated right an equal amount; if the tank started up a hill, the gun barrel (and coaxial machine-gun) dipped an equivalent amount, etc.

Stabilization compensation is not instantaneous, especially if the driver makes a quick or violent maneuver. After all, the heavy tank turret and gun assembly weighs many tons and is moved hydraulically. It can be slow to respond. Of course, the gunner feels this as he's tossed around the turret. This is why American tank gunners always announce "On the way" a split-second before they fire. This warns the driver to keep things steady until he feels the cannon recoil.

Rangefinders: The next major problem in tank gunnery is finding the range. High velocity tank guns have a "battlesight" range and a maximum effective range. Out to "battlesight" range the shell travels in virtually a straight line. Beyond that it begins to fall toward the ground. To compensate, the barrel must be raised an extra amount ("superelevation"). The amount of superelevation increases geometrically with range.

During WWII (1939-45) battlesight range for the common tank guns of the time was 400 to 600 meters. Today the battlesight range of the M1's 120mm sabot ammunition is about 1500 meters, but HEAT battlesight is only 800 meters (the shell has much greater air resistance).

Stadiametric ("stadia") rangefinders were the first, crude attempt to help the gunner estimate the range and figure out the necessary superelevation. A stadia rangefinder has "mil" markings on the gunsight optics. A "mil" represents 1 meter of distance at 1,000 meters range. For example, the US M60 tank is 3.2 meters tall. Russian tank sights have horizontal marks 3.2 mils apart vertically. The Russian gunner aims at an M60 and aligns the bottom mark to the bottom of the target. If the top mark is right at the top of the turret, then the tank is 1000 meters away. If the mark is above the turret top, the tank is beyond 1000 meters. If the mark is below the turret top, the tank is closer than 1000 meters. Secondary mil markings at 0.5 and 1.0 mil intervals help him estimate how much closer or farther. Then the gunner cranks in the appropriate superelevation for his range estimate (the gunner is expected to memorize the superelevation for various ranges and ammunition from ballistic tables issued him).

Stereoscopic rangefinders were favored by the US Army in the 1950s and 60s. The original M60 models used this type of rangefinder. Here the gunsight had two lenses, one on each side of the turret, with both images projected by mirrors onto the gunner's eyepiece glass. The gunner adjusted dials that angled the mirrors until the two images merged to one. The device compared the mirror angles and used simple trigonometry to compute and display the range. Of course, the resulting accuracy depended on image clarity and the gunner's eyesight. Aligning tiny images seen through a smokey battlefield while riding inside a bouncing tank isn't easy!

Laser rangefinders were introduced in the 1970s, and are almost universally used by all major armies today. Although expensive, they're the best and most reliable ranging device. The rangefinder fires a laser beam from the gunsight. When the beam hits a target it breaks up, scattering in all directions. Special sensors sensitive to the laser's frequency pick up this scatter. The device determines the amount of time between the laser's firing and the scatter's return. Since the speed of light is constant, the range is easily computed and displayed on either the gunsight itself or a nearby computer readout. Of course, the laser must be aimed correctly for a valid reading. If the laser bounces off a nearby hill, tree, or cloud of smoke, the result is incorrect.

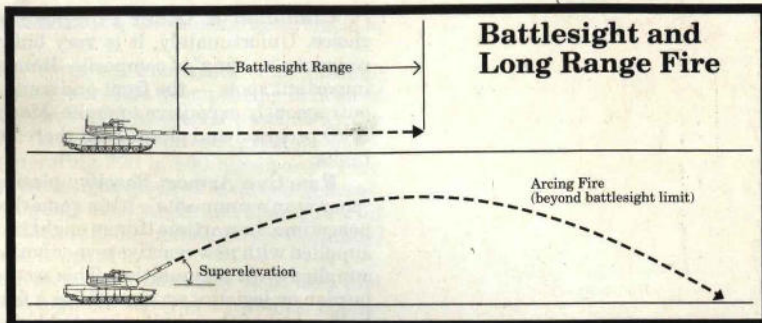
Ballistic Computers: Even with laser rangefinders the gunner must remember the correct superelevation for the weapon — and this value changes depending on the ammunition used. He must also correct for target movement by “leading” the enemy a bit (to insure that the enemy shell meets the enemy vehicle, rather than landing where it used to be!). Wind and barometric (air) pressure also affect shell performance.

The latest Western tanks, including the M1 series, have a ballistic computer that makes all these calculations and estimates for the gunner. If the target is moving, the gunner tracks it with his sight. If the range is correct, the computer uses the turret movement to compute how fast the enemy is moving, then automatically adds the appropriate additional rotation to “lead” the target. The computer also corrects for the vehicle's tilt on the ground and for wind, using the wind sensor at the rear of the turret roof.

At the moment most Eastern Bloc AFVs do not have computers. The gunner must make these mathematical calculations in his head, or simply estimate from tables supplemented by his eye and experience. Unfortunately, eastern bloc tank gunners get very little practice firing with live ammunition. The result is poorer accuracy, especially at longer ranges or against moving targets.

Steel: Standard heterogeneous steel with Kevlar anti-spall liners remains a common armor in many AFVs. In most cases a nation already has steel plants available, while composite or lightweight alloy fabrication may require a major new industrial investment.

Modern steel armor is almost always cast in rounded forms that increase the chance of a shell ricocheting off. Even tank hulls are rounded (such as the M60A3 hull), although the tracks, track-guards, and top decking often conceal this fact.



Armor

Chobham & Other Composites: Composite armor is the protection of choice. Unfortunately, it is very bulky and very heavy. No tank can afford a complete "coating" of composite. It must make do with composite armor over the important spots — the front and some part of the sides. Composite armor is also outrageously expensive to make. Many smaller nations cannot afford their own R&D program and plants, and therefore must either do without or buy pre-built tanks.

Reactive Armor: Reactive plating, usually over conventional steel, is the "poor man's composite". It's a remarkably sensible solution, and inexpensive in peacetime. In wartime things might be different. Reactive tanks would have to be supplied with new reactive armor boxes in roughly the same quantities as they're supplied with ammunition. This would place a large and probably unexpected burden on logistics services. After a few days of combat, tanks might end up with half or less of their hull protected by reactive armor.

Lightweight Alloys: Aluminum and similar alloys significantly lighten a vehicle, which not only makes them more mobile, but means a smaller, cheaper engine can be used. Although light alloys have a spotty combat reputation (M113s in Vietnam and BMPs in Afghanistan were all too vulnerable), the cost savings continues to attract both major and minor powers.

Mobility

A tank is useless unless it can move itself cross-country. Tanks are expected to travel over rock, dirt, mud, sand, snow, underbrush, and even shallow water. Tanks must be able to cross trenches and ditches, climb up and down moderate slopes, and pass over shell-holes. For such conditions treads are the only feasible answer. From the first tanks of 1916 to the present, all main battle tanks use treads, not wheels.

Tracks: A tank track is composed of dozens of small metal "shoes" linked together. The linking is done with holes and pins, usually bushed with rubber. Hard rubber shoes may be used instead of metal, since metal instantly tears up road surfaces. However, metal is superior for off-road travel.

When a 40 to 65 ton tank skids sideways on a slope, it's very easy for a track to slip from a wheel, or break entirely. After all, the small pins in the tracks or rubber surfaces on a wheel is trying to hold 40-65 tons of momentum! High speeds and irregular ground are a deadly combination to tank tracks, and quite common in battle conditions! Without skillful driving a tank can immobilize itself!

Sufficient high explosive near or beneath a track also breaks it. This is the function of buried anti-tank mines. The pressure of a track explodes the mine, which breaks the track.

When a tank loses a track, the upper part must be manhandled off the upper rollers until it lies flat on the ground in front of the tank. Bad shoes, broken wheels and damaged suspension parts are replaced, then the tank is "driven up" the track and the break reconnected at the bottom front. This is a long, brutal job that requires the entire crew and any other strong bodies in the area for 30 to 90 minutes. If the tank is immobilized in uneven, rugged terrain it may be impossible

to fix the track in that locale. Another tank must tow the immobilized vehicle to flat, smooth ground for the repair.

Engines: The first tank engines were borrowed from trucks and gasoline powered. However, by the 1930s and 40s these were fast disappearing in favor of diesel engines running on oil. Diesel oil is less explosive than gasoline and is consumed more slowly for its weight and volume (giving the tank greater range). However, acceleration is less. Diesels generating 300 to 500 horsepower were common for WWII, and by the 1970s efficient designs resulted in diesels generating as much as 750 hp. Unfortunately, designing even larger and more powerful diesels produces diminishing returns. To date only one nation (West Germany) has attempted it, with mixed results in the Leopard 2.

Then in the early 1980s America and Russia simultaneously went back and tried gasoline engines again, but this time high-efficiency gas turbines. Horsepower jumped to 1000 or more and tanks began to drive like sports cars instead of tortoises. Cruising range decreased and engine maintenance requirements rose. The Americans solved the maintenance problem by making the engine extremely modular — with a simple crane an entire M1 engine can be replaced in 30 minutes!

Ratings: There are two common measures of tank mobility. The first is a horsepower/weight ratio. The higher this value, the more power a tank develops. A more powerful tank can climb steeper slopes, drag itself out of deeper mud, and (usually) reach a higher top speed on both the road and cross-country. Given equal types of engines, a more powerful tank accelerates faster, giving it better “dash” ability. However, the acceleration curves of gasoline engines are almost universally superior to diesels.

The other important rating is a tank's ground pressure. The higher the ground pressure, the more the tank sinks into the earth. If two tanks have equal horsepower/weight ratios, the one with the lower ground pressure accelerates and travels faster. The heavier tank also can be mired (immobilized in mud) more easily. Ground pressure is a crucial factor in cross-country performance, considered by many to be more important than horsepower/weight.

The absolute (total) weight of a tank is also important. All bridges have weight limits. If a tank exceeds these limits, the bridge breaks. In Western Europe many bridges are limited to 40 metric tons, sometimes 50. When nothing better than steel armor existed, many tanks designs were kept to 40 tons weight, since extra weight in more armor contributed little to survivability. When composite armors gave tanks a hope of defeating HEAT missiles, designers abandoned the 40-ton limit. Most modern western tanks run 55 to 65 tons.

Long Distance Travel: The unpleasant truth about tanks is that they're nowhere near as reliable as cars. They require daily maintenance, and even then something is bound to demand attention or replacement every 50 to 100 miles. In rough going tracks wear out and start breaking after a few thousand miles.

As a result, all modern armies try to avoid “marching” their tanks behind friendly lines. Instead, tanks are loaded onto flatbed railroad cars and moved by

rail. Special tank transporter trucks were popular for a time in the 1950s and 60s, but these proved little more reliable than the tanks themselves! If tanks must march a large distance, they do it in easy stages, with frequent maintenance stops and a few days for extra repairs when the journey is done. Otherwise the unit will enter battle under strength and falling apart.

Survivability

In addition to armor, tank designers have given considerable thought to vehicle layout that enhances survivability, or at least reparability. After all, even if a tank is penetrated, it's far better to have a wreck that needs a day or two of repairs, rather than a wreck that's a burned-out hulk only good for scrap metal.

Layout: The basic layout of a tank has a strong effect on survivability. Many tanks store their main gun ammunition in open racks around the base of the turret. Although easily accessible, the ammunition is also easily set off by a penetrating hit. Some designs have set up ammo storage in the hull, surrounded by relatively inert diesel oil tanks. But the best design concept to date is placing the ammunition in a walled-off turret bustle. This way a penetrating turret hit will not trigger an explosion that demolishes the vehicle — it will either penetrate the turret crew area without an explosion, or it will demolish the bustle while leaving the rest of the turret relatively intact.

Another excellent concept is redesigning the hull layout. Most tanks have the driver and fuel tanks in front, the turret in the center, and the engine at the rear. The Israeli Merkava and various IFVs place the engine in the front, the driver in the middle, while the turret and fuel tanks are in the rear. The advantage is that hits which penetrate the front armor will wreck the engine, but not affect the crew or turret areas, leaving the expensive gunnery equipment and the trained crewmen relatively intact.

Fire Suppression: A tank's flammability is an important issue. Some tanks catch fire and burn easily. On these tanks a penetrating hit can start a fire that totally demolishes the vehicle. However on tanks that rarely catch fire, a penetrating hit only damages part of the vehicle. This allows for repairs, or at least a source of spare parts. The M1 is the leader in sophisticated and extensive fire suppression systems. It has automatic sensors and halon fire extinguishers for each of the three main areas: the driver, the turret, and the engine compartment.

Trade-Offs and National Preferences

Tank designs have a unique national character. This is created by an interaction between the military specifications for a new design and how engineers use existing and new technologies to achieve these goals. Although the military personnel issuing the specifications change, the engineering and manufacturing groups have decades of history and tradition that strongly affect how they solve problems and implement new ideas.

Design Trade-Offs: Tank design is a trade-off between armament, armor and mobility. Thick armor increases the weight, reducing mobility. Furthermore, each crewman and each large piece of equipment (like a big gun or a big engine) increases the internal volume. The larger the volume, the more area the armor

must protect, which again increases the armor weight. Finally, bridge widths and railroad flatbed car sizes restrict tank size — a tank that can't cross bridges or ride on a train will never reach the battle area! As a result, designers like to keep weaponry compact and engines small but powerful.

Experience indicates that the maximum feasible weight for a tank is 60 to 70 tons, with 40 to 50 tons preferable. Weights over 70 tons are easily mired, not to mention destroying roadbeds, culverts, and most bridges.

USA Designs: Until the M1 the USA had a long history of solid, reliable and entirely mediocre tank designs. The 1940s M4 "Sherman", the 1950s M48 "Patton" and the 1960s M60 had much in common: big, oversized, comfortable (by tank standards) and mechanically reliable. The Sherman had very mediocre armor and a weak gun that underwent almost yearly improvements. The M48 was a good design for the 1950s, but the M60 was almost built obsolescent. It was huge and was slowed by heavy armor and a weak engine. But despite the armor, ATGM HEAT warheads could still penetrate. Worse, the M60A2 model abandoned its one decent attribute (the 105mm gun) in favor of the disastrous 152mm gun-missile system. Today there are no 152mm-armed M60s left in existence. All have been scrapped or converted to rear-area duties. In the 1970s the Army jointly designed the "MBT 70" with West Germany, creating a horrendously expensive vehicle full of gimmicks that added little to its combat capabilities. Mercifully, the program was killed before production started.

When the US Army started another design program in the late 1970s, armor theorists didn't expect much and congressmen snickered. They looked forward to more subcommittee fun exposing new military blunders.

The M1 broke all expectations. It is a stellar performer with armament, armor and mobility all superior to its competitors from other nations. Although expensive, the money has been spent in useful places, such as designing the most powerful tank engine ever made, thermal sights, and Chobham armor, rather than unmaintainable gimmicks like variable-height suspensions and gun-missile systems. Although anti-military congressmen and journalistic pundits searched for boondoggles, all they could find were the usual assortment of "teething" troubles that have been repaired. They couldn't even complain about the "unnational" use of a West German 120mm gun — because the US Army had the political wisdom to initially fit the outdated 105mm, then switch to the 120mm after proving it incontestably superior.

Soviet Designs: From the 1950s onward Soviet tank designs have emphasized armament and mobility. Armor is lighter than expected, but the designs try to compensate with small, rounded turrets that deflect hits. To avoid cramped conditions, the smallest 5% of the soldiers drafted into the Russian army are assigned to tanks and similar vehicles. The result is exceptionally light, fast tanks with powerful guns. They're better at dodging than slugging it out with the opposition. Israelis tankers, familiar with British and American designs, have said that Soviet tanks "drive like sports cars".

The Soviets pioneered smoothbore guns for the new sabot and HEAT ammu-

dition, and gradually Western nations have copied them. In fact, the West has started beating them at their own game. The new Rheinmetall 120mm has more power and better accuracy than the Soviet 2A46 125mm. This is probably due to the West's higher tolerance manufacturing technology. But the Soviets have recognized this problem too, and developed a through-the-barrel missile (the AT-8) as a long-range "equalizer".

German Designs: Like the French, the Germans also designed a light, fast, heavily armed tank for the 1960s and 70s: the Leopard 1. At the time it had the best suspension and cross-country performance in the world. When composite armor appeared, the Germans began a gradual upgrade process that refitted the Leopard with the new armor, as well as their new, fabulously powerful 120mm Rheinmetall smoothbore gun.

The result was the Leopard 2, West Germany's tank of the 1980s and early 90s. Unfortunately the new armor and bigger gun added to the turret area and overall weight, forcing a new engine. The Germans chose a diesel, the largest MBT diesel engine in the world, which added yet more weight. Although the Leopard 2's speed equals the M1, its acceleration is inferior, giving poorer "dash" performance.

Other AFVs

APCs

(Armored Personnel Carriers)

During WWII, Armored Division commanders needed infantry to accompany their tanks. In fast-moving armored actions units moved faster than infantry could walk, and often needed to roll past machine-gun posts or artillery barrages. The lightly-armored halftrack was the usual solution, despite inferior cross-country mobility and an open top (making its passengers prey to artillery airbursts and infantry fire from higher ground).

In the 1950s most nations began building fully tracked vehicles with a roof. These armored personnel carriers were designed to carry a squad of 10 to 12 infantrymen, plus the vehicle driver. The American M113 is the most common and possibly the best of these designs, with roof hatches for driver, commander, and some of the infantrymen, and a rear door-ramp for quick debarking and embarking. It was also amphibious, able to swim in calm rivers, swamps, etc. Unfortunately, to keep the vehicle light and cheap, it had aluminum armor just barely sufficient to the purpose. The only armament was a machine-gun mounted on the roof: it provided rudimentary self-defense against ground and air attack, but the vehicle's real fighting power lay in its cargo of infantry.

The main alternative to a tracked APC is a wheeled vehicle. After various experiments, in the late 1950s Russia settled on an eight-wheeled design (the BTR-60) that eventually acquired a roof and a small machine-gun turret. The great value of wheeled vehicles is their lower cost and easier maintenance. They're fine on roads, and with all-axle drive using solid tires they can move cross-country and survive bullets and shrapnel. However, when moving cross-country they must go around or break down low walls and small ditches that a tracked vehicle could ignore.

Given the 1960s-1980s Soviet Army theory of "quantity first, quality second", lots of BTRs made sense. Unfortunately, the Soviet design had numerous design

flaws that were largely ignored in the BTR-70, and then finally fixed in the BTR-80. Meanwhile, an armored variant of an arctic tractor, the MT-LB, has proved itself to be an extremely agile and useful fully tracked APC.

In 1962 Russia revealed a novel new AFV design: the BMP. It carried a squad of infantry like an APC, but it also carried a light 73mm cannon and tank-killing ATGMs (anti-tank guided missiles). It was fully tracked and could travel with tanks, but was lightly armored like an APC. Its cost was higher than an APC, but much less than a tank. In short, it was a light tank, missile carrier, and APC rolled into one.

Armies around the world turned an envious eye on this new concept. Theorists argued long and hard. America and Britain dragged their feet for years. After all, no Russian invention could really be that useful, could it? But today both America and Britain are fielding their own IFVs.

In theory, the IFV is an infantryman's dream. It carries heavy firepower infantrymen need but cannot manpack. In fact, infantry frequently view the IFV as a light tank for their squad. A light tank they can ride inside, for added protection and comfort.

However, IFVs have reduced infantry squads to the minimum possible size: 6 to 8 men. The squad now depends on the vehicle for heavy firepower. Worse, squads increasingly depend on the IFV for their cohesion. Most IFVs are designed so the squad leader remains aboard, rather than dismounting. This means the infantry won't move far from the vehicle. Increasingly the IFV is fought like a tank, although its crew isn't trained in tank tactics. Worse, the vehicle is unsuited for the task because of its light armor. IFVs are vulnerable to virtually every gun, missile and infantry rocket on the battlefield. The result is lots of wrecked IFVs and incapacitated infantrymen, both on exercises and in real life. IFVs were the majority of AFV casualties for Syria 1973 and 1982, and for Russia in Afghanistan. The American M2s and M3s have yet to see action.

The solution is an IFV with heavier armor. This would make it a tank-variant that replaced the big-gun turret with a small turret and infantry space. However, such a vehicle costs almost as much as a tank. No contemporary army could afford to mount its infantry this way without overwhelming sacrifices elsewhere. Until the money is found, or the army is reduced in size, IFVs will keep tempting infantrymen into "death rides". In the design and testing of this simulation, we were struck over and over by the quick casualties among IFVs. They'd fire a missile or two, then get hit by something and die. In this simulation the infantry squad always dismounts instantly, whenever the vehicle stops. This frequently saves the infantrymen. Unfortunately, in real life the infantry hate all that running in and out of their "tank". The price of this comfort is a flaming death. This happened frequently in Afghanistan, and still happens (without actual casualties, of course) in US Army exercises.

IFVs (Infantry Fighting Vehicles)

Reconnaissance & Cavalry

In the early days of armored forces many armored units were created out of old horse-cavalry units. However, since the 1950s "cavalry" has referred almost exclusively to armored reconnaissance units, and is popular only in the West.

The main duty of armored reconnaissance is to collect information about the enemy and inform headquarters. There is a large, ongoing debate about how much fighting recon troops must do to get this information. The Russian theory is that they should do very little. As a result their recon forces have used armored cars (BRDMs) with machine guns for decades. Only recently have they added cannon-only variants (the BRM) of the BMP IFVs. The vehicles are deliberately under-armed to discourage the troops from closely engaging the enemy. On the other hand, many BRMs carry battlefield surveillance radar (a 10 km ranged model) on the rear deck, an expensive innovation rarely found on equivalent Western vehicles.

In Western armies reconnaissance has heavier armament. American "armored cavalry" has two different organizations and purposes. Independent armored cavalry regiments have both M1 tanks and M3 CFVs (Cavalry Fighting Vehicles). Their duty is to guard the NATO borders and delay any invasions. American Divisions of infantry and armor have armored cavalry reconnaissance squadrons with just M3s.

However, the American M3 is virtually a light tank and missile carrier. Externally similar to the M2, it carries two infantry scouts as well as the three-man crew. The remainder of the rear cargo space is filled with extra TOW ATGMs. The M3 is far more powerful than Russian BRDMs and BRMs. This increases the overall firepower of the American army, but true reconnaissance activities may suffer as the cavalry gets involved in battles and takes casualties, rather than spending their time observing and reporting.

Supporting AFVs

Modern armies are almost completely armored and mechanized. As a result, specialty vehicles are mounted in modified versions of tanks, IFVs, APCs, and armored cars.

ATGM Carriers: During the heyday of the anti-tank missile (the 1960s and 70s), many armies built special vehicles just armed with ATGMs. These missile carriers were intended to hang back and fire from long ranges, destroying enemy tanks easily and cheaply.

The US Army uses a M113 variant for its M901 missile carrier. The Russians uses their BRDM armored car. In both cases the missiles are mounted on the roof, so the vehicle minimizes its exposure when firing.

AA Vehicles: The prevalence of helicopters and close-support attack jets means that both anti-aircraft (AA) guns and missiles must closely accompany other ground troops.

The most common and useful weapons are shoulder-launched SAMs (surface-to-air missiles), such as the US "Stinger" and the Russian SA-7 or SA-14 "Grail". Most infantry squads carry at least one such missile, which gives most APCs and IFVs an anti-aircraft capability. At the moment tanks don't carry these missiles.

Special AA gun vehicles are used by all nations. The American M163 PIVADS is just a 20mm gatling gun mounted on the roof of a modified M113. The gun has rudimentary radar sights, but is of dubious accuracy against jets and dubious penetrating power against helicopters. The Russians have had the admirable ZSU-23-4 AA tank with quadruple 23mm auto-cannons for decades. They are now replacing it with the more powerful twin 30mm ZSU-30-2. The US Army attempted to create an AA tank with the twin 40mm "Sergeant York", but the vehicle was a dismal failure that has been cancelled.

Finally, both nations have mounted SAMs of all sizes on lightly armored vehicles with either wheels or tracks. Most of these vehicles are designed to sit a few kilometers to a few dozen kilometers behind the lines, covering the battlefield air space while remaining out of range of enemy guns and missiles. Russia has a much greater variety of launchers carrying a wide variety of missiles, while the USA has a rather limited selection, both in types and absolute numbers. The US Army by default seems to rely on the US Air Force to control the battlefield airspace.

Observation Vehicles: Artillery forward observers (FOs) and forward air controllers (FACs) now have their own specialty vehicles. They are "armed" with laser rangefinders and designators, high quality night vision aids, and lots of radio gear. Although they carry a machine-gun for self defense, their main "weapon" is the powerful artillery barrages and air strikes they call and direct on their radios. Although platoon and company commanders are also trained in the procedures for artillery and air support, all major armies are organized so that specialists do the communication and control, rather than the "up front" ground commanders.

The American M981 "FISTV" FO/FAC vehicle looks identical to the M901 missile carrier. Instead of holding missiles, the rooftop launcher has powerful lenses, lasers and a thermal viewer. The Russian MT-LBu is built on the MT-LB chassis, but with a large superstructure and small turret containing lenses, laser rangefinder, and image intensifiers for night vision. Unlike the American equivalent, the vehicle is also used for artillery command posts, where it is filled with typically cumbersome Soviet computer equipment.

Artillery: Modern artillery is commonly mounted on tracked vehicles and protected with light armor. This allows artillery to move quickly and deploy on any suitable ground. When artillery fires its position can be quickly determined using radar. As a result, the firing artillery soon comes under fire themselves. Armored vehicles greatly reduce casualties, and can quickly move to another firing location. "Shoot and scoot" tactics are standard whenever artillery faces modern opponents.

The lightest battlefield artillery is 82mm to 120mm mortars, usually mounted on APC type vehicles. The American M106 mounts a 107mm (4.2") while a new 120mm mortar vehicle is planned. The Russians have a new "mortar tank" with a breach-loading 120mm in a small turret. They are also experimenting with various mountings for their new 82mm auto-loading mortar.

Field artillery is the next step up. American artillery has been the 155mm gun-howitzer on specialized heavy chassis designed in the 1960s and still going strong.

This is the M109, and it forms most of the artillery in the US Army today. The USSR uses a roughly equal mix of 122mm and 152mm howitzers. Until the 1970s these were towed guns, but then the SO-122 (2S1) and SO-152 (2S3) lightly armored, all-tracked self-propelled guns appeared. The SO-122 uses an APC chassis (the MT-LB), while the SO-152 borrows a heavier chassis originally used by the SA-4 SAM carrier.

The ultimate in heavy-hitting artillery is no longer bigger guns. Instead it's the big, new artillery rocket launchers. Since 1942 Russia has used truck-mounted rocket launchers that fire ripple-salvos of dozens of rockets. Calibers ranged from 82mm upward to 140mm and beyond. The advantage of a rocket launcher battery is that it can pulverize an area instantly. The disadvantage is that the launchers must move immediately, and then take a while to reload. In the 1980s the West began applying advanced rocket technology to battlefield artillery rockets. Larger rockets with longer range and better payloads resulted. The new US 227mm MRLS and Russian 220mm BM-27 exemplify this "second generation" rocket artillery. The American MRLS is on a tracked chassis, while the Russian BM-27 uses a wheeled transporter (Russian rocket artillery has always used truck chassis). The rockets themselves often have submunition warheads that scatter explosive bomblets, mines, etc.

TACTICS

Weapons

Sabot is the primary round for the M1A1. It's the only shell that has a chance against the frontal armor of T-72s and T-80s. Unfortunately you need about 1000m range against a T-72 and 500m against a T-80, which makes your tank pretty vulnerable too. Against light AFVs like BMPs and BTRs it's a knife going through butter.

In addition, Sabot has a very flat trajectory. A battlesight range to 1500 meters is extremely useful if your rangefinder or ballistic computer is down. Using Sabot you can just point and shoot. Leading moving targets isn't too hard when the computer is out of action.

However, Sabot can be waste against hull-down tanks at long range. It tends to bounce off, although sometimes it snaps a track or shatters a sight. It's also useless against infantry, and can pass through trucks or jeeps without affecting them.

HEAT is the secondary round for the M1A1. It's very useful against any AFV without reactive armor, especially T-62s and T-55s. It can produce kills at any range, provided it has a chance to penetrate. Unfortunately the reactive fronts on the T-64/72/80 series render it almost useless there.

Furthermore, if you can't penetrate, but you'd like to do damage anyway, HEAT explosions and shock waves are more likely to wreck something than a lucky sabot ricochet.

HEAT is also great against infantry and all lightly armored vehicles. It's especially handy against BTRs and BMPs because even if you miss the vehicle it just might hurt infantry nearby.

The great weakness of HEAT is its poor ballistic performance. For long range shooting you need a large superelevation. For that you need a rangefinder and a ballistic computer. Without those tools the chance of scoring hits at 3000m or more is nearly hopeless.

Machine-guns are fairly useless against an armored opponent. The coaxial is fine for gunning down infantry beside their wrecked BMPs and BTRs at nice, long ranges. The TC's caliber .50 can penetrate BMP, BTR and BRDM side or rear armor at close ranges. In point-blank dogfights this can be downright useful. Finally, if enemy helicopters or jets are bothering you, feel free to blaze away at them too (use the caliber .50). The chance of a penetrating hit is laughably small, but something is better than nothing!

Maximum Visibility: On the modern European battlefield maximum visibility is about 4,000 to 5,000 meters (2 to 3 miles). Beyond that the rolling countryside, trees, buildings and haze make it hard to pick out objects. In fact, even at that range it's hard to see vehicles unless their moving or firing. With good vision aids and high ground (or a helicopter) can you see farther, but care and patience is needed to examine all the terrain where vehicles and troops might lurk.

Therefore, in tank battles 3,000 to 4,000 meters is considered very long range.

Engagement Ranges

Scoring a hit with a tank gun is a mark of great skill. ATGMs do better, provided the gunner isn't disturbed and maintains a clear line-of-sight to the target.

At 2,000 to 3,000 meters tankers can score hits if they have good, accurate weapons like the NATO 105mm or the new Rheinmetall 120mm. Russian guns and ammunition are manufactured to slightly lower standards, so they are much less accurate. This range is the favored "killing range" for all NATO tankers, although they need side or rear shots to damage T-72s and T-80s.

The 1,000 to 2,000 meter range is the "slug it out" range for modern tank duels. Modern high-velocity guns have flat trajectories past 1,000 meters, so even the most inept gunner has a fairly good chance of scoring a hit. In the 1960s and 70s most hits translated into kills. Today, with the newer armors, many guns cannot penetrate.

Under 1,000 meters is "dogfight" range. After a couple shots vehicles can actually intermix, which means lots of flank shots, and that means anybody can kill anyone. Worse, 125mm's can hole M1A1s in the front at this range, negating the US tank's armor advantage.

Armor

Facing: All modern AFVs, without exception have their strongest armor on their fronts. Sides are weaker, and the rear is weakest of all. Therefore, the standard tactic in armored battles is to make sure the enemy is shooting at your front, while you're shooting at their side or rear.

Thickness: Relative strength of armor is also important. It's wise to compare your weapons against enemy armor, and vice versa. Now you can make intelligent decisions about optimum fighting range. Unless you're up against T-80s, the M1 is better at longer ranges. Your more accurate gun and their weaker armor means long-range duels favor you. But still, maneuvering for flank shots is vastly more effective than trying to play penetration distance games.

Vehicles other than tanks have ridiculously thin armor. Although gunners typically go for the most dangerous opponent, you may wish to override them and knock out the BMPs and BRDM-3s. The big problem with ignoring those pesky missile carriers is that their non-penetrating hits can immobilize a tank and/or seriously reduce its accuracy. Worse, if they get around your flanks, you're a goner.

But the most dangerous opponent is the T-80. This tank's thick turret armor matches your own. Going head-to-head with these guys is disastrous, since you'll trade tank for tank, and they probably outnumber you. You must move carefully, anticipate their moves, lead them into traps, distract them with other attacks, then dash forward for killing shots in the flank or rear.

Using Terrain

Full Defilade: In this position the tank is just barely concealed behind a crestline. If you select the *Outside Tank* view you can see over the crestline to the terrain beyond. This is equivalent to the TC standing on the turret roof or dismounting to "scope out" the area without revealing his position.

Full defilades are commonly used in ambush situations. You can keep your tanks in defilade while the enemy moves past, then roll up to a hull-down position

and blast them in the flank. If the ambush doesn't go well, you can always roll back to full defilade and move elsewhere, safely protected by the ridge crest.

Hull-down: The classic defensive position for a tank is hull-down. This means a ridge crestline blocks the enemy's view of the hull, while the turret is visible and able to fire. Hull-down tanks are harder to hit. Often a tank's turret armor is superior to its hull, making it harder overall to penetrate.

In combat, tanks move into hull-down positions by "inching up" slowly from full defilade. They stop as soon as the turret can see the target. The driver knows he's gone too far if he too can see over the crestline.

Small Obstacles: Buildings, trees and burning wrecks often confuse the enemy, or your own men for that matter. It's not uncommon for tanks to miss an enemy who's hiding among wrecks. In these situations your own naked eye is often superior to that of your "computer" crewmen.

Turret Smoke Grenade Launchers: The smoke grenades are commonly used to defeat incoming missiles. If you fire a salvo when a missile launches, then switch to thermal sights, you can continue firing while the missile frequently misses. As the missile gets closer, smoke has less and less effect on its accuracy.

However, missiles have very little chance of penetrating your front armor. About the safest thing you can do is just face toward them, close the hatches and pray. Don't bother wasting smoke GLs on a missile that's close to hitting you. Save it for escapes (see below).

Engine Exhaust Smoke Generators: The VEES exhaust smoke generator lays a continual smoke screen behind your vehicle. Obviously, this is useful when retreating.

In addition, exhaust smoke can be useful on the offensive. For example, if the leading tank in an echelon formation lays exhaust smoke, then the following tanks are protected from attack from the "off" flank. That is, in Echelon Right the smoke covers the left flank of the formation, while in Echelon Left the smoke covers the right flank.

In the Vee formation, if both outside vehicles lay smoke then each protects the flank of the other three.

Escapes: Inevitably, in some battles you'll drive a tank into a bad spot. To escape quickly, aim your turret at the biggest concentration of enemies and fire a smoke grenade salvo. Next turn on the exhaust smoke screen. The smoke GLs protect you while you turn around, then the exhaust smoke covers your rear as you retreat.

At first night fighting seems more difficult than daytime, since you're restricted to binoculars, gunner's GPS, and driver's periscope (the only positions with night viewing equipment). Most people find the GPS most useful, scanning with low magnification, then switching to high for close-ups of blips. Remember that buildings can show very hot or very cold at night. Before firing, it's often useful

Smoke Screens

Night Combat

to use the image intensifying binoculars to confirm that you're aiming at an enemy, not a barn or a friend.

The worst possible situation at night is to drive your tanks into a point-blank dogfight. In the confusion it's easy to mistake friends for enemies, especially with thermal sights. In all the shooting, it's easy to take penetrating flank and rear shots that kill your tank. At night you're always better off standing back at longer ranges.

Overcoming Damaged Equipment

No Ballistic Computer: When your ballistic computer reads "8888" it's been knocked out ("gone belly up"). You have to lead targets and apply superelevation yourself. However, you should still use the laser to find the range, since the range will affect both the amount of lead and the amount of superelevation you need.

If you're firing at stationary targets within battlesight range (800m for HEAT, 1500m for Sabot), everything's simple. Just placed the gunsight on the target and fire. No lead or superelevation is needed.

If the target is moving, you must lead it. To lead a target, aim slightly in front of it. The longer the range, the more lead you use. The faster the target, the more lead you need. And finally, HEAT rounds need more lead than Sabot, since HEAT travels slower.

If the target is beyond battlesight range (800m for HEAT, 1500m for Sabot) you must use superelevation. Place the sight on the target (or in front, if you're leading it), then move it upward. The amount you aim above the target depends on the range and ammunition. The greater the range, the more superelevation needed. HEAT needs much more superelevation than Sabot.

Learning the appropriate superelevation for different ranges and ammunition takes practice. The best way is learning on the static gunnery range. Turn off the ballistic computer (press the *Computer-Battlesight* key so that the switch changes from "NORM" to "BAT"). Lase the range and experiment with the amount of superelevation needed to score a hit at that range.

At ranges under 2500m you can use "coax computing" to help you fire HEAT.

Coax Computing: At ranges under 2500m the coaxial machine-gun makes a useful substitute for the ballistic computer. At short to medium ranges the ballistic trajectory of the coax's bullets are roughly similar to those of a HEAT round. If you're having trouble leading or superelevating, switch to the coax (press the *Main-Coax* key) and fire until the tracers are on the target. Note the amount of superelevation and lead required. Now switch back to the main gun (HEAT ammo of course), make sure the lead and superelevation are still correct, and fire. Unfortunately, the "coax ranging gun" trick doesn't work past 2500m because the bullet's tracer burns out.

No Rangefinder: Living without a rangefinder is easy if the enemy is within battlesight range (1500m for Sabot, 800m for HEAT). You just input the battlesight range to the computer (press the *Set Range to Battlesight* key) and aim normally.

How can you tell if the enemy is within battlesight range? If you've got lots of

ammo and a fast loader, just fire using battlesight range and see what happens. If the shell drops short you know he's beyond battlesight range.

Another method is mapboard estimation. The entire battle area is 8000x8000 meters. Each level of zoom halves the view, so two zooms reduce the field shown to 2000x2000 meters, a third reduces it to 1000x1000. Remember that on a 2000x2000m area the distance along the diagonal is 2828m; similarly on a 1000x1000m area the diagonal distance is 1414m. Use these figures to judge the distance between tanks.

A third method is to move to a neighboring tank and use its laser to measure the range, then return and enter that value into your ballistic computer. It's certainly not perfect, but it's better than any estimation you could make.

As a general rule, firing any significant distance beyond battlesight range without a rangefinder is a waste of ammo. It's unlikely that you'll have the range accurate enough to score a hit.

No Computer and No Rangefinder: If both rangefinder and computer are inoperative you're left with battlesights. You might as well switch to them (press the *Computer-Battlesight* key that changes the panel switch from "NORM" to "BAT"). With every new target you must decide if the target is within battlesight range for the ammunition you're using. You'll need to add superelevation if the target is beyond battlesight range. In addition, you'll have to lead the target if it's moving.

Because of all these complexities and uncertainties, in this situation it's best to fight only at battlesight ranges. Fire Sabot or use the "coax computer" trick (see above) to fire HEAT.

No Magazine: Losing your turret magazine deprives you of all but six rounds of ammunition (3 Sabot, 3 HEAT). A tank in this position must soon retire from battle, since a tank without ammunition isn't very effective. However, if you're in an especially desperate fight you can use the TC's caliber .50 against BMPs, BTRs, BRDMs and other non-tank vehicles. Of course, at the 100m to 200m range you'll need, it's wise to fire from the TC Buttoned position.

Let the Troops "Fire at Will" Immediately: Your platoon always starts with "cease fire" orders. Give the entire platoon "fire at will" orders immediately. Otherwise you might forget and lead helpless tanks into battle.

Hiding Behind Wrecks: Burning vehicles provide superior concealment from both normal observation and all night vision devices. You'll probably see the enemy doing this from time to time. If your TC's don't spot him, it seems like a wreck is firing at you. Actually, a hidden enemy near the wreck is firing.

HEAT Bombardments: There are times in any battle where you're really sure the enemy has somebody hidden on a reverse slope (behind the crestline). One useful trick is to switch to HEAT, lase to the crestline, then elevate the gun so the aiming point just clears the crestline. What you've done is aimed your shell at the crestline, then manually added a bit of extra superelevation. The shell will clear the crestline and land just beyond on the reverse slope.

Tricks

HEAT is a better round for this tactic because its explosive radius can produce damage without scoring a direct hit. Furthermore, the destructive ability of HEAT is unaffected by range. You can use this tactic at 4,000 or 5,000 meters — distances far beyond normal engagement ranges.

Battlesight Sabot: When the range is less than 1500m you can forget about computers and laser ranging as long as your Sabot ammunition holds out. Either switch off the ballistic computer (press the *Computer-Battlesight* key) or put battlesight range into the computer (press the *Set Range to Battlesight* key). Thereafter you can just “point and shoot” with your gun. In a frantic point-blank range gun duel this can be very handy.

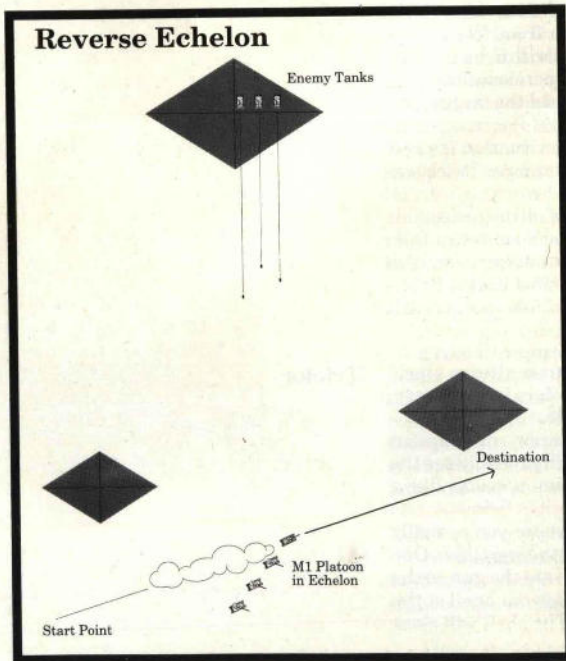
Formation Movement

Driving Speeds: The driver in the platoon leader's tank doesn't drive at flat-out maximum speed. Instead he travels at 75 to 80% maximum speed. This is because when the leader's tank turns, other tanks in the formation often travel a larger distance. If the platoon leader were moving full-speed, these tanks would fall behind, causing the formation to straggle and disintegrate.

Therefore, if you want to get a group of tanks moving at maximum speed, move to the driver's viewpoint in the platoon leader tank. Now you control the speed, and can “crank it up” to maximum. This is especially useful on roads. You can follow the road more efficiently than the normal drivers, allowing your column of vehicles to dash along the hardtop at very high speeds.

Slow Columns: In column formation the leader moves forward and then each vehicle follows the one in front. This works fine if the leader is the leading vehicle (the #1 tank). However, if the leader is in the middle of the column he can only move as far as the vehicle in front of him, then stop. Just as he's stopping the rest of the column starts up, only to stop shortly thereafter because the leader is stopped. The result is a slow-moving “inch worm” effect that reduces travel to a crawl. The lesson is that the leader should *always* be the first tank in the column. Note that the standard order of vehicles in column is #1, #2, #4 and #3. Therefore, if tank #1 is out, make sure the leader is #2 before ordering a column formation.

Reverse Echelon: The echelon right and left formations were originally designed so that an advancing line could engage targets to the right or left without getting in each other's way. However, if the #1 tank turns on its engine exhaust smoke, then the three following tanks have their vulnerable sides screened by smoke. Some platoon commanders use this tactic when dashing between hills, es-



pecially if the enemy is too far to be hurt by cannon fire.

When your primary mission is protecting Blue-1, you're on the defensive. Here your main concern is position. Where should you deploy your forces?

The Traditional Theory says that tanks should be deployed hull down, behind crestlines, facing generally east, and sited to cover the main lines of the enemy advance. With their interlocking fields of fire they form the main line of defense. The best positions for these tanks are the tallest hills, since they sometimes see over low ones.

Incidentally, the only way to tell the difference in hill elevation is unbutton the TC's hatch and scan around. Exceptionally tall hills usually stand out. At night you'll need to use the image intensifiers in the binoculars.

In traditional thinking, missile carriers (M901s and M3s) should be deployed behind the tanks, hull-down on some hill farther west. This is because of their thin armor. If they're farther from the enemy they may attract less attention. Besides, their missiles are just as accurate at those longer ranges. The M2s and M113s are placed on the objective, so their infantry can dismount and dig in. On hilltop objectives the vehicles are hull-down; in towns they hide behind buildings.

Ambush Defenses: Newer tactical theories suggest that instead of forming a strong defensive line you should set up ambushes. Here your tanks and missile carriers set up on hills north or south of the enemy's likely advance route. The tanks should be closer, the missile carriers further away. All the vehicles are placed in full defilade to start. Then, as the enemy moves past their position, they move up to a hull-down position and fire into the flanks. Sometimes this firing is enough to wipe him out. If the enemy is still strong and moves to attack the ambush, then the ambushing vehicles pull back to defilade again while simultaneously another ambush opens fire from another direction, hitting the enemy in their newly exposed flanks or rear.

In ambush defenses infantry are sited on reverse slopes on or near the objective. Reverse slopes are the back sides of hills, positions invisible from the enemy until they drive over or past the hilltop. The advantage of reverse slopes is that the enemy doesn't see the infantry until it's very close. This gives the infantry and their vehicles a chance to hit the enemy's side or rear with surprise shots. Brave "grunts" with their trusty Dragons can take down T-80s this way — something they'd never manage using conventional tactics.

The great disadvantage of ambushes occurs when the enemy attacks along an unexpected path. Suddenly the ambushers may themselves be surprised, while others are far away from the battle. The counter to this problem is dismounting and looking around on foot (use the *Outside Tank* and *Outside Any* views with the *Zoom*). This gives you a chance to spot his movements, note his routes of advance, and take appropriate countermeasures.

Mobile Defenses: Sometimes the enemy is too close or moving too fast. The Russian Army places great stock in fast-moving offenses. On the attack they often have a "stop for nothing" attitude. Therefore, you may not have time to organize

Team Tactics

The Defense

a defense.

In this situation you must decide quickly which vehicles will run for cover and which will stand and fight. Normally the lighter vehicles run. They turn on the smoke and move toward a hill away from the enemy. Meanwhile the tanks slug it out. If a tank must maneuver, it should make sure its nose remains toward the enemy. The greatest error of beginners is to turn their sides or rear toward a shooting enemy. Even those silly BMPs can penetrate the rear armor of an M1!

Remember, the M1 is at its best at 1,000 to 2,000m ranges. Its gun is more accurate and its penetration chances are better. A close-range dogfight where everybody penetrates everyone else is bad for the outnumbered side, and that's usually you. Even if you win you'll probably take heavy casualties.

The Offense

If your primary mission is taking Red-2 and/or exiting to the east, then you're on the offensive. Your main problems are (a) where is the enemy?, and (b) how to destroy his forces? If you can inflict sufficient casualties, Red-2 will fall into your hands easily. If you can't eliminate a pesky pocket of defenders, you'll find it costly at least, impossible at worst to occupy Red-2.

Scouting: The first job is detecting the enemy. This means scouting. The most common scouting technique is to move behind a ridge in full defilade, then get outside and look around (use the *Outside Tank* and *Zoom* keys). Often you can find telltale signs of enemy vehicles behind hills, near a road junction, and/or at bridges. If you have scouting helicopters, it's great fun to call them up, then after they arrive go to *Outside Any* and look around from the observer's seat in the Kiowa.

More aggressive commands simply move forward, halt their units in defilade and then move one vehicle from the platoon up to hull-down. This risks just one unit, rather than everyone, and collects information quickly.

Some commanders just take their supporting units and send them straight to the objective, just to see what shoots at them. This is a *very un-American* way to run an army. It wastes lives and equipment for information that can be gotten at much less cost.

The Covered Approach: Although your M1s are strong, they are not invulnerable. Non-penetrating hits can damage your tracks and fire control equipment. On the offense track hits are the worst non-fatal hit, since immobilized tanks almost always stall an attack.

Therefore it's best if your attack moves from hill to hill, using crestlines for cover as you move from one hull-down position to another. Use hill crests to conceal yourself from some enemies while you concentrate on destroying others.

Bounding Overwatch: The "overwatch" is a standard US Army tactic where some vehicles stop while others dash forward. For example, two M1s stop at a crestline that affords a wide field-of-fire. The other two M1s then dash forward to the next hill. Once they reach it, they stop and the rearward tanks catch up, or leapfrog past them. This is an overwatch by sections.

You can also overwatch by platoons. For example, an M60 platoon might take

position and overwatch while the M1 platoon advanced. Then the M1s wait for the M60s to catch up before they move farther.

In general, section or even individual vehicle overwatches are useful. However, with entire platoons it's often better if each platoon takes a slightly different route.

If one platoon runs into trouble, the other may be in a position to swing around and make a flank attack on the enemy position.

Concentrated Attacks: One of the oft-quoted military principles is "concentration of force." The concept is simple: arrange things so you have lots of firepower that quickly smashes a smaller enemy. Even when the overall enemy force is large, you can prevail by engaging small parts one at a time with your entire force.

Concentration doesn't mean you need to keep all your vehicles together in one clump. Your vehicles or platoons can be scattered. What's important is that they all emerge from cover together and begin blazing away at the same small group of enemies.

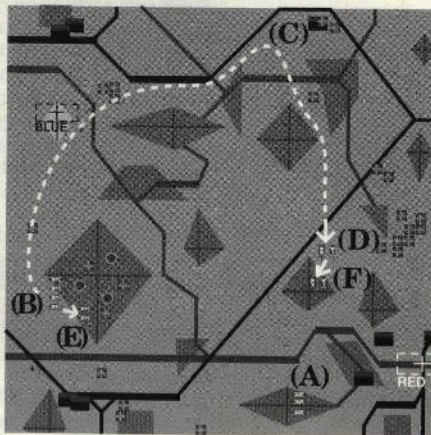
Concentration also means that it's very bad to send in your tanks one at a time. Then the enemy achieves concentration against you: all his force blazes away at a single tank, while the others are out of sight and unable to help.

Coordinated Attacks: In tank warfare it's very effective if you engage the enemy from different directions simultaneously. Whichever attacking group the enemy faces, his side or rear is exposed to the other group.

Coordinated attacks mean you need first to discover the enemy position, then split your force into different groups. Typically one group moves into position to attack along the expected axis of advance. This group will "fix" the enemy's attention. Another group then swings far north or south to make a flanking attack.

Timing is very important in coordinated attacks. The frontal-attack "fixing" force must remain hidden until the flanking force has achieved a good position. Then the front-attack begins. Typically this is moving from full defile to hull down positions at long range. As soon as the enemy starts firing back

Flank Attack



- (A) Platoon of T80s Hull-down, Blocking Your Advance
- (B) Initial Positions of 4 M1s
- (C) Two M1s Move Around Enemy's Northern Flank
- (D) Flanking Force Pauses Until "Fixing" Attack Starts
- (E) Two M1s Move to Hull-down Positions, Open Fire to "Fix" the Enemy
- (F) Flanking Force Moves Up to Hull-down Positions, Attacks Enemy in Flank

the flank force reveals itself, clobbering the enemy.

A common difficulty occurs when the flanking force encounters additional, unexpected enemies. Enemy defensive positions frequently have flank guards and/or reserves that scouting doesn't find. The flanking force may get embroiled in a separate battle, and possibly need yet another force to "bail it out" by outflanking the flank guards.

Another problem occurs when the fixing or flank force is so weak that they're quickly destroyed by enemy fire. This leaves the enemy free to turn their entire force to face the other threat. If you're using M2s, M3s or M901s for either force it's often wise to "stiffen" them with an M1.

Discretion and Valor

One difficult decision every officer must make sooner or later is when to give up. Sometimes you just don't have enough resources to pursue an attack. Mindless bravery in the face of impossible odds destroyed the Light Brigade at Balaclava. Don't let it destroy you too. Sometimes it's better to just call it quits and press the *End the Battle* key.

On the defense, it's much more difficult to judge when the tide has turned against you. Usually casualty rates are a clue. If you're down to just one or two "runners" and the enemy is still strong, then it's probably time to head westward with your engine exhaust smoke running. Other times it's the sheer mass of the enemy. If you see platoon after platoon of tanks headed your way, it's probably time to get out of town fast. Most commanders will run for a flanking hill and try to inflict some damage before they leave. Sometimes the sniping will turn the course of the battle.

Learning when discretion is the better part of valor is crucial when fighting veteran or elite opponents. Even Erwin Rommel, master of the mobile battle, knew when to retreat.

Combined Arms Tactics

Infantry & Armor Coordination

Infantry is more difficult to find and kill than armored vehicles. However, infantry has weaker anti-tank weapons and is extremely vulnerable while riding its lightly armored IFVs and APCs. Infantry is therefore best used to hold a place you've already captured.

One of the most useful attributes of infantry is their Stinger SAMs. If you're worried about enemy airpower, keep the infantry near. Their missiles provide valuable air defenses for your tanks.

Working with M113 Tracks: Infantry riding in M113s has virtually no useful firepower while moving. But when the "track" stops infantry deploys outside with Dragon ATGMs and Stinger SAMs. Remember, though, that the Dragon can't fly beyond 1500m and is unable to penetrate the front of most tanks. It's best to use infantry to ambush enemies from reverse slopes, or to sneak up behind an enemy, then debark and open fire from a crestline near the enemy position.

Working with M2 Bradleys: Infantry in M2s can function like M113s. However, the M2's long-range TOW missiles provide a missile-carrier capability as well. TOWs are best used for long-range (3000-4000m) flank attacks, firing at

targets whose attention has been "fixed" by others. Using M2s like tanks is fatal, since the M2's light armor will result in heavy casualties. If you must put M2s up on the firing line, put them slightly behind the tanks. Often the enemy is distracted into engaging the tanks (which are nearer to him) instead of clobbering the thinly armored M2s.

Missile Carriers (the M901): The ITV missile carriers are very useful flank attack units. They can maneuver to a hilltop far to the north or south, then when the enemy gets involved in battle with your other forces, the ITVs roll up to a hull-down position and launch missile after missile into the enemy's weaker side armor. If they're lucky the enemy won't even notice until the missile hits!

ITVs are also useful for stiffening a defensive line. They're best used on a hill to the rear of the main line. From there they can fire missiles over the top of the main line, and meanwhile the main line absorbs most of the enemy's attention.

ITVs can be used for scouting, but their thin armor dooms them to an early demise. Furthermore, their cross-country speed and agility is mediocre at best.

Cavalry Fighting Vehicles (the M3): The M3 can be used much like an M901 ITV. In addition, at medium to short ranges its 25mm Chain Gun can chew up lightly armored BRDMs and BTRs. The M3 is better armored than the M901: its front armor is proof against the 14.5mm machine-guns of BTRs and BRDM-2s (but not BRDM-3 missile carriers!).

The M3 is also faster than the M901. The combination of greater speed and greater frontal armor makes it useful as a scout vehicle. However, the M3 cannot stand up to an ATGM, much less a tank. When it does find the enemy, its first reaction should be to hide, not shoot.

Finally, the M3 carries Stinger SAMs, making it useful in air defense. In this role it could follow behind M1 or M60 tanks, covering them with both TOW and Stinger missiles.

Air Defense (the M163): The PIVADS gun carrier can be disappointingly ineffective against enemy aircraft. The Vulcan guns are best at close range. Therefore the PIVADS should closely accompany vehicles that need AA cover (such as tanks). For example, a tank platoon that is hull-down along a crestline would have its PIVADS hidden on the reverse slope, just a couple hundred meters behind. On the move the PIVADS should follow 250 to 500 meters behind the unit it covers.

Usually the M1 tanks are most in need of air defense. However, M901s and M60s also lack any integral air defenses. If M2s or M3s (which carry Stinger SAMs) are with the M1s then the M163 could cover M60s or M901s.

The PIVADS' 20mm cannon has enough punch to destroy lightly armored vehicles at medium ranges. However, its own armor is quite weak. Unless weather conditions insure that aircraft are no threat, you're best off keeping the PIVADS to the rear, behind and covering the other vehicles.

Using Special Units

Artillery Support

The MRLS 227mm rockets are your most powerful artillery weapon. You only have HE cluster warheads for your rockets, no smoke. The 155mm field artillery is your next most powerful weapon. They fire HE or Smoke (WP), as you prefer. The 107mm (4.2") mortars are only slightly less powerful than the 155s, and also have HE and Smoke.

Bombardment: Artillery bombardment is most effective against enemy infantry. The high explosive quickly eliminates dismounted infantry, and it's not uncommon to damage stationary BMPs or BTRs as well. However, if the vehicles are moving, the chances of scoring a hit drop dramatically, and of course the infantry is safely "under armor" on the move.

Artillery is also effective against stationary BRDMs and BRMs, as their armor is no better than BMPs and BTRs. However, as before, the chances against a moving target are very poor.

Artillery is least effective against stationary tanks. If you're very lucky a barrage might partly disable a tank by destroying a track or damaging its gunsights.

Smoke Screens: Artillery smoke (including WP-white phosphorous) is extremely useful when you're attacking. Drop it just in front of an enemy position to blind them. Once they're unable to see you can either sneak around them for a flank attack, or just concentrate your fire on some other enemy position instead.

Artillery smoke is also useful in a plain fire-fight. Drop the smoke in front of the enemy, then switch to your night gunsights. The thermal imagers can see right through the smoke. You can continue firing and hitting while the enemy can't see to shoot back.

Air Support

When air support shows up, it's always useful to watch the map to see what they spot. All sorts of interesting things can appear. That's about all the OH-58D can do, so it's best to call him early, before enemy surprises cost you vehicles.

Attack Helicopters: The Apache gunship is a bit more useful, since his Hellfire missiles can knock out enemy AFVs at long range. However, Apaches tend to be cautious, hanging around behind hills. Furthermore, their missiles can miss, or fail to penetrate composite or reactive armor on tanks. Don't expect too much from an Apache, but expect it to survive so you can call it back again and again.

Attack Jets: The A-10 "Warthog" is your most powerful air strike. The A-10s swooping attacks with cannon and missiles often catch enemy vehicles in the side or rear, doing great destruction even to tanks. Unfortunately, enemy SAMs can take out serious damage to A-10s. It's often best to hold your A-10 strike in reserve. Concentrate on eliminating enemy infantry. This reduces their SAM coverage. Then call in the A-10 to eliminate the enemy tanks.

Remember that the A-10 is good defense against Su-25s. With an A-10 in the area chasing him around the Su-25 is unable to make ground attacks.

Enemy Units

Tank Platoons: Dealing with enemy tanks depends entirely on their quality. T-80s are extremely tough to the front. It's vital that you seek flank shots against these fellows. T-72s are almost as tough, but you can get lucky, especially around 1000 to 1250m range where your penetration probabilities are significantly superior to his. Still, flank attacks are far safer than frontal against T-72s. The older tanks have weaker frontal armor, with the T-62 and T-55 especially pathetic. These guys can be nailed at increasingly long ranges with Sabot.

BMP Motor Rifle Platoons: These opponents are nowhere near as deadly as T-64/72/80 tanks, but they demand a certain respect. At long ranges their ATGMs immobilize you, or even destroy a tank that carelessly exposes its side to a missile. At short ranges (500m and less) their light guns begin hammering away while the infantry starts launching RPGs. This can damage or even kill tanks if they hit your side or rear.

BMPs are deadly at all ranges against AFVs lighter than tanks. If you expose Bradleys, M113s, ITVs, etc. to enemy BMP fire, don't be surprised if you start losing vehicles.

BTR Motor Rifle Platoons: The BTR-equipped infantry are far less formidable than BMPs. The BTR has no ATGM, and its heavy machine-gun is only dangerous to lightly armored vehicles at very short ranges. It is incapable of penetrating M2 or M3 frontal armor.

Some BTRs do carry manpack ATGMs that their infantry fires when they dismount, like American infantry. All the Russian infantry carries RPG launchers, which can do significant damage at close ranges against surfaces unprotected by reactive armor.

Therefore, the painless way to dispose of BTRs is to attack them while they're moving at ranges beyond 500 meters. M2s, M3s, M901s and even M163s can do this quite safely.

BRDM-3 Missile Carriers: The BRDM-3 is the Soviet equivalent of the M901. It's wheeled and not as mobile, but cheaper to build. Just like BMPs, their missiles can immobilize tanks with frontal shots, perhaps destroy them with side shots, and almost certainly destroy any lighter vehicle. However the BRDM-3 has very light armor. HEAT shells and missiles that hit almost always produce a satisfying explosion.

BRDM-2 and BRM Recon Vehicles: Soviet-built reconnaissance vehicles are designed to collect information, not fight. They have no long-range weapons, so it's perfectly safe to stand at 1 or 2 km or more away and blast them with ATGMs or tank guns.

At close ranges (under 500m) the BRM's light cannons can cause damage to lighter AFVs. The BRDM-2 has only a heavy machine-gun, making it a very weak opponent.

FOs & FACs: Soviet military methods require that a specially trained FO (Forward Observer) call and adjust all artillery fire. If the FO's vehicle is destroyed then the link to the artillery is cut, and therefore no more artillery fire occurs. Similarly, FACs (Forward Air Controllers) are needed to request Mi-24 helicop-

ters or Su-25 jets. If the FAC is knocked out then no more air support is called.

FOs and FACs have operated from BRDM-2s for years. Recently the MT-LBu observation vehicle was introduced. In some units these are used instead. Tactically, this means that you "kill on sight" any MT-LBu, since that will deprive the enemy of some piece of air or artillery support. Lone BRDM-2s are also likely to be a FO or a FAC, since reconnaissance BRDM-2s travel in platoons of 3 or 4.

Unfortunately, in some cases FACs (but not FOs) operate from specially modified BMPs. It's almost impossible to tell the difference from the outside. About their only distinguishing trait is that a BMP carrying a FAC may travel alone, while most BMPs travel in groups of three.

MILITARY MENTALITY AND DOCTRINE

Russian Mentality & Doctrine

Introduction

Formative Influences: Soviet strategy and tactics were formed by the cataclysm of WWII. The doctrine that defeated Nazi Germany remains the Russian doctrine today. The Soviets teach this same doctrine to their Warsaw Pact allies and third world clients, along with the military equipment they sell. The doctrine has worked well at times and worked poorly at times. It is being reviewed and revised in light of the Afghanistan War, but no changes are obvious yet.

In 1941 during WWII the Soviet Union stood on the defensive and let Germany invade. In that first year their entire pre-war army was destroyed. Only when the Russians finally stopped the Germans and counter-attacked were they able to win. In modern mechanized warfare the Russians recognize no successful defense. Their experience is that only the attack leads to victory. Furthermore, if you must defend, never do it on home ground, where your native population can suffer. Between 1941 and 1945 one in every eight Russians died — the single largest death toll of any nation in the history of warfare.

Raw Materials: Until the last year or two, the Soviet military system emphasized quantity over quality. Unlike America's volunteer army, Russia has universal military conscription. Every young man is required to serve two years of active service (three in the navy). The number of conscripts who reenlist after the mandatory period is low. Outstanding conscripts are rapidly promoted to Corporal and Sergeant in their second year. Officers are all professionals with military school or equivalent educations. Many make the military their career. As a result, Soviet officers are experienced, but anyone below Lieutenant is usually a short-term conscript of somewhat questionable knowledge, skill and reliability. The Soviet Army has no equivalent to the highly experienced sergeants who hold together most Western armies.

Soviet military equipment often has innovative concepts, but is frequently flawed in small details that hamper everyday use. Tanks have fully stabilized smoothbore guns, but for decades the loading mechanics prevented continual target tracking.

On the other hand, over the centuries Russians have acquired a well-deserved reputation for stolid toughness in war. Their armies have endured all manner of hardship and horrifying losses, yet stood fast and continued fighting, to the last man if necessary. Napoleon's French, just like Hitler's Germans, were amazed by the Russian willingness to stand and die for their motherland. However, they also both noticed that the Russians had to be well-organized before they could mount an offensive. But once that well-planned offensive started, they were hard to stop.

Intellectual Concepts: The Soviet system considers military affairs to be a science. Everything from equipment design, to battlefield tactics, to rear area

logistics has basic principles and axioms. Mathematical equations are used to demonstrate these principles and determine the proper course of action. Military doctrine is created "scientifically". Lower level officers are expected to follow theories and plans created by high-ranking "scientists" who know what they're doing. They believe firmly in fighting "by the book".

As a result, Soviet forces are like a reliable machine. Senior officers know exactly what to expect, and are encouraged to frequently visit the front, just to make sure. Unquestioning obedience to orders may be costly for individual units, but the entire army can maneuver with a speed and sureness that surprises opponents.

Of course, the weakness of this approach is that on small-scale tactics they seem robotic, willing to throw away troops and equipment for no good reason. Against a skillful opponent they continually suffer serious casualties. This was true in WWII, but the Germans discovered that no amount of tactical finesse could compensate for the huge losses they suffered whenever a Russian hammer-blow annihilated part of their line.

Offensive Doctrine

On the offensive the Soviet Army uses waves to win battles. On every level from Armies to battalions, troops are divided into leading waves and following waves. The initial wave charges into the enemy, guns blazing. If the defense is weak they overwhelm them and roll onward. If the defense is strong, the first wave takes heavy losses but seeks to inflict serious losses as well. Then the follow-up wave comes through and overwhelms the enemy survivors. Attacks are accompanied by quick, massive artillery barrages, then by helicopter and air support. Coordination between arms is considered vital.

The key to this technique is the application of mass on a vast scale. At the individual tactical level vehicles are often moving forward like a parade-ground formation. Decisions to outflank are made at higher command levels and passed down — junior officers and sergeants aren't expected to make such choices. As a result, a flexible opponent could dodge aside, inflict large losses and slip away. However, the attack would continue rolling forward until the spearhead was exhausted. Then the next wave would take over.

The Russian army is deliberately organized to keep going despite losses. Repair, maintenance and other services are kept far to the rear and very centralized. Combat units keep fighting until they're virtually wiped out. Only then are they sent back for reorganization. Individual battalions, regiments and divisions aren't cluttered up with support elements. Instead the army seeks to be "lean and mean", moving fast.

Soviet offensives normally avoid urban areas. They know from WWII that cities are extremely difficult to capture if defended by a determined foe. Their attacks will probably flow around cities, rather than try to pass through them.

The lack of western-style senior noncoms means that low level Soviet units key around their officers. Therefore a platoon almost always moves together, as a single unit. Company commanders normally join up with a platoon, often the

leading one. Armored units are trained to keep moving, with infantry remaining aboard BMPs and BTRs as much as possible. Lines and wedges are favored formations in the battle area.

The Soviet Army spends only small amounts of time in defensive training (about 20%). On a large scale the army always defends in depth, with more than half its strength in the second line or reserve, ready to counter-attack. First line troops are expected to stand and fight where they're deployed. This allows commanders to size up the attack and commit appropriate rear-area forces to break up the attack.

On a smaller scale, Soviet platoons group together and create defensive strongpoints, usually on high ground or within built-up areas. Where terrain permits, platoons are deployed within 300m, but often distances expand to 500m or more. These distances are still adequate given the range of ATGMs, turret-mounted machine-guns, and heavy cannon.

Individual platoons are expected to hold in place. They are not expected to counter-attack or maneuver against attackers. In fact, any movement requires approval from higher headquarters, and is unlikely to be forthcoming quickly.

Until recently Soviet air and artillery rarely supported defensive operations. It was reserved for attacks, and anyway response time was slow and coordination difficult. However, with the common use of computers and plentiful radio gear the Soviet army is changing. In the later years of the Afghanistan War the army displayed speed and skill in using supporting arms.

The Afghanistan War (1980-1988) was a classic confrontation between a modern, mechanized army and indigenous insurgents mainly using infantry weapons. The first year or two proved costly and indecisive because the Soviet Army attempted to apply conventional war doctrine to a counter-insurgency situation. However, by 1982 the Soviet army was operating with new tactics suited to the terrain and the nature of the enemy. Furthermore, their military operations were aimed at political and economic goals, including bombardments and minelaying designed to destroy the agricultural infrastructure supporting the guerrillas. Meanwhile the Soviets began a program to rebuild the DRA (Afghan Army). This ultimately allowed the Soviets to withdraw their forces, although the war now continues as an Afghan civil war.

The Afghanistan War gave Soviet junior grade and field grade officers valuable combat experience. It proved that the Soviets could adapt to new situations and be effective. Soviet equipment was maintained and operated in difficult conditions for long periods, although in small quantities and at greater cost than equivalent Western forces. In short, the Afghanistan War indicated that the Soviets are competent military opponents.

Defensive Doctrine

The Afghanistan Experience

American Mentality & Doctrine

Introduction

Formative Influences: The American Army has been an overseas fighting force for over a century. WWI, WWII, Korea and Vietnam were all fought on foreign soil. As a result, the American Army has a huge logistical "tail" with unmatched expertise in setting up bases and managing long supply lines that run half way around the globe. Of course, all these services do conspire to make the proportion of frontline fighting troops somewhat less than other armies — there are proportionately more clerks, supply sergeants, construction engineers, etc.

The American Army also relies on "rugged individualism" in its soldiers. Basic technical training is good, but tactical training is often rudimentary, outdated, or just plain wrong. Despite continual attempts to prevent this, at heart the Americans don't really mind. American soldiers, down to the lowest ranks, are expected to show initiative and create their own tactics to suit local conditions.

Modifying issued equipment and "borrowing" more is an equally common practice. Americans soldiers are comfortable with machinery and high tech devices, which they consider to be "neat toys". Even without formal cross-training, most vehicle crewmen can exchange jobs and help each other in many tasks. The result is unmatched tactical flexibility at low levels. Unfortunately, this flexibility often causes vast confusion in the high command, who almost never find out who's really doing what! Whether a big operation succeeds brilliantly or fails miserably rarely seems to be a matter of generalship. America's most famous battles (D-Day, the Bulge, Iwo Jima) were won by thousands of individual efforts, not by a single master plan flawlessly executed.

Another outgrowth of independent and self-reliant soldiers is a high sense of self-preservation. This can sometimes cause problems. For example, when a unit runs up against a strong position it often hesitates. Their instinct is to call for support (artillery, gunships, air strikes, whatever). If a costly assault is required, the troops must be "psyched up" for it. Although it can make big movements unnaturally slow, this instinct also helps the army avoid costly debacles.

Raw Materials: During major wars the US Army uses conscription, but during peacetime the army is traditionally a volunteer force. The officer corps are generally graduates from the West Point military academy (officers from other programs rarely rise above junior levels in the regular army). Non-commissioned officers (sergeants) are recruited almost exclusively from enlisted men who volunteer for 10 or 20 year service. Since junior officers are frequently young college graduates, the oldest and most experienced soldiers are the sergeants.

American military equipment has a reputation for unimaginative, stolid designs. However, the engineering details and manufacturing is generally to a high standard. Ease-of-use has been important for decades, but maintainability is sometimes compromised by technical complexity. New equipment almost always has "teething" problems, but within a year or two these difficulties are solved. Occasionally the development system seems to experience some strange synergy that produces a truly exceptional item. The M1 tank is such an item.

Since WWII the American Army has become much more experimental, trying some new military concept every 10 to 15 years. The "Air Cavalry" Division with

hundreds of helicopters was extremely novel in 1965; the new square organization for "Division-86" with its outrageously extensive cross-attachments is just as radical, but uniquely suited to America's highly individualistic style of fighting.

Intellectual Concepts: The American military system forces officers to experience a wide variety of tasks and billets. Technical expertise is only recognized in traditional academic fields such as engineering and the hard sciences. There is no equivalent to the Soviet concept of "military science." Rather, military operations are seen as tasks that all officers should master. Most officers are truly a "Jack of all trades, master of none."

Strangely, no matter how much peacetime effort is put into tactical training and realistic exercises, in every war to date both troops and officers are strangely lacking in tactical finesse. Each time they had to learn costly lessons on the battlefield itself. Fortunately, American creativity and individualism insured that the lessons were learned quickly, and passed rapidly by word-of-mouth. Green troops moved into battle become combat-savvy in a matter of days.

Although the reliance on a lengthy logistics line to maintain and replenish units can be expensive and time-consuming, it does have advantages. Units are maintained in the field with a constant stream of new replacements. As a result, veterans can instruct newcomers at the battlefield, where the lessons are fresh and obvious to all.

American offensives rely primarily on heavy applications of firepower. The primary attack is expected to seize the objective with appropriate artillery and air support. Rarely is there a second or third wave. Instead, higher headquarters simply maintains a reserve, which they commit to aid the attack, stop an enemy counter-attack, or exploit a gap, as the situation requires.

Major attacks are well organized with detailed reconnaissance. Unless the enemy is well fortified, artillery and aircraft rarely do more than a perfunctory initial bombardment. Instead they remain "on call" to assist attacking units against individual strongpoints. This gives the army great flexibility, but if communications are disrupted or support is lacking the attack frequently falters.

Hasty attacks are quite different. These usually occur when troops stumble into the enemy. In this case the units have no external resources. In theory they're supposed to maneuver around the enemy, avoiding nose-to-nose combat and seek flank or rear attacks. In practice it's unclear if this technique will work, or whether it will simply lead to disorganization as the unit fragments, each element seeking its own advantageous position.

American platoons frequently divide into sections or even individual vehicles, depending on tactical conditions. Every vehicle has at least one sergeant aboard, giving the crew an experienced "old hand" who can and will take independent action.

Offensive Doctrine

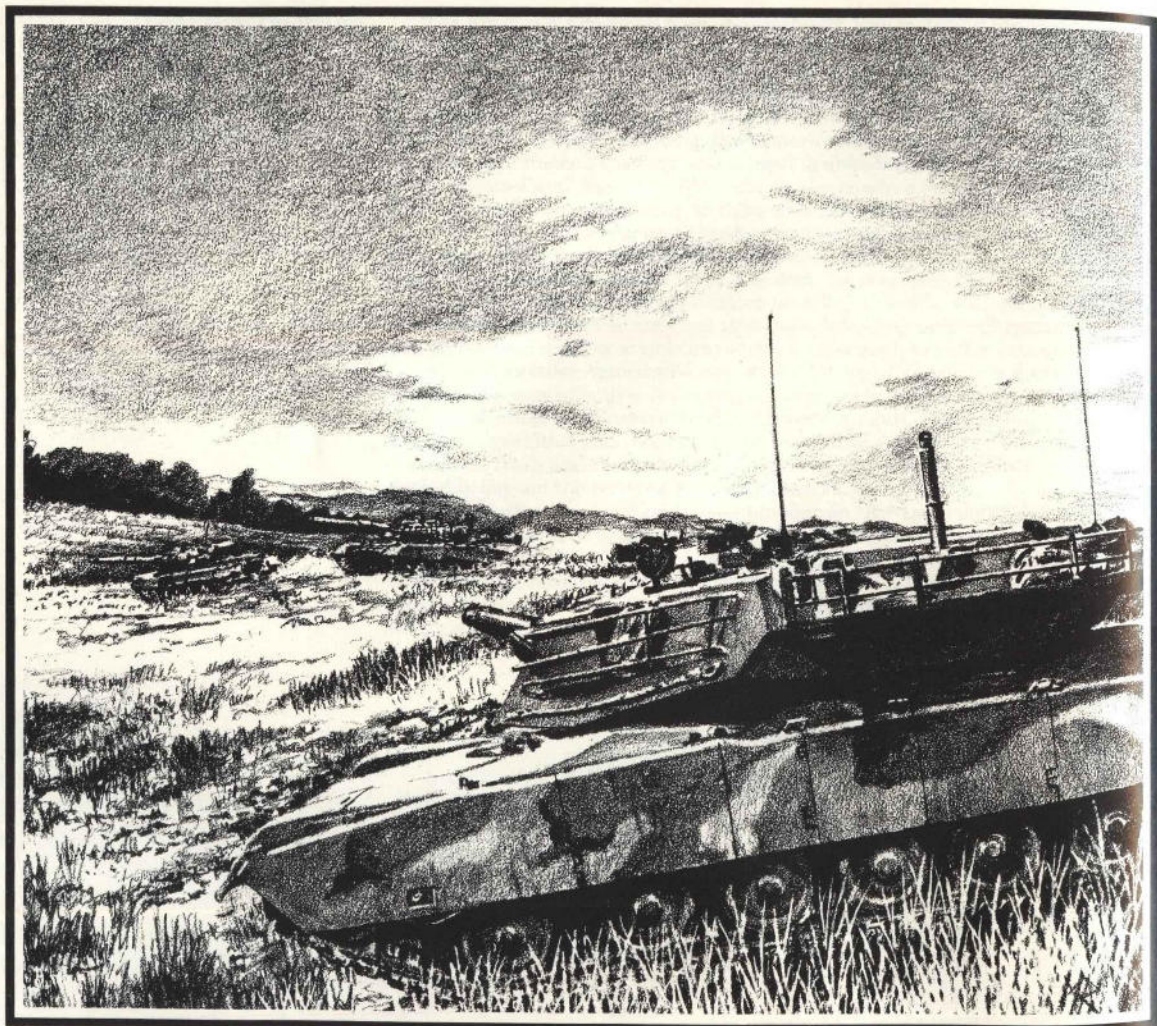
Defensive Doctrine

The American Army has been obsessed with how to defend for decades, as it constantly prepares to repulse a Warsaw Pact attack across the inter-German border. Defensive plans are based on the presumption that the Pact will greatly outnumber NATO. Doctrine to deal with the situation changes every 10 to 15 years. The current method is "Air-Land 2000", which stresses the mobile defense.

In "Air-Land 2000" the defending American forces are trained to *not* stand their ground. Instead they are encouraged to abandon a defensive position after a few minutes and move to a new spot on the enemy's flank or rear. Wherever possible units are encouraged to fight past the enemy's first wave and make contact with the following units further back. Attack helicopters are expected to penetrate even farther, while Air Force fighter-bombers conduct deep-penetration raids to the enemy's rearmost areas. The doctrine presumes that the disorganization caused by all these small counter-attacks, in depth, will quickly halt the attack. The doctrine also assumes that each defending unit will remain roughly intact, because it never stands anywhere long enough to suffer casualties.

Against another American Army, with a big logistics tail, this doctrine would probably be very effective. However, it's very unclear whether the doctrine will have much effect on a Russian "by the numbers" assault. The Russians are trained to ignore casualties and shoot back while continuing to move forward. Following waves are fresh and ready to fight. Logistics arms are buried deep in the rear, probably beyond the reach of American attacks.

On the other hand, it's quite possible that an "Air-Land 2000" defense would cause the two armies to interpenetrate almost completely, causing a vast "battle in depth" beyond the control of any high command. Although the Soviet spearheads might continue until they ran out of fuel and ammo, in the end American individualism and creativity would prevail, like a horde of microbes chewing away on a giant intruder.



4. EQUIPMENT & ORGANIZATION

US VEHICLES

Vehicle weights are given in metric tonnes (1,000 kilograms or 2,200 pounds), which makes it 1.1 times greater than a US ton. Metric measures are used because most major armies, including the US Army, use the metric system.

Data Format
Weight

"Crew" gives the normal fighting complement of the vehicle — men who remain aboard in combat situations. "Passengers" frequently dismount in combat, although they may remain aboard in some circumstances.

Crew & Passengers

The type and horsepower of the engine is provided. Larger engines are generally advantageous.

Engine

The "official" maximum speed when traveling alone on a road. This is a remarkably useless figure, since combat vehicles use roads primarily for "route marches" rather than in combat, and route march columns generally travel at 15 to 30 kph.

Max Road Speed

This value represents the acceleration and raw power available to the vehicle. Values over 20 suggest superb performance, while values under 10 imply miserable performance.

HP/Weight

This value applies mainly to tracked vehicles, and represents how easily they are bogged down in soft ground. The higher the ground pressure, the greater the chance of being "mired".

Ground Pressure

The size and type of the vehicle's main gun is always important. "SB" stands for smoothbore. All other guns are rifled.

Main Gun

The *loader* is sometimes a human crewman, sometimes a mechanical device. Lighter weapons are frequently automatic cannons or machine-guns with a high-speed mechanical feed powered by the gun recoil or an electric motor ("chain" guns).

Ammunition indicates both the total number of rounds carried and the various

types of ammunition available. Ammunition abbreviations include:

AP	Armor Piercing
APDS	Armor Piercing, Discarding Sabot
APHE	Armor Piercing, High Explosive
APFSDS "Sabot"	Armor Piercing, Fin Stabilized, Discarding Sabot
APT	Armor Piercing Tracer
Ball	Steel-jacketed Lead (the traditional "bullet")
CLGP	Cannon Launched Guided Projectile
HE	High Explosive
HEAT	High Explosive, Anti-Tank
HEAT-MP	High Explosive, Anti-Tank, Multi-Purpose
HEDP	High Explosive, Dual Purpose
HEP	High Explosive Plastic
HE/RAP	High Explosive, Rocket Assisted Projectile
HVAPFSDS	High Velocity APFSDS, equivalent to APFSDS
WP	White Phosphorous (Smoke)

Frequently ammunition has a "-T" or "-I" suffix. The "-T" means tracer: each shell has a small tracer in its back, allowing the firer to see where the shell goes. The "-I" means incendiary. The shell includes a small warhead space of incendiary material (usually phosphorous). This causes a puff of smoke when the shell hits, and may even help start a fire.

Missiles

The main type of missile carried is noted. In virtually all cases this is an ATGM (anti-tank guided missile). The infantry squad inside an IFV or APC may carry additional missiles and rockets.

Secondary Guns

Many larger armored vehicles carry one or more secondary weapons, usually machine-guns, for local defense.

Coaxial weapons are mounted beside the main gun in the turret's gun mantlet. *Roof* weapons are on flexible mountings near the rooftop hatches. They can be used against ground or air targets.

Cupola weapons are mounted in a small rooftop turret.

Rangefinder

Iron sights means the main weapon has no rangefinding device. The gunner estimates the fall of shell by eye and makes appropriate corrections.

Stadiametric sights are mil markings on the gunsight glass. If the gunner knows the length or height of the target, these markings help him estimate the range. This is frequently termed a "stadia" rangefinder.

Stereoscopic sights are "match the twin images" sights. It has two lenses, one on either side of the turret, that feed a single gunsight. This is sometimes known as a "coincidence" rangefinder.

Laser rangefinders send a laser beam down the sight line and measure the return to give extremely accurate ranges.

White searchlights are the most primitive systems, and are simply a visible-light searchlight that broadcasts the user's position for miles.

Active IR (Infrared) night sights require the gunner to use an IR searchlight and IR viewer. The viewer is very simple, hence the need to strongly illuminate a target with Infrared light. Although the IR searchlight beam is invisible to normal eyesight, it's a beacon to all IR and thermal viewing systems.

Image Intensifiers enhance any natural light on the battlefield manifold. Effective range is 1,000 to 2,000 meters (it varies with system quality), although dim hints can be picked up at longer ranges. They don't reveal the user's location.

Thermal Imagers are passive IR systems with superb sensitivity and resolution. They display the natural heat (or coldness) of objects. They do not reveal the user's location. Although extremely expensive, good thermal systems have better range and resolution than Image Intensifiers.

FLIR (Forward-Looking Infrared) is a passive IR system very similar to Thermal Imagers. They were originally designed for aircraft and are optimized to show terrain, rather than men and vehicles.

Night Gunsights

Type & Thickness: All armor thickness values are approximations. The thickness represents effective stopping power as if the armor were face-hardened steel plate hit by a kinetic energy round. Armor thickness takes into account the effective increase in armor generated by its rounding or slope, as well as the value of special materials.

Composite or Chobham armor is more than twice as effective against HEAT and similar chemical-energy warheads.

Reactive armor is a coating of explosive boxes outside the main armor, and is very effective at stopping HEAT warheads.

Rounded armor has three-dimensional curved surfaces that increase the chance of deflections and ineffective HEAT hits. Although less useful than composites or reactive, it's better than nothing.

Sloped armor has a two-dimensional sloping surfaces that slightly increases the chance of deflections and ineffective HEAT hits. It is the least effective armor enhancement scheme.

Location: *Front turret armor* is the front faces of the turret. This is what you'll hit if the enemy's turret is aimed at your weapon. The gun mantlet is usually somewhat thicker.

Front hull armor is the front face of the vehicle hull. This is what you'll hit if the enemy is driving toward you (or backing directly away from you).

Side and rear armor are defined similarly — what you hit if the enemy's turret or hull side or rear is facing you.

Note that unless a single face of the enemy is faced squarely toward you, a shell or missile could hit either of two faces. For example, if a tank is moving diagonally in front of you, your shell could hit either his front or his side.

Armor

Other Defenses

Smoke GLs are grenade launchers mounted on the sides of the vehicle turret or hull. A salvo can be fired from forward, placing a short-lived smoke screen in front of the turret or hull.

Engine exhaust smoke allows the driver to "doctor" the normal engine exhaust to produce a smoke screen that comes out the vehicle's hull rear (from the exhaust pipes).

Laser warning systems alert the vehicle whenever an enemy laser rangefinder or designator strikes it. These systems are speculative; most armies are reluctant to admit their operational existence.

M1A1 "Abrams" Main Battle Tank

This is the definitive version of the M1, with an upgraded cannon and depleted uranium armor. The armor enhancement was added partway through the production run to the front hull, but since it's an external plate, it could be added to already-built vehicles during an overhaul. There are rumors that this armor will also be added to the turret front as well as the hull. This enhanced-armor version is sometimes termed the "M1A2".

Weight: 57.1 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 1500 hp gas turbine
Max Road Speed: 67 kph
HP/Weight: 26 hp/tonne
Ground Pressure: 1.00 kg/sq.cm

Main Gun: 120mm SB, fully stabilized
Loader: Human
Ammunition: 40 rds APFSDS, HEAT-MP
Missiles: None
Secondary Guns: 7.62mm Coax MG, 12.7mm Roof HMG,
 7.62mm Roof MG
Rangefinder: Laser
Night Gunsight: Thermal Imaging

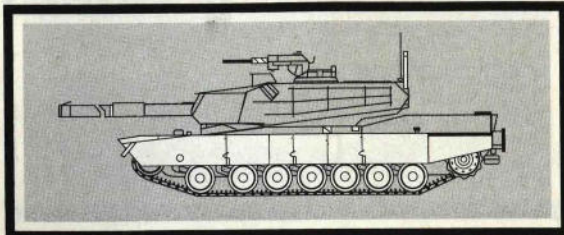
M1 "Abrams" Main Battle Tank

This original production version of the M1 carried the old NATO-standard 105mm rifled cannon. Only 2,375 of this model were built, and many (especially those in Europe) will eventually have the 105mm replaced by the 120mm. This version also lacks the depleted uranium armor, making it slightly more vulnerable to kinetic energy penetrators.

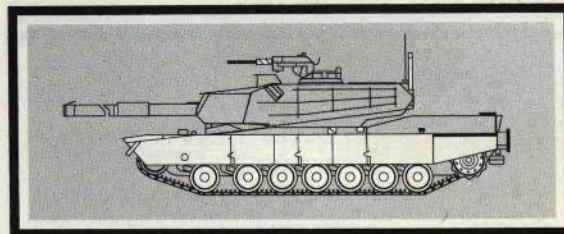
Weight: 54.5 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 1500 hp gas turbine
Max Road Speed: 72 kph
HP/Weight: 27 hp/tonne
Ground Pressure: 0.96 kg/sq.cm

Main Gun: 105mm, fully stabilized
Loader: Human
Ammunition: 55 rds APFSDS, HEAT-MP, HEP, WP
Missiles: None
Ammunition: None
Secondary Guns: 7.62mm Coax MG, 12.7mm Roof HMG,
 7.62mm Roof MG
Rangefinder: Laser
Night Gunsight: Thermal Imaging

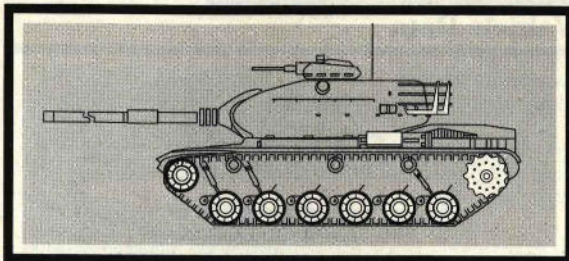
Vehicle Data



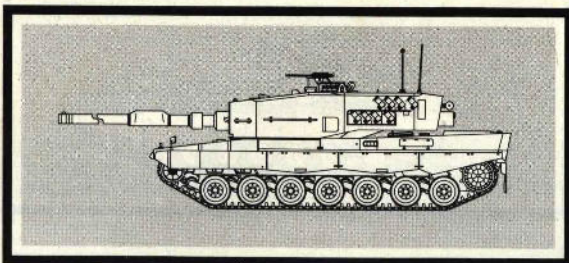
Front Turret: ~380mm Chobham
Front Hull: ~410mm Chobham/DU
Side Turret: ~300mm Chobham
Side Hull: ~200mm Chobham
Rear: ~75mm flat
Other Defenses: Smoke GLs on turret, VEES engine exhaust smoke, laser warning system



Front Turret: ~380mm Chobham
Front Hull: ~375mm Chobham
Side Turret: ~300mm Chobham
Side Hull: ~200mm Chobham
Rear: ~75mm flat
Other Defenses: Smoke GLs on turret, VEES engine exhaust smoke



Front Turret: ~315mm reactive
Front Hull: ~260mm sloped
Side Turret: ~160mm reactive
Side Hull: ~55mm sloped
Rear: ~55mm sloped
Other Defenses: Smoke GLs on turret,
 VEES engine exhaust smoke



Front Turret: ~340mm composite
Front Hull: ~340mm composite
Side Turret: ~100mm composite
Side Hull: ~100mm sloped
Rear: ~25mm flat
Other Defenses: Smoke GLs on turret, possibly a
 laser warning system

M60A3 Main Battle Tank

Designed in 1956-1957, this tank entered service in 1960. The development time was quick because the tank is a minor redesign of the M48. The M60 is a big, tall tank with a rounded turret and heavy armor for its time. The A1 and A2 versions both fought in Vietnam, the A2 having the disastrous 152mm gun/launcher system. The A3 version was created from older A1s, as well as new production that ended in 1987. The A3 has improved night sights, laser rather than stereoscopic rangefinder, a ballistic computer, full stabilization, reactive armor boxes plating the turret front and side, and defensive smoke systems. Even so M60A3 is still inferior to the M1 or T-80.

Weight: 52.6 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 750 hp diesel
Max Road Speed: 48 kph
HP/Weight: 14 hp/tonne
Ground Pressure: 0.87 kg/sq.cm

Main Gun: 105mm, fully stabilized
Loader: Human
Ammunition: 63 rds APFSDS, HEAT-MP, HEP, WP
Missiles: None
Ammunition: None
Secondary Guns: 7.62mm Coax MG, 12.7mm Cupola HMG
Rangefinder: Laser
Night Gunsight: Thermal Imaging

Leopard 2 Main Battle Tank (West Germany)

After the failure of the joint US-West German MBT70 project the Germans designed this Leopard sequel in 1972-1977. The first vehicles entered service in 1978. About the only thing this tank has in common with the Leopard 1 is the name "Leopard". The gun, engine, armor, and fire control systems are all new. The tank is a direct competitor to the M1. In fact, for a time the US Army and Congress considered buying this instead of building M1s. However the Leopard has slightly less armor and slightly inferior battlefield mobility due to its diesel engine.

Weight: 55.1 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 1475 hp diesel
Max Road Speed: 65 kph
HP/Weight: 27 hp/tonne
Ground Pressure: 0.83 kg/sq.cm

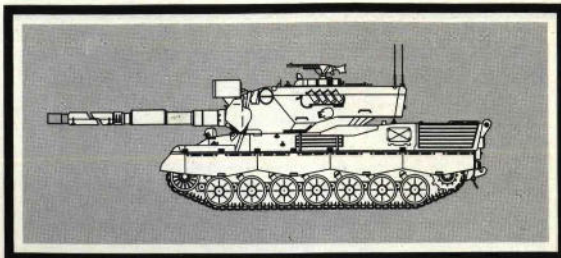
Main Gun: 120mm SB, fully stabilized
Loader: Human
Ammunition: 42 rds APFSDS, HEAT
Missiles: None
Ammunition: None
Secondary Guns: 7.62mm Coax MG, 7.62mm Roof MG
Rangefinder: Laser
Night Gunsight: Thermal Imaging

Leopard 1 Main Battle Tank (West Germany)

Designed in 1957-1963, the first Leopard entered service in 1965. Created in the era of invincible ATGMs and HEAT warheads, the Leopard was the fastest, most maneuverable tank of its time. It was bought in quantity by the many other NATO nations, including Belgium, Denmark, Greece, Italy, Netherlands and Norway, as well as Canada, Australia and Turkey. Various upgrades over the years included improved armor and gunlaying. Final variants included a new turret with composite armor (~290mm front thickness) containing the 120mm Rheinmetall smoothbore.

Weight: 40.0 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 830 hp diesel
Max Road Speed: 65 kph
HP/Weight: 21 hp/tonne
Ground Pressure: 0.86 kg/sq.cm

Main Gun: 105mm, stabilization added
Loader: Human
Ammunition: 60 rds APFSDS, HEAT, WP
Missiles: None
Ammunition: None
Secondary Guns: 7.62mm Coax MG, 7.62mm Roof MG
Rangefinder: Usually Laser, some Stereoscopic
Night Gunsight: Image Intensifiers



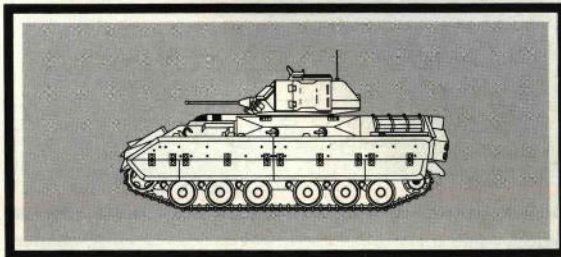
Front Turret: ~60mm rounded
Front Hull: ~85mm sloped
Side Turret: ~60mm rounded
Side Hull: ~45mm sloped
Rear: ~25mm flat
Other Defenses: Smoke GLs on turret

M2A1 "Bradley" Infantry Fighting Vehicle

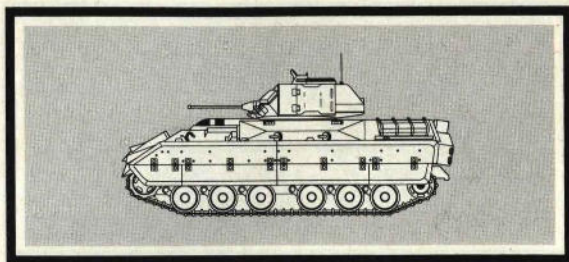
After a long design debate on IFVs (from 1972 to 1979), production started in 1980 and the first vehicles were delivered in 1982. The A1 version enlarged the missile launcher to fit the TOW 2 and added reactive armor where possible. The internal 5-missile stowage can be used for more TOWs, manpack Dragon IIIs and/or Stinger SAMs. Most vehicles carry a variety, usually a couple TOWs and a couple Dragons, and a Stinger. The great strength of the M2 is its exceptional mobility. It's the only IFV or APC in the US Army that can keep up with the M1. The M2's weakness is a high profile and thin armor.

Weight: 22.6 tonnes
Crew: 3 - Cmdr, Gnr, Drvr
Passengers: 7 Infantrymen
Engine: 500 hp diesel
Max Road Speed: 66 kph
HP/Weight: 20 hp/tonne
Ground Pressure: 0.54 kg/sq.cm

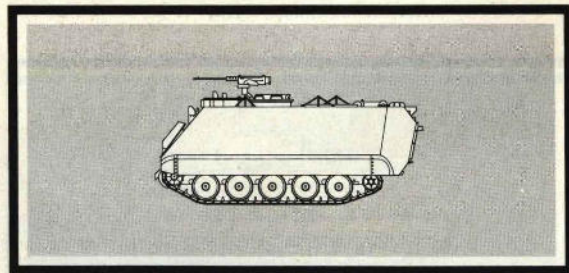
Main Gun: 25mm, fully stabilized
Loader: Automatic chain gun
Ammunition: 900 rds APDS, HE
Missiles: twin TOW 2 launcher in turret
Ammunition: 2 in launcher, up to 5 in reserve
Secondary Guns: 7.62mm Coax MG
Rangefinder: Stadiametric
Night Gunsight: Thermal Imaging



Front Turret: ~60mm sloped
Front Hull: ~60mm reactive
Side Turret: ~40mm reactive
Side Hull: ~40mm reactive
Rear: ~50mm flat
Other Defenses: Smoke GLs on turret, VEES engine exhaust smoke



Front Turret: ~60mm sloped
Front Hull: ~60mm reactive
Side Turret: ~40mm reactive
Side Hull: ~40mm reactive
Rear: ~50mm flat
Other Defenses: Smoke GLs on turret,
 VEES engine exhaust smoke



Front Armor: ~40mm sloped hull
Side Armor: ~27mm flat hull
Rear Armor: ~12mm flat hull
Other Defenses: None

M3A1 "Bradley" Cavalry Fighting Vehicle

The cavalry version of the M2 is used in reconnaissance units and independent armored cavalry regiments. It's exactly the same as the M2 except the rear compartment contains more missiles and fewer passengers. Usually a Stinger SAM is carried for air defense. The two infantry scouts frequently remain mounted, since they're needed to reload the TOW launcher.

Weight: 22.4 tonnes
Crew: 3 - Cmdr, Gnr, Dvr
Passengers: 2 Infantry Scouts
Engine: 500 hp diesel
Max Road Speed: 66 kph
HP/Weight: 20 hp/tonne
Ground Pressure: 0.53 kg/sq.cm

Main Gun: 25mm, fully stabilized
Loader: Automatic chain gun
Ammunition: 1200 rds APDS, HE
Missiles: twin TOW 2 launcher in turret
Ammunition: 2 in launcher, 10 in reserve
Secondary Guns: 7.62mm Coax MG
Rangefinder: Stadiametric
Night Gunsight: Thermal Imaging

M113A3 Armored Personnel Carrier

Originally designed in 1956-59, the first vehicles entered service in 1960, with the upgraded M113A1 quickly following in 1963. It quickly became the workhorse APC of the US Army. The vehicles were heavily used in the Vietnam war, often with field additions of more machine-guns and extra armor, since the original armor was insufficient to stop RPG rockets, point-blank heavy machine-gun fire, or anti-tank mines. The A3 version upgraded the engine and transmission, and added ballistic-cloth spall-liners inside the aluminum armor. The M113 chassis is used for a variety of other vehicles, including mortar carriers (M106 and M125), AA gun carriers (M163), ATGM carriers (M901), artillery observation vehicles (M981 FISTV), and mobile command posts (M577), as well as rear-area cargo carriers (M548).

Weight: 12 tonnes
Crew: 2 - Cmdr, Dvr
Passengers: 7 Infantrymen
Engine: 275 hp diesel
Max Road Speed: 66 kph
HP/Weight: 22.8 hp/tonne
Ground Pressure: 0.56 kg/sq.cm

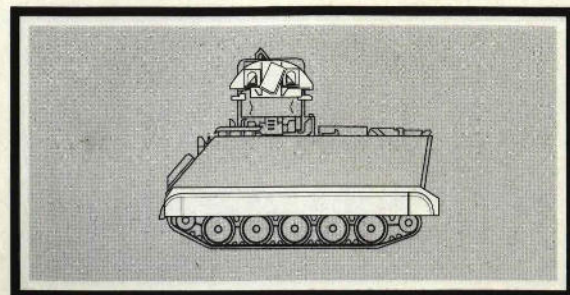
Main Gun: 12.7mm HMG
Ammunition: 1200 rds Ball
Missiles: None
Secondary Guns: None
Rangefinder: None
Night Gunsight: None

M901A2 ITV Anti-Tank Missile Carrier

The ITV (Improved TOW Vehicle) is the standard anti-tank missile carrier of the US Army. The missiles and fire control optics are mounted in an Emerson elevating turret, which in turn is mounted on the roof of an M113. This allows the gunner to sit below, under armor, while just the "hammerhead" turret pokes over the crestline to "see" targets and fire missiles. When the enemy fires back they can destroy the turret, disabling the vehicle's combat ability, but the crew, engine, and spare ammo can survive.

Weight: 12 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 275 hp diesel
Max Road Speed: 66 kph
HP/Weight: 22.8 hp/tonne
Ground Pressure: 0.56 kg/sq.cm

Main Gun: None
Missiles: two TOW 2 launchers
Ammunition: 2 in launcher, 10 in reserve
Secondary Guns: 7.62mm Roof MG
Rangefinder: SACLOS
Night Gunsight: Thermal Imaging



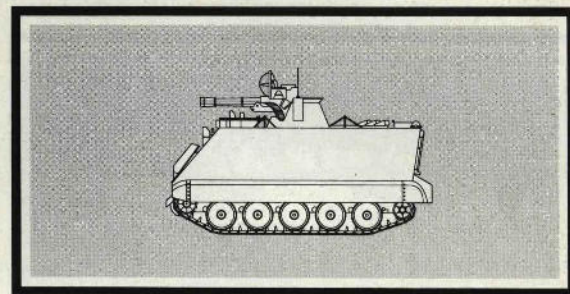
Front Armor: ~40mm sloped hull
Side Armor: ~27mm flat hull
Rear Armor: ~12mm flat hull
Other Defenses: None

M163A2 PIVADS Anti-Aircraft Gun Carrier

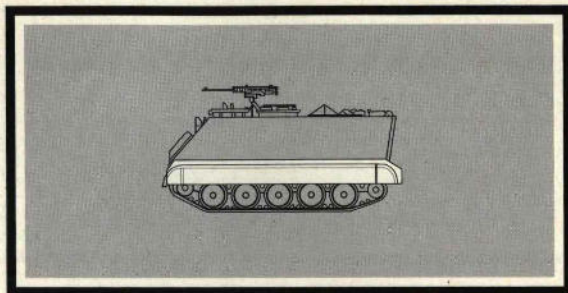
The PIVADS (Product Improved Vulcan Air Defense System) puts the standard M61A1 gatling gun used by Air Force fighters into a power-operated turret on the roof of an M113. The fire control system was upgraded in the A2 PIVADS model by integrating the ranging radar with a ballistic computer to simplify the gunner's task. Unfortunately, the gun is short-ranged. It doesn't always have sufficient power to penetrate Mi-24 or Su-25 armor. The US Army proudly boasts that the kill probability in an engagement would be 35%. However, it's not unlikely that the other 65% of the time the angry helicopter or jet would nail the M163! Even the US Army sees a need for something better, but the last replacement was a total failure (the disastrous DIVAD M247 "Sergeant York").

Weight: 12.3 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 215 hp diesel
Max Road Speed: 67 kph
HP/Weight: 17.5 hp/tonne
Ground Pressure: 0.61 kg/sq.cm

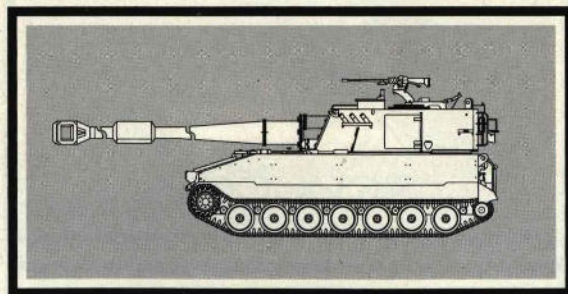
Main Gun: 20mm "Vulcan" 6-barrel Auto-cannon
Loader: Automatic (recoil)
Ammunition: 2100 rds APT
Missiles: None
Secondary Guns: None
Rangefinder: Ranging Radar
Night Gunsight: None



Front Armor: ~40mm sloped hull
Side Armor: ~27mm flat hull
Rear Armor: ~12mm flat hull
Other Defenses: None



Front Armor: ~40mm sloped hull
Side Armor: ~27mm flat hull
Rear Armor: ~12mm flat hull
Other Defenses: None



Front Turret: ~25mm sloped
Front Hull: ~20mm sloped
Side Turret: ~7mm sloped
Side Hull: ~7mm flat
Rear: ~7mm flat
Other Defenses: None

M106A2 Mortar Carrier

US Army Armored and Mechanized Infantry battalions mount their mortars in these armored vehicles. The M113 chassis has a hole cut in the roof so the mortar can fire upwards. With a bit of heavy physical work the mortar can be dismounted to fire from the ground (usually a firing pit). In most cases the mortar vehicles fire indirectly, at targets spotted by forward observers. These vehicles are valuable because they're the only "artillery" integral to battalion task forces. Heavier artillery is more powerful, but is easily "borrowed" by higher commanders for other purposes.

Weight: 12 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, 3 Ldrs
Passengers: None
Engine: 215 hp diesel
Max Road Speed: 67 kph
HP/Weight: 17.9 hp/tonne
Ground Pressure: 0.59 kg/sq.cm

Main Gun: 107mm (4.2") Mortar
Loader: Humans
Ammunition: 100 rds of HE, WP (Smoke)
Missiles: None
Secondary Guns: 12.7mm Roof HMG
Rangefinder: Stadiametric
Night Gunsight: None

M109A3 Self-Propelled Artillery

After a long and sometimes confusing design process from 1952 to 1961, the M109 emerged as the premier SP artillery piece in the world. To this day it remains the workhorse of not only US Army artillery, but also most of NATO. Progressive upgrades have included launching capability for "Copperhead" (CLGP) rounds, as well as a vast array of specialty ammunition. Like all artillery, the M109 is not expected to actually see the enemy. It simply parks, delivers a "fire mission" on instructions from a FO, then drives off to the new firing location before enemy counter-battery guns or rockets zero-in on its position.

Weight: 25 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, 3 Ldrs
Passengers: None
Engine: 405 hp diesel
Max Road Speed: 56 kph
HP/Weight: 16.2 hp/tonne
Ground Pressure: 0.82 kg/sq.cm

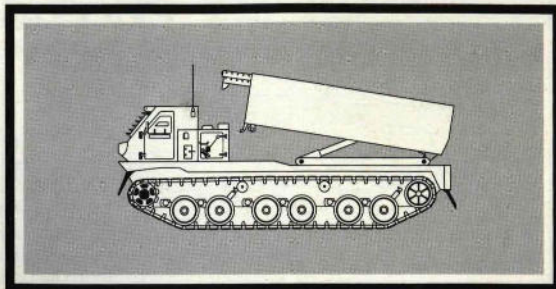
Main Gun: 155mm Gun-Howitzer
Loader: Humans
Ammunition: 34 HE, WP (Smoke), HEAT, HE/RAP and 2 CLGP
Missiles: None
Secondary Guns: 12.7mm or 7.62mm Roof MG
Rangefinder: Stadiametric
Night Gunsight: None

MRLS Rocket Launcher

Although ostensibly an international program, the MRLS is primarily a US Army design begun in 1977 and put into service in 1983. The vehicle chassis (tracks and engine only) is borrowed from the M2 Bradley. The M77 cluster rocket with hundreds of bomblets is the standard ammunition, but it can fire special rockets that drop "instant minefields" of AT2 anti-tank mines. Various clusters of self-guiding, armor-piercing submunitions are in development (SADARM and TGM), but the earliest possible deployment is 1991 or 92, assuming design trials reveal no problems.

Weight: 25.1 tonnes
Crew: 3 - Cmdr, Drvr, Ldr
Passengers: None
Engine: 500 hp diesel
Max Road Speed: 64 kph
HP/Weight: 19.9 hp/tonne
Ground Pressure: 0.55 kg/sq.cm

Rockets: Twelve 227mm Rockets
Loader: Human with crane assistance
Ammunition: M77 (644 HEAT bomblets), AT2 (9 anti-tank minelets)
Missiles: None
Secondary Guns: None
Range-finder: On-board ballistic computer fire control system
Night Gunsight: None
Weight: 2.0 tonnes



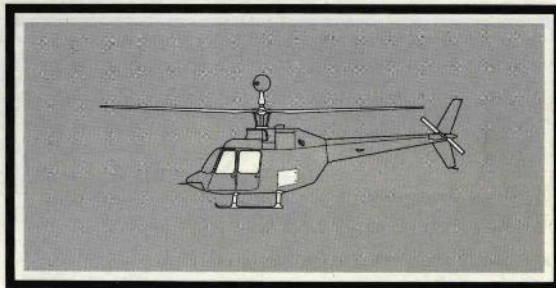
Front Armor: ~12mm flat
Side Armor: ~7mm flat
Rear Armor: None
Other Defenses: None

OH-58D "Kiowa" AHIP Scout Helicopter

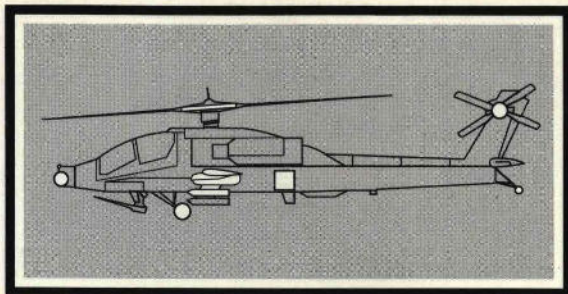
In 1968 the US Army adopted the Bell "Jet Ranger" for its scout and observation helicopter. They first saw combat in Vietnam in 1969. Over the next 20 years the helicopters were gradually upgraded, especially the new "D" (AHIP) version which has an overhead mast-mounted sight and a bigger engine. Despite all these improvements, the craft needs armor and higher speed to do well on a modern battlefield. There is a feeling that scouts need not be fast or fancy. People who feel that way are encouraged to ride those scouts in wartime when enemy helicopters fill the skies!

Crew: 2 - Pilot, Obsvr
Passengers: 2 Passengers
Engine: 650 shp turboshaft
Max Speed: 241 kph (130 kts)
HP/Weight: 325 hp/tonne
Ground Pressure: None

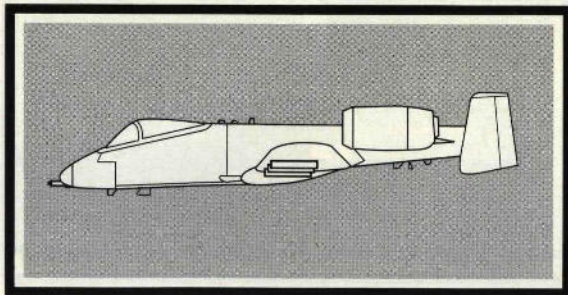
Main Gun: 7.62mm or 12.7mm MG or 70mm rocket pods
Ammunition: Ball (bullets)
Missiles: Stinger often carried
Ammunition: 2 or 4 ready to fire, no reloads
Secondary Guns: None
Range-finder: Laser (doubles as designator)
Night Gunsight: FLIR
Weight: 9.5 tonnes



Armor: None
Other Defenses: Radar and IR Jammers and Decoys



Front Armor: ~40mm flat
Side Armor: ~30mm flat
Rear Armor: ~30mm flat
Other Defenses: Radar and IR Jammers and Decoys



Front Armor: ~25mm
Side Armor: ~10mm
Rear Armor: None
Other Defenses: Optional jammer and decoy pods

AH-64A "Apache" Attack Helicopter

Designed in the mid 1970s, the first AH-64s were delivered to the US Army in 1984. They are state-of-the-art attack helicopters with powerful armor, exceptional maneuverability, and first class weapons. The IHADSS helmet gunsight system (weapons aim at whatever the pilot or gunner looks at!) is an expensive but exceptionally potent fire control system. The Hellfire missiles are superior to the TOW in penetrating power and have a new radar-guided variant that can home on targets through fog and smoke. The 30mm cannon has substantial shells, but doesn't have the penetrating power of the M2's 25mm or the A-10's 30mm.

Crew: 2 - Pilot, Gnr
Passengers: None
Engine: two 1696 shp turboshafts
Max Speed: 365 kph (197 kts)
HP/Weight: 357 hp/tonne
Ground Pressure: None

Main Gun: 30mm, fully stabilized
Loader: Automatic chain gun
Ammunition: HEDP
Missiles: Hellfire ATGMs
Ammunition: 8 or 16 ready to fire, no reloads
Secondary Guns: 70mm rockets may replace Hellfires
Rangefinder: Laser (doubles as designator)
Night Gunsight: FLIR
Weight: 22.7 tonnes

A-10A "Thunderbolt II" Attack Jet

Designed in the early 1970s, the A-10 entered service with the US Air Force in 1973. Production ended ten years later. Popularly known as the "Warthog", the A-10 was designed purely for front-line close air support, with extensive armor and defensive features to enhance survivability. The 30mm Avenger cannon is the most powerful weapon ever mounted in an aircraft; it runs almost the entire length of the fuselage! Although the wing pylons can hold a vast array of stores, Maverick missiles are popular for missions against enemy armored forces.

Crew: 1 - Pilot
Passengers: None
Engine: two 9,065 lb static thrust turbofans
Max Speed: 834 kph (450 kts)
Thrust/Weight: 0.7
Ground Pressure: None

Main Gun: 30mm 7-barrel gatling
Loader: Automatic (recoil)
Ammunition: 1,174 rds of AP
Missiles: Maverick
Ammunition: 4 to 6 carried on wing pylons
Secondary Guns: None
Rangefinder: None
Night Gunsight: None

US WEAPONS

The name lists the type of weapon, its model number, and in appropriate cases the original designer/manufacturer.

There is a separate entry for each ammunition type.

Muzzle Velocity gives a rough measure of the weapon's accuracy, and the penetrating power of its kinetic energy rounds. Muzzle velocities over 1,500 indicate a very high-powered weapon, values around 1,000 are barely adequate, and anything below 500 is likely to be blown off course in a strong wind.

Kinetic Energy Armor Penetration values are averages. You can expect that about 50% of the time a hit on this thickness armor will penetrate. The weapon can penetrate thicker armor (by hitting a weak point like the turret ring), but the chances decrease significantly. Assured (100%) penetration occurs at about half the range given.

HEAT Armor Penetration is also a matter of probability. However, range is not an issue, since the penetrating power is unaffected by distance. Again, HEAT can do damage even against thicker armor, especially if indirect damage is selected.

SACLOS (semi-active command line of sight): the gunner must keep the sight on the target to achieve a hit. Normally course corrections from the gunsight to the missile run along a fine wire trailed by the missile. Sometimes the corrections are sent by radio instead.

Laser Designated: The gunner shines a laser on the target. The missile flies to whatever the laser beam illuminates. Sometimes an infantryman uses the laser, while a separate launcher vehicle or helicopter fires the missile.

FLIR: Forward-looking infrared. The missile is aimed at the target by the gunner or pilot. When he "locks on" the missile a computer image-matching system in the missile "reads" the heat patterns of the target. When the missile is launched, it flies toward that pattern.

This indicates which vehicles commonly carry the weapon.

APFSDS "Sabot" Ammunition:

Muzzle Velocity: 1,661 meters/second

Typical Armor Penetration at-

500 meters:	399mm
1000 meters:	368mm
1500 meters:	336mm
2000 meters:	305mm
3000 meters:	243mm

Mounting:

M1A1 MBT, Leopard 2 MBT

HEAT-MP Ammunition:

Muzzle Velocity: about 1,330 m/second

Typical Armor Penetration against-

Flat Steel:	455mm
Sloped Steel:	369mm
Rounded Steel:	292mm
Reactive Plating:	202mm
Composite Armor:	180mm

Data Format

Ammunition

Missile Guidance

Mounting

Guns

Rheinmetall

M256 120mm Smoothbore

In the late 1970s Rheinmetall designed a new tank cannon with far superior performance to the NATO 105mm rifle. The 120mm is arguably the most powerful tank gun used in Western tanks. The semi-combustible cartridge is light enough to handle in one piece (the British 120mm and Russian 125mm are in two pieces). The new M827 round with a depleted uranium penetrator bolt probably has the best penetrating ability of any shell in the world. The only drawback is ammunition variety. It only has two types of rounds: APFSDS and HEAT rounds. No WP (smoke) exists.

Royal Ordnance M68E1 105mm Rifle

APFSDS "Sabot" Ammunition:

Muzzle Velocity: 1,458 meters/second

Typical Armor Penetration at-

500 meters: 377mm

1000 meters: 349mm

1500 meters: 322mm

2000 meters: 294mm

3000 meters: 238mm

HEAT-MP Ammunition:

Muzzle Velocity: 1173 meters/second

Typical Armor Penetration against-

Flat Steel: 425mm

Sloped Steel: 345mm

Rounded Steel: 273mm

Reactive Plating: 188mm

Composite Armor: 168mm

Mounting:

M1 MBT, M60A3 MBT

Developed in Britain in the late 1950s for the Centurion, this gun was a vast improvement over the 90mm and 100mm competing weapons. Its amazing muzzle velocity (for its time) developed unrivaled accuracy and penetrating power throughout the 1960s. The L7 version was adopted by almost all the NATO armies, including the USA, who manufacture it under license as the "M68". Not until the early 1980s did tanks acquire sufficient armor to raise doubts about its penetration ability. Most European armies are now upgunning their tanks or consigning the 105mm vehicles to second-line duties. Only Israel still stands by the weapon as their standard tank gun. The 105mm fires a wide variety of ammunition, including smoke (white phosphorous usually) and a variety of outdated types such as HEP and HESH "squash head" concussion penetrators, or "Beehive" cannister rounds.

GAU-8/A 30mm "Avenger" Seven-barrel Auto-Cannon

AP Ammunition:

Muzzle Velocity: 1,066 meters/second

Typical Armor Penetration at-

500 meters: 69mm

1000 meters: 38mm

1500 meters: 16mm

2000 meters: none

Mounting:

A-10A Attack Jet

This heavy cannon is the most powerful gun ever mounted in an aircraft. It runs virtually the entire length of the A-10A, and when fired almost stops the plane in mid-air. Each shell has a depleted uranium penetrator that easily pierces the top deck armor of any AFVs. Its only weak point is ammunition: the shells have no explosive power, and are therefore useless against infantry.

M230 30mm Chain Gun

HEDP Ammunition:

Muzzle Velocity: 790 meters/second

Typical Armor Penetration at-

500 meters: 39mm

1000 meters: 4mm

1500 meters: none

Mounting:

AH-64A Attack Helicopter

This lower-powered 30mm gun is chin-mounted on the AH-64A. It's nowhere near the Avenger in penetrating power, partly because the gun has lower muzzle velocity and partly because the ammunition is dual-power high-explosive, rather than simply bolts. Still, the HEDP can cut through the top decks and

rear armor of most AFVs at useful ranges, and the high explosive is very effective against infantry and other soft targets.

APDS Ammunition:

Muzzle Velocity: about 1100 meters/second

Typical Armor Penetration at-

500 meters: 27mm

1000 meters: 1mm

1500 meters: none

Mounting:

M2A1 IFV, M3A1 CFV

This chain gun has an extremely high muzzle velocity, accuracy and penetrating power. It is quite capable of carving up BMPs, BTRs, and BRDMs at ranges far beyond an M2 or M3 gunner is likely to score hits. It's also quite effective against infantry and other soft targets. Of course, as the above figures show, it's quite useless against the front armor of MBTs.

APT Ammunition:

Muzzle Velocity: 1,036 meters/second

Typical Armor Penetration at-

500 meters: 45mm

1000 meters: 31mm

1500 meters: 16mm

2000 meters: 2mm

3000 meters: none

Mounting:

M163A2 PIVADS Gun Carrier

The Vulcan cannon is the standard gun of USAF jet fighters, who need a weapon that instantly fills the air with shells. The gun's ground adaptation is designed to engage enemy aircraft and helicopters with its rate of fire halved from 6,000 rds/min to 3,000 rds/min. It's also devastating against ground targets, including both lightly armored vehicles and infantry. For this role it has a special 1,000 rds/min rate-of-fire setting. Unfortunately, the accuracy of the gun in an AA role is hampered by its rather primitive target acquisition and fire control.

Ball (Bullet) Ammunition:

Muzzle Velocity: 890 meters/second

Typical Armor Penetration at-

250 meters: 8mm

500 meters: 1mm

1000 meters: none

Mounting:

M113A3, secondary gun on many vehicles

This weapon is the venerable "caliber .50" air-cooled machine-gun that was so successfully used on both AFVs and aircraft during WWII. It remains the standard heavy machine-gun in the US Army.

Ball (Bullet) Ammunition:

Muzzle Velocity: 840 meters/second

Typical Armor Penetration-

none

Mounting:

Coaxial or other secondary gun on many vehicles

This new Belgian gun was first adopted by the US Army on the M1 tank. It was so successful that it's been adopted for many other vehicles, including the A3 version of the M60 as well as in coaxial mountings on the M2 and M3. It's a simple, reliable, effective and well-made weapon.

M242 25mm Chain Gun

M61A1 20mm "Vulcan" Six-barrel Gatling Gun

M2HB 12.7mm Heavy Machine-gun

M240 7.62mm Medium Machine-gun

Missiles

300mm AGM-65D Maverick AAM

Average Flight Speed: 180 meters/second
Maximum Range: 16,000 meters
Guidance System: FLIR (Forward Looking Infrared) "fire and forget"
Typical Armor Penetration against-
Flat Steel: 650mm
Sloped Steel: 527mm
Rounded Steel: 417mm
Reactive Plating: 288mm
Composite Armor: 257mm

Mounting: A-10A and similar attack aircraft

The AGM-65 has long been the standard air-to-ground missile of the US Air Force. The original version had a small TV camera in the nose, which has been upgraded to a FLIR camera that sees through clouds and smoke. The pilot has a special screen and joystick in the cockpit to aim the missile's camera. He then presses "lock on" and fires the missile. The missile's on-board computer uses image-matching software to stay aimed at the "locked on" image. Despite the apparent complexity, reliability and accuracy is high — much higher than dropping bombs! The main disadvantage is that a pilot must concentrate on the tiny screen and making lock-on while flying the plane straight into enemy guns and missiles!

178mm AGM-114A Hellfire ATGM

Average Flight Speed: 170 meters/second
Maximum Range: 7,000 meters
Guidance System: Laser Designated or Radar Guided
Typical Armor Penetration against-
Flat Steel: 650mm
Sloped Steel: 527mm
Rounded Steel: 417mm
Reactive Plating: 288mm
Composite Armor: 257mm

Mounting: AH-64A attack helicopter

Initially designed to complement the AH-64 Apache helicopter, the Hellfire is the US Army's only laser-guided ATGM. The missile is slightly larger and more powerful than the TOW 2, but lacks the improved TOW's dual warhead. A new radar-guided version is entering service on modified Apaches with mast-mounted radar sets. The advantage of radar is that smoke, rain and snow don't block missile guidance. The disadvantage is that the Apache must designate its own targets, while the laser-guided version has the option of an infantryman designating with a hand-held laser while the Apache fires the missile from complete concealment.

152mm BGM-71D TOW 2A ATGM

Average Flight Speed: 190 meters/second
Maximum Range: 4,000 meters
Guidance System: SACLOS (Semi-active command line-of-sight)
Typical Armor Penetration against-
Flat Steel: 600mm
Sloped Steel: 487mm
Rounded Steel: 385mm
Reactive Plating: 266mm
Composite Armor: 237mm

Mounting: M2 IFV, M3 CFV, M901 ITV, others

The TOW (Tube-launched, Optically-controlled, Wire-guided missile) has long been the US Army's heavy ATGM. It's purely a vehicle-launched weapon (although one uninformed US President claimed otherwise). The TOW 2 has an improved two-stage warhead designed to explode reactive armor with the first stage, then penetrate the steel beneath with its second stage. This rather dubious expedient probably works better on the firing range than in battle.

Average Flight Speed: 175 meters/second
Maximum Range: 1,500 meters
Guidance System: SACLOS (Semi-active command line-of-sight)
Typical Armor Penetration against-
Flat Steel: 400mm
Sloped Steel: 324mm
Rounded Steel: 257mm
Reactive Plating: 177mm
Composite Armor: 158mm

Mounting: Infantry manpack

Produced between 1972 and 1980, the Dragon is still the US Army's standard medium ATGM. It is the largest missile infantrymen are expected to carry. The sight unit and missiles (in cannisters) are separate items. When the missile is fired the empty cannister is discarded and the sight attached to the next missile. The Dragon is short-ranged and of lesser penetrating ability than the TOW. However it's certainly far more effective than the LAW (see below).

Average Flight Speed: 115 meters/second
Maximum Range: 135 meters
Guidance System: None
Typical Armor Penetration against-
Flat Steel: 250mm
Sloped Steel: 203mm
Rounded Steel: 161mm
Reactive Plating: 111mm
Composite Armor: 99mm

Mounting: Infantry manpack

Developed in the late 1950s and in production since 1962. The LAW (Light Anti-tank Weapon) is a completely disposable rocket. Unfortunately, some infantrymen have been tempted to dispose of it before firing! Maximum range and penetration are so pathetic that only lucky shots would hurt a modern MBT, and then only in sides or rear unprotected by reactive or composite armor. LAWs are also useful against buildings, pillboxes, bunkers, and similar targets, but again their small warheads and short range mean questionable effectiveness.

114mm M47 (FGM-77A) Dragon III ATGM

66mm M72A3 LAW Rocket

US ORGANIZATION

The US Army created a new organization for the 1980s. Originally termed "Division-86" (it went into effect in 1986), it includes "Corps-86" and "Army-86".

Under this system the majority of the army is organized into "heavy" mechanized divisions. Heavy divisions are the core of the army and its main fighting force in Europe. There are also an experimental light infantry division and air assault division, as well as a traditional airborne (parachute) division. However, these forces lack the massed firepower provided by the tanks and artillery of the "heavies". Therefore, most of the regular army and the national guard are organized as heavy divisions.

Since the end of WWI, most armies have used a "triangular" organization. A division had three brigades, each brigade had three battalions, each battalion had three companies, etc. In battle they fought as an inverted triangle: two up front, the third to the rear in reserve. However, since the 1960s the US Army uses extensive cross-attachments. This means a unit "gives away" an element to another unit, leaving it with only two elements instead of three. Then another element may be required for garrison (in guerilla campaigns) or rebuilding (after heavy fighting), leaving the unit just one element for combat.

Division-86 solves this problem with a new "square" organization. On every other level the division has four elements to a unit, not three. The division has four combat brigades, a battalion has four combat companies, and a platoon has four combat vehicles.

Size Symbol Keys

•	Squad	X	Brigade
••	Section	XX	Division
•••	Platoon (Troop if cavalry)	⌈	Company Team (company-sized battlegroup)
I	Company (Battery if artillery, Squadron if cavalry)	⌈⌈	Battalion Task Force (battalion-sized battlegroup)
II	Battalion	⌈⌈⌈	Brigade Battlegroup
III	Regiment		

Unit Symbol Keys



Armored
(tanks)



Mechanized Infantry (US) or Motor Rifle
(in general; also for APC-mounted infantry)



Mechanized Infantry (US) or Motor Rifle
(IFV-mounted)



Armored Cavalry (US) or Reconnaissance (USSR)
(scout vehicles)



Infantry (US) or Rifle (USSR)
(Foot infantry)



Unarmored Reconnaissance
(Scouts without armored vehicles)
(formerly horse cavalry)



Anti-tank
(normally missile carriers)



Air Defense
(AA tanks, gun carriers,
and/or SAM launchers)



Armored Artillery
(self-propelled field artillery)



Armored Mortars
(self-propelled mortar carriers)
(not a standard NATO symbol)



Armored Rocket Artillery
(rocket launchers on AFVs,
mainly the MRLS)



Rocket Artillery
(rocket launchers,
usually on trucks)



Artillery Target Acquisition
(spotter vehicles and
fire control systems)



Army Aviation
(helicopters and
light aircraft)



Air Cavalry
(heli-borne troops
with integral support)



Attack Helicopters
(helicopter gunships)



Observation Helicopters
(light scouts and/or
small transports)



Transport Helicopters
(troop and cargo-
carrying helicopters)



Signals
(communications)



Maintenance & Logistics
(simplified; actual symbology
is much wider and much
more complex)



Engineers
(minefields, construction
and demolition)



Armored Engineers
(armored vehicles for minefields,
construction and demolition)



Support or Heavy Weapons
combined with a type above
(weapons designed to support
the unit type indicated)



Headquarters
combined with a type above
(command element for
next higher level unit)

Weapons Symbols Key



Tracked, Heavily Armored AFV
(a tank)



Tracked, Lightly Armored AFV
(usually an IFV or APC)



Wheeled, Lightly Armored AFV
(usually an APC or Armored Car)



Machine-guns
(Light, Medium or Heavy)



Anti-Tank Rocket Launcher
(LAW and RPG-7/16 are light AT launchers)



Mortar
(30mm AGS-17 is light, 81-82mm is medium, 107-120mm is heavy)



Recoilless Gun
(73mm smoothbore on BMP-1 is a light RCL gun)



Gun (Rifle or Smoothbore)
(20-30mm is light, 100-115mm is medium, 120-125mm is heavy)



Anti-tank Guided Missile (ATGM)
(Light, Medium and Heavy; Dragon is medium, TOW is heavy)



Surface-Air Missile
(manpacked Stinger or SA-7/14 are light)



Infantry Squad
(with automatic rifles and grenade launchers)

Example:



Tank with Heavy Gun
(M1, T-80, etc.)



IFV with Light Gun and Heavy ATGM
(M2, M3 or BMP-2)



IFV with Recoilless Gun and Heavy ATGM
(BMP-1)



Tracked APC with HMG
(M113, MT-LB)



Wheeled APC or Armored Car with HMG
(BTRs and BRDMs)



Infantry Squad with MMG, Mdm ATGM, Lt ATR, plus non-standard Lt SAM
(for US: M-60 Machine-gun, Dragon III and LAWs; plus "acquired" Stinger)

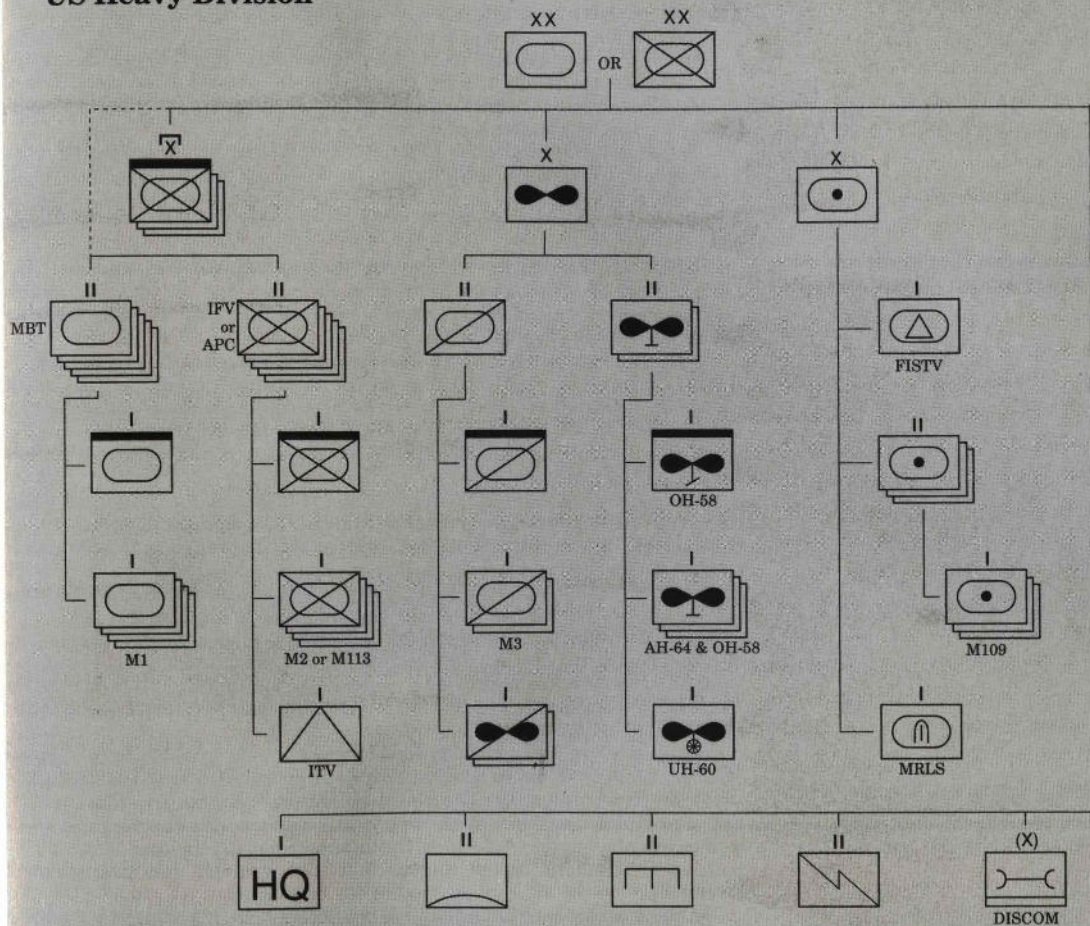
The Heavy Division

Heavy divisions are titled either "armored" or "mechanized infantry". In equipment and manpower, the differences are small. Armored divisions normally contain six armored battalions and four mechanized infantry battalions, while mechanized infantry divisions have five of each. However, many divisions have "exceptional" organizations where one or more of these battalions is missing, substituted, traded, etc. The main difference between armored and mechanized infantry division is the attitude of the officers. Armored division personnel think of themselves as 'slash-and-roll' descendants of General Patton, while the infantry division leaders still envision fighting on foot with plenty of air, artillery, and armor support.

Each heavy division has three mechanized brigade battlegroup headquarters. The division commander assigns battalions to each brigade HQ as circumstances dictate. Typically a battlegroup has three or four battalions, but some could have two or five.

The aviation brigade is new in the Division-86. It can function as a fourth brigade battlegroup HQ, trading various helicopter units in exchange for armor and mechanized infantry companies. However, it has no battalion task force headquarters to command these assets. Theorists suggest that the brigade should fight together, as a single powerful striking force of helicopters and armored cavalry. Just as massed tanks changed the nature of warfare in 1940, massed helicopters could do the same in 1990, becoming the new "super weapon". Unfortunately, the US Army

US Heavy Division



has no theory, doctrine, training or regular exercises in massed helicopter warfare. In peacetime the air brigade HQ's main problem is keeping all the choppers running (helicopters require enormous amounts of maintenance).

The artillery brigade HQ is not a combat formation. Instead, the divisional artillery is allocated to other brigades for battlefield support. Most allocations are over the radio, rather than by physical movement. The US Army excels at rapid-response artillery, to the point where individual platoon commanders can call up artillery on a few minutes notice.

The various independent battalions within the division (air defense, engineers and signal) are usually split up and assigned to the brigade battlegroups. DISCOM is the divisional logistics and support train, an organization too large and complicated to describe here.

Battalion Task Forces

In the field armored and mechanized infantry battalions "cross attach" one or more companies. The example in the diagram shows cross-attachments based on a US Army field manual for a "typical" task force. Cross-attached battalions are called "task forces" in the US Army parlance.

In this mechanized infantry task force the battalion has given away one of its infantry companies, and gotten in return an armored company from another battalion. Cross-attachment also works between companies. Notice that the armored company has given away one of its tank platoons to a infantry company, and gotten in return a mech infantry platoon. Cross-attached companies are called "teams" in the US Army.

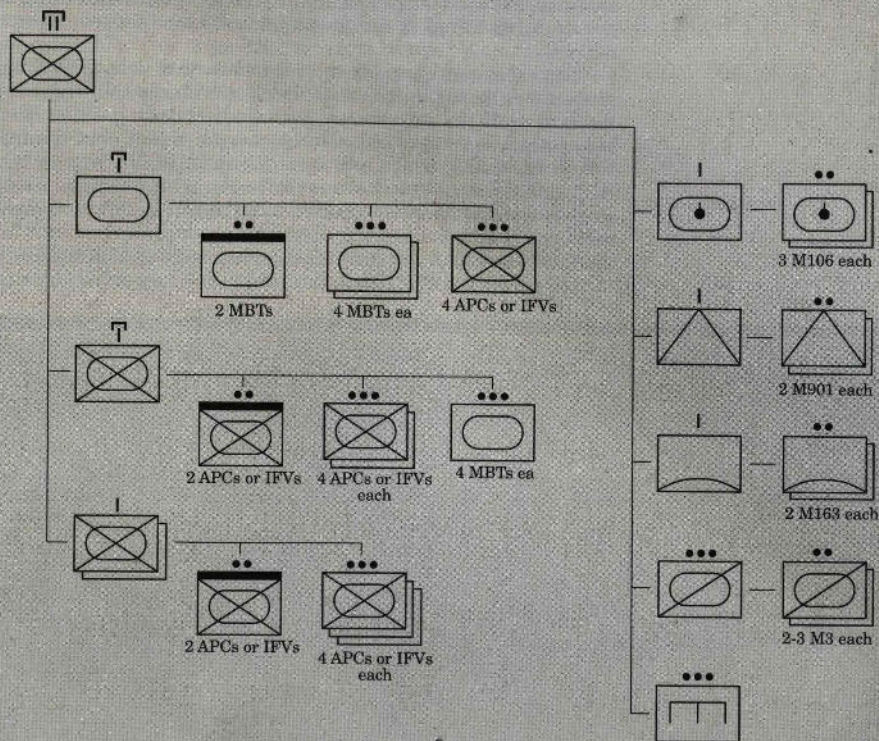
The mortars (M106s), TOW carriers (M901 ITVs), cavalry (M3s), air defense (M163 PIVADS) and engineers theoretically stay together in their own platoons or batteries. Task Force doctrine frequently shows them as such. However, in real combat it's likely that pleas from company commanders will force the battalion commander to split up these units, giving them out as sections or even single vehicles.

Armored battalion task forces look very similar to this. They would give away one tank company in return for a mechanized infantry company. The companies would be organized as above, with armored and mechanized infantry symbols switched. The only other exception is that armored battalions don't have an integral anti-tank company.

An alternative armored task force organization might divide the acquired "fourth" company of mechanized infantry, giving one platoon to each of its three remaining tank companies. The tank companies would now have three tank and one "mech" platoon. This makes every tank company a potent striking force with its own infantry support. Of course, the infantry company commander would have nothing to command except himself, but that wouldn't matter much to the tankers!

In hasty or confused situations, it's not uncommon for a battalion to have one of its companies "stolen" for special duty somewhere — a fire base garrison, as a

US Battalion Task Force



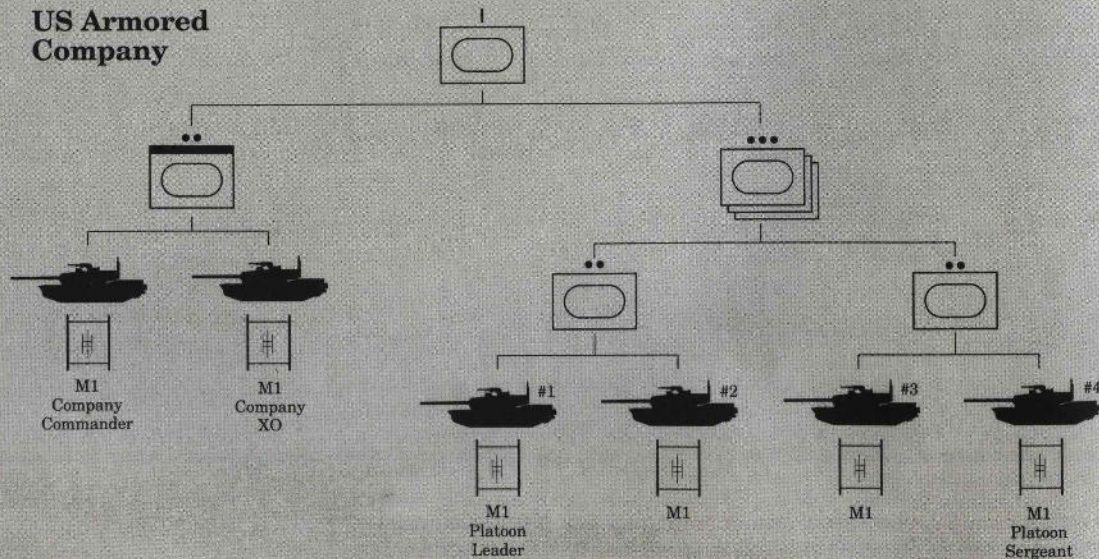
cross-attachment for some special mission, or to unit that lost its first cross-attachment in battle. After some time in the field a battalion task force might have three companies instead of the four shown here.

The Armored Company

The organization depicted here is the "tabular" (paper) pattern. In reality many companies would give away one of their three platoons and gain a mechanized infantry platoon in its stead. This gives the company "team" its own integral infantry, allowing tanks and infantry to fight together. It's not unlikely that one or two M163 PIVADS AA guns might also be attached to the company for air defense.

Tank platoons normally fight together, in a unit of four vehicles. The main reason for the two sections is "overwatch" tactics. In this, one section moves forward while the other covers it from a hull-down position. The moving section stops when it reaches a good hull-down position, and from there covers the following section, which either comes up beside it, or leapfrogs into the lead. Although overwatch tactics were the "hot topic" in 1960s and 70s doctrine, they are greatly de-emphasized in new US Army manuals. The new small-unit manuals stress movement as a group, firing as a group. Firepower is to be commanded decisively and used full-force, rather than split up into smaller pieces.

US Armored Company



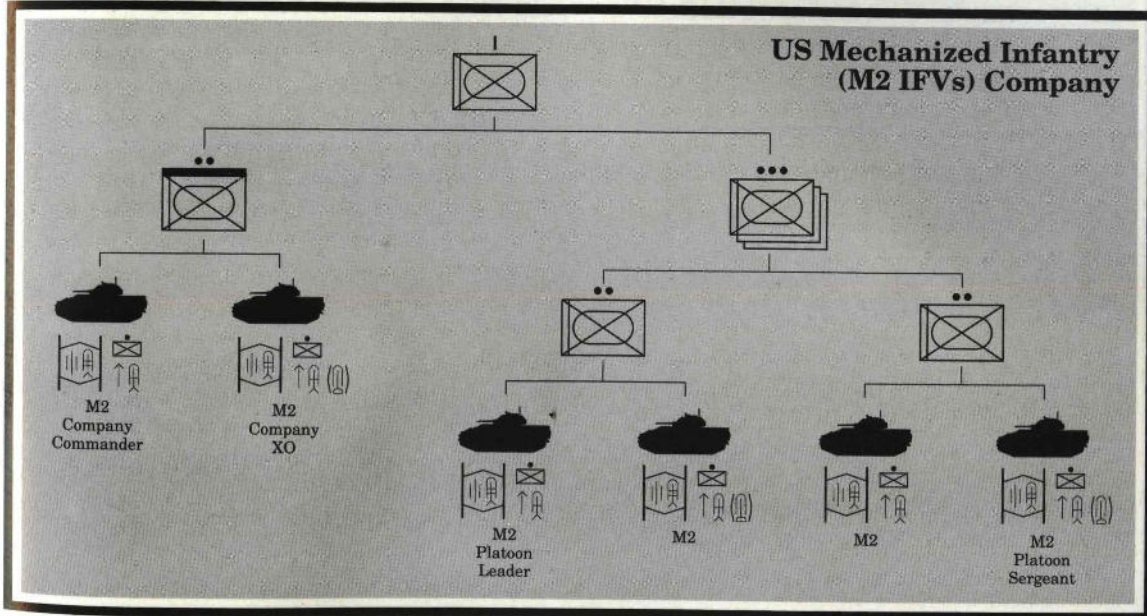
The organization depicted is the "tabular" pattern. In many cases the company would give away a platoon in exchange for a tank platoon. The company might also gain a section of two ITV missile carriers and possibly a M163 PIVADS gun carrier.

Although the paper organization does not provide them, it's quite likely that a combat-savvy "mech" company would quickly acquire as many Stinger shoulder-launched SAMs as possible. This organization shows two per platoon, plus an extra in the company HQ section. Extremely enterprising troopers might end up with one in every vehicle. The missiles and launchers are doubly valuable because American divisions are very weak in air defense vehicles.

Each M2 Bradley carries an infantry squad with a SAW light machine-gun and Dragon ATGM. Although LAW rockets could be carried, it's unlikely anybody will bother issuing them to M2 infantry, since the vehicle already has a TOW.

Note that the Bradley infantry squads do not have a medium machine-gun. Although the SAW is more portable, it can't deliver steady, sustained, reliable firepower like the old M60 MG. This means the infantry really do need the autocannon and coaxial machine-gun of the M2, and on the defense as well as the offense.

The IFV Mechanized Infantry Company

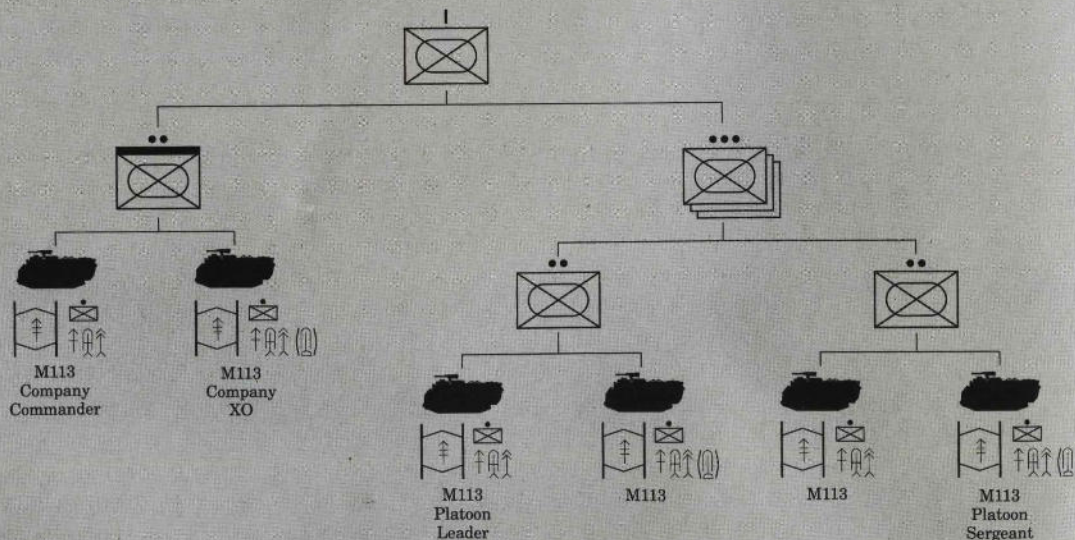


The APC Mechanized Infantry Company

This organization is very similar to the IFV mechanized company. Many of those remarks also apply here. The main difference, aside from the vehicle itself, is that the infantry squad carries more and heavier weapons. They use the M60 medium machine-guns and are issued LAW rockets as well as Dragon ATGMs. Enterprising sergeants and corporals will certainly acquire as many Stinger SAMs as possible.

However, this additional infantry equipment in no way compensates for the lack of weapons on the M113. The APC has no heavy ATGM. Furthermore, instead of an auto-cannon with coaxial machine-gun in a stabilized turret with night-sights, the lowly M113 has a pintle-mounted caliber .50. In combat conditions gun-shields would probably be jury-rigged around the machine-gun, giving the gunner some protection from bullets and shrapnel.

US Mechanized Infantry (M113 APCs) Company



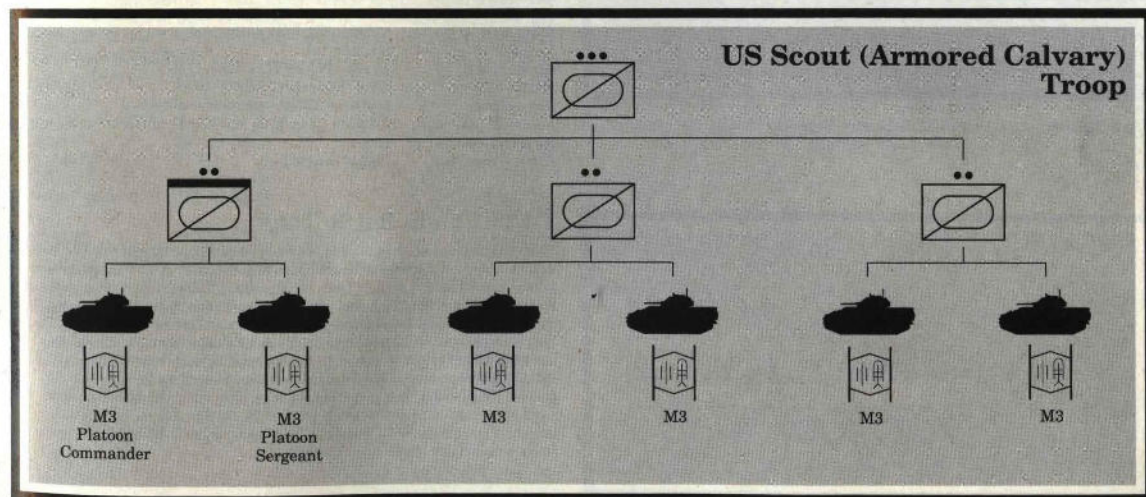
This is the reconnaissance force in a battalion task force. American armored cavalry has undergone innumerable reorganizations, each one more confusing than the last. It appears that organizational patterns are dictated by whatever amount of equipment makes the tables "come out right", rather than by what reconnaissance troopers really need.

In action this troop (cavalry equivalent of a platoon) could fight as three two-vehicle sections, or two three-vehicle sections. Much would depend on how well the platoon commander trusted his two section leaders. If they were inexperienced, the platoon CO and platoon sergeant would probably each join one of the sections, "stiffening" them. In veteran units the platoon CO and platoon sergeant might operate as a third section.

It's also possible that individual sections might be "lent" to company commanders, especially those in the lead. Reconnaissance troops can also take heavy casualties if they're unlucky. The troop therefore might be reduced to just two sections, or perhaps only its headquarters section!

Each M3 carries two infantry scouts, one with the rifle, the other with the rifle/grenade-launcher (a rifle with a grenade launcher attachment under the barrel). They would probably "acquire" Stinger SAMs, LAWs, and who knows what other equipment. Scouts are frequently expert at "scouting" friendly supply depots as well as enemy positions!

The Scout (Armored Cavalry) Troop

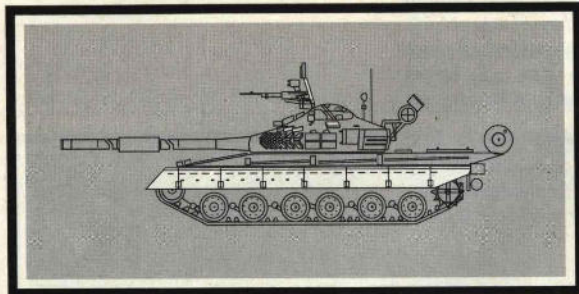


USSR VEHICLES

Data Format

These vehicles use the same format as the US Vehicles. See pages 00-00 for a complete explanation.

Vehicle Data



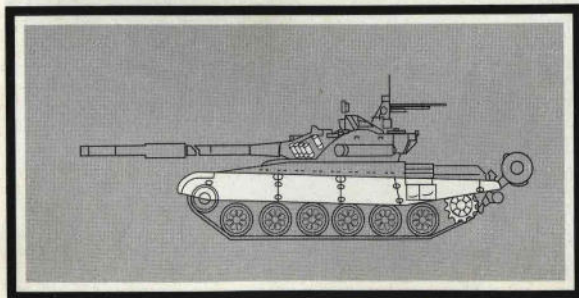
Front Turret: ~400mm reactive
Front Hull: ~250mm reactive
Side Turret: ~350mm reactive
Side Hull: ~60mm reactive
Rear: ~45mm flat
Other Defenses: Smoke GLs on turret, Engine exhaust smoke, Laser warning

T-80m84 Main Battle Tank

Also known as the T-80A, this vehicle entered service about 1983. It represents the latest and best in the T-64/T-72 family. It has much thicker turret armor and added reactive armor covering most of the turret and the front half of the hull. It has greater speed and cross-country agility from a powerful new engine and lower ground pressure. The AT-8 missile is launched through the gun tube. It compensates for the 125mm's poor accuracy at ranges over 2,000 meters.

Weight: 42.0 tonnes
Crew: 3 - Cmdr, Gnr, Drvr
Passengers: None
Engine: 985 hp gas turbine
Max Road Speed: 75 kph
HP/Weight: 23 hp/tonne
Ground Pressure: 0.83 kg/sq.cm

Main Gun: 125mm SB, fully stabilized
Loader: Mechanical
Ammunition: 40 rds HVAPFSDS, HEAT, HE
Missiles: AT-8 "Songster" ATGM
Ammunition: replaces 125mm shells about 2-for-1
Secondary Guns: 7.62mm Coax MG, 12.7mm Roof HMG
Rangefinder: Laser
Night Gunsight: Image Intensifiers



T-72m1 Main Battle Tank

This was the main battle tank of the Soviet army throughout the 1970s and is now widely exported and license-built. The first models had stadia rangefinders and IR searchlights, but virtually all Soviet ones have since upgraded. In fact the T-72 has undergone ten or more revisions. Some later variants of the T-72 were termed "T-74" for a short period, but this nomenclature has fallen into disuse. The latest revision added reactive armor to the turret and hull fronts. These additions have certainly added weight, perhaps more than the three extra tonnes represented in the estimate above. The main drawback of this tank is its mediocre cross-country mobility, further degraded by extra weight. Overall the T-72 is certainly inferior to the T-80 or M1, but at least equal if not superior to the M60.

Weight: about 44 tonnes
Crew: 3 - Cmdr, Gnr, Drvr
Passengers: None
Engine: 780 hp diesel
Max Road Speed: 60 kph
HP/Weight: 17.7 hp/tonne
Ground Pressure: 0.89 kg/sq.cm

Main Gun: 125mm smoothbore, fully stabilized
Loader: Mechanical
Ammunition: 39 rds of HVAPFSDS, HEAT, HE
Missiles: None
Secondary Guns: 7.62mm Coax MG, 12.7mm Roof HMG
Rangefinder: Laser
Night Gunsight: Image Intensifiers

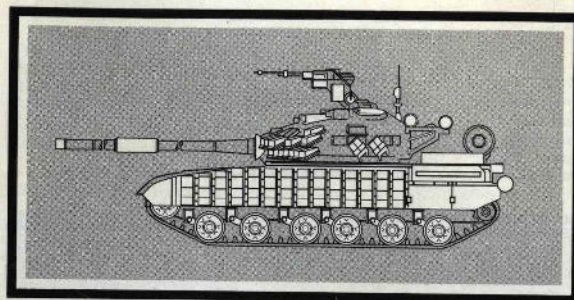
T-64B Main Battle Tank

Prototypes of this tank were tested in the mid 1960s, but had too many mechanical problems. The most notable were inside the cramped turret, where the mechanical loader sometimes misloaded ammunition, causing spectacular explosions. Turret space was so cramped and badly arranged that crewmen were frequently snagged by the machinery, in some cases causing the gunner's arm to be loaded into the cannon! Gradually these problems were worked out and the T-64A saw limited production. Upgrading of the rangefinder (to a laser), adding reactive armor, and including AT-8 capability produced the T-64B, which is still in production today. The confusing spectacle of three separate MBTs in production simultaneously (the T-64, T-72 and T-80) is certainly a new triumph in the inefficiencies of Soviet economic planning.

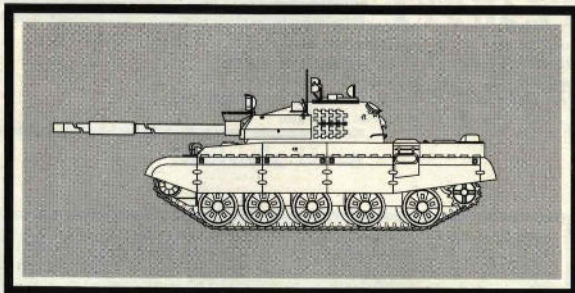
Weight: 42 tonnes
Crew: 3 - Cmdr, Gnr, Drvr
Passengers: None
Engine: 750 hp diesel
Max Road Speed: 70 kph
HP/Weight: 17.8 hp/tonne
Ground Pressure: 0.73 kg/sq.cm

Main Gun: 125mm SB, fully stabilized
Loader: Mechanical
Ammunition: 40 rds of HVAPFSDS, HEAT, HE
Missiles: AT-8 "Songster"
Ammunition: 2 to 4 missiles
Secondary Guns: 7.62mm Coax MG, 12.7mm Roof HMG
Rangefinder: Stereoscopic or Laser
Night Gunsight: Image Intensifiers

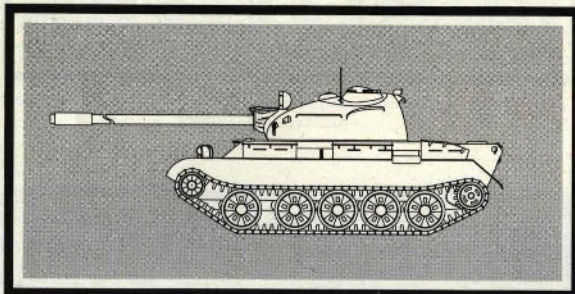
Front Turret: ~350mm reactive
Front Hull: ~250mm reactive
Side Turret: ~300mm rounded
Side Hull: ~60mm sloped
Rear: ~45mm flat
Other Defenses: Smoke GLs on turret, engine exhaust smoke generator



Front Turret: ~250mm reactive
Front Hull: ~200mm reactive
Side Turret: ~150mm rounded
Side Hull: ~60mm reactive
Rear: ~45mm flat
Other Defenses: Smoke GLs on turret, engine exhaust smoke system



Front Turret: ~300mm sloped
Front Hull: ~200mm steeply sloped
Side Turret: ~150mm rounded
Side Hull: ~80mm flat
Rear: ~45mm flat
Other Defenses: Engine exhaust smoke system



Front Turret: ~200mm sloped
Front Hull: ~100mm steeply sloped
Side Turret: ~150mm rounded
Side Hull: ~80mm flat
Rear: ~45mm flat
Other Defenses: Engine exhaust smoke generator

T-62M Main Battle Tank

This tank was a redesigned successor to the barely adequate T-54/55 series. The T-62 was the first major tank design to use a smoothbore gun. It emphasized speed and armor shape as a defense against HEAT missiles. Unfortunately, engineering details greatly compromised the effectiveness of this tank, just as in the T-54/55. For example, to reload the gun, the turret must be rotated to a specific position and the barrel elevated to a specific height. This greatly compromises good gunnery and/or seriously slows the rate of fire. Furthermore, the transmission and tracks wear out quickly, while poor ventilation quickly exhausts the crew. Overall, it's a fine tank for robotic dwarves, but a very poor tank for humans.

Weight: 40 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 580hp diesel
Max Road Speed: 50 kph
HP / Weight: 14.5 hp/tonne
Ground Pressure: 0.83 kg/sq.cm

Main Gun: 115mm SB, fully stabilized
Loader: Human
Ammunition: 40 rds of HVAPFSDS, HEAT, HE
Missiles: None
Secondary Guns: 7.62mm Coax MG, 12.7mm Roof HMG on some
Rangefinder: Stadiametric or Laser
Night Gunsight: IR Searchlight or Image Intensifiers

T-55 A(M) Main Battle Tank

This 1950s vehicle was Russia's first major postwar tank design (the intermediate T-44 design was a dismal failure). Some early versions had a 85mm cannon. Like the T-62, the T-54/55 series had superior concepts but bad detail engineering. Difficult reloading, unreliable power trains, exhausting crew conditions, and other problems conspired to greatly reduce combat efficiency. Thousands were exported or made in Soviet client states, and many are still in service today. However, the Soviet Army is finally phasing out the vehicle. Some unarmed versions have been sent to state farms for use as tractors.

Weight: 36 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 580 hp
Max Road Speed: 48 kph
HP / Weight: 16.1
Ground Pressure: 0.81 kg/sq.cm

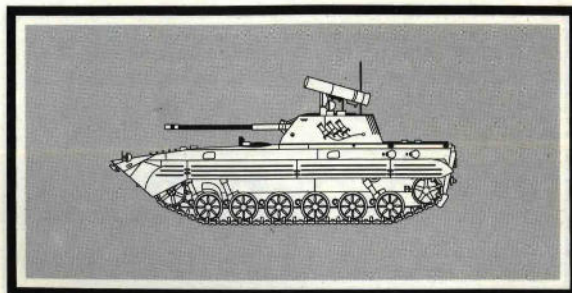
Main Gun: 100mm rifle, fully stabilized
Loader: Human
Ammunition: 43 rds of HVAPDS, HEAT, HE, APHE
Missiles: None
Secondary Guns: 7.62mm Coax MG, 12.7mm Roof HMG
Rangefinder: Stadiametric, a few Lasers
Night Gunsight: IR Searchlight, a few Image Intsfrs

BMP-2 Infantry Fighting Vehicle

This upgrade of the BMP-1 entered service in the late 1970s. The biggest improvement was replacing the poor 73mm gun with a 30mm high-velocity auto-cannon. The 30mm elevates to 70° for shooting at helicopters and slow aircraft. Armor has not been improved, probably because mobility would suffer too much. Unfortunately, the armor is desperately needed because the internal layout is so packed with vulnerable, burnable and explosive systems that virtually any penetration does heavy damage. In Afghanistan pictures of blown up or burned out BMPs are commonplace, including vehicles that blew up so violently they landed upside down!

Weight: 14.6 tonnes
Crew: 3 - Cmdr, Gnr, Drvr
Passengers: 6 - Infantrymen
Engine: 350 hp diesel
Max Road Speed: 65 kph
HP / Weight: 24 hp/tonne
Ground Pressure: 0.64 kg/sq.cm

Main Gun: 30mm Auto-cannon
Loader: Automatic (recoil)
Ammunition: 500 rds of AP, HE
Missiles: AT-5 Spandrel (AT-4 on some)
Ammunition: 1 in launcher, 4 extra inside
Secondary Guns: 7.62mm Coax MG
Rangefinder: Stadiametric
Night Gunsight: Image Intensifiers



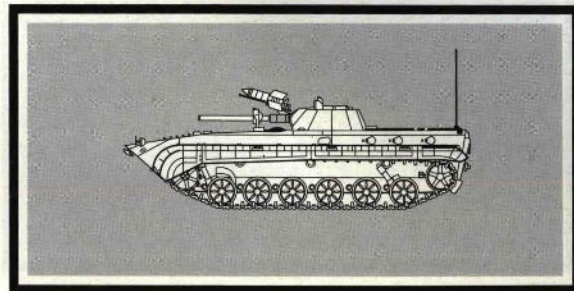
Front Turret: ~25mm sloped
Front Hull: ~20mm steeply sloped
Side Turret: ~20mm sloped
Side Hull: ~16mm flat
Rear: ~16mm flat
Other Defenses: Smoke GL launchers on turret, Engine exhaust smoke generator

BMP-1 Infantry Fighting Vehicle

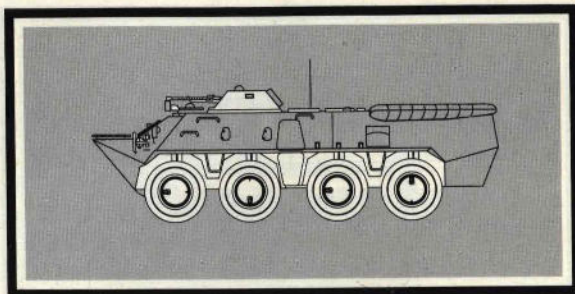
Designed in the early 1960s, this revolutionary vehicle provided an infantry squad with armored transportation on the battlefield and their own "light tank" carrying ATGMs, cannon and machine-guns. The vehicle entered service in the late 1960s, but was so expensive (compared to APCs) that twenty years later some infantry still rides APCs. This is in spite of the fact that much of the armor is cheap electro-slag remelted steel. After a regrettable tendency to explode and burn, the greatest weakness of this version was its highly inaccurate 73mm weapon.

Weight: 13.9 tonnes
Crew: 2 - Gnr, Drvr
Passengers: 9 - Cmdr, 8 Infantry
Engine: 300 hp diesel
Max Road Speed: 70 kph
HP / Weight: 21.6 hp/tonne
Ground Pressure: 0.57 kg/sq.cm

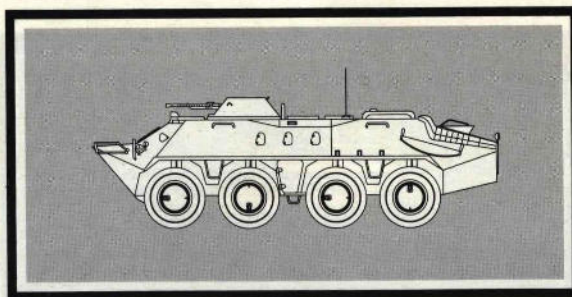
Main Gun: 73mm SB
Loader: Human (by gunner)
Ammunition: 40 rds of HEAT
Missiles: AT-3 Sagger ATGM
Ammunition: 1 on launcher, 4 reloads
Secondary Guns: 7.62mm Coax Machine-gun
Rangefinder: Stadiametric
Night Gunsight: IR Searchlight, Image Intensifiers on some



Front Turret: ~25mm sloped
Front Hull: ~20mm steeply sloped
Side Turret: ~20mm sloped
Side Hull: ~16mm flat
Rear: ~16mm flat
Other Defenses: Engine exhaust smoke generator



Front Turret: ~7mm sloped
Front Hull: ~10mm steeply sloped
Side Turret: ~7mm sloped
Side Hull: ~7mm sloped
Rear: ~5mm sloped
Other Defenses: Smoke GLs on turret



Front Turret: ~7mm sloped
Front Hull: ~10mm steeply sloped
Side Turret: ~7mm sloped
Side Hull: ~7mm sloped
Rear: ~5mm sloped
Other Defenses: None

BTR-80 Armored Personnel Carrier

This vehicle is the last in the eight-wheeled BTR series that began in the late 1950s. It has an improved machine-gun turret and better infantry entrance/exit (side doors as well as top hatches). However, the biggest improvement is a new diesel engine with greater reliable and less flammability. Taken together, the BTR-80 is a cheap and useful APC. It's at its best in well-developed regions with lots of roadway (such as western Europe), and its worst in undeveloped, rugged country with few roads.

Weight: 11.5 tonnes
Crew: 2 - Drvr, Gnr
Passengers: 9 Infantrymen
Engine: 260 hp diesel
Max Road Speed: 85 kph
HP / Weight: 22.6 hp/tonne
Ground Pressure: 8-wheeled

Main Gun: 14.5mm HMG
Loader: Automatic (recoil)
Ammunition: 500 rds of Ball
Missiles: None
Secondary Guns: 7.62mm Coax MG
Rangefinder: Stadiametric
Night Gunsight: None

BTR-70 Armored Personnel Carrier

This slightly improved version of the BTR-60PB was manufactured in quantity throughout the 1970s. Unfortunately, virtually all the flaws of its predecessor were ignored. Therefore it still has the twin gas engines that are unreliable, quite flammable, and without sufficient power. The infantry squad must enter and exit through two small roof hatches over six feet above the ground, making them ideal targets. The gun turret cannot elevate sufficiently to fire at nearby helicopters or aircraft. East-bloc infantry will continue cursing for decades the Soviet state planners who approved mass production of this boondoggle.

Weight: 11.5 tonnes
Crew: 2 - Drvr, Gnr
Passengers: 9 Infantrymen
Engine: two 115hp gasoline
Max Road Speed: 80 kph
HP / Weight: 20 hp/tonne
Ground Pressure: 8-wheeled

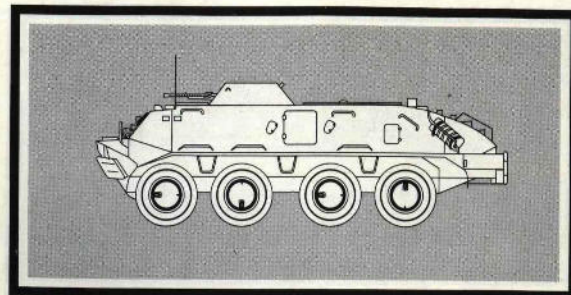
Main Gun: 14.5mm HMG
Loader: Automatic (recoil)
Ammunition: 500 rds of Ball
Missiles: None
Secondary Guns: 7.62mm Coax MG
Rangefinder: Iron Sights
Night Gunsight: None

BTR-60PB Armored Personnel Carrier

The original BTR-60 had an open top and a single machine-gun on a pintle mount. Progressive refinements during the 1960s created the PB version, which had a closed top and the now-familiar machine-gun turret with a 14.5mm and a 7.62mm (mounted coaxially). The vehicle has all the weaknesses of its successor, the BTR-70 (see above). Although it has four exit doors along the side of the hull, these are too small for everyday use by combat infantrymen.

Weight: 10.3 tonnes
Crew: 2 - Drvr, Gnr
Passengers: 9 to 14 Infantrymen
Engine: two 90 hp gasoline
Max Road Speed: 80 kph
HP / Weight: 17.5 hp/tonne
Ground Pressure: 8-wheeled

Main Gun: 14.5mm or 12.7mm HMG
Loader: Automatic (recoil)
Ammunition: 500 rds of Ball
Missiles: None
Secondary Guns: 7.62mm Coax MG
Rangefinder: Iron Sights
Night Gunsight: None



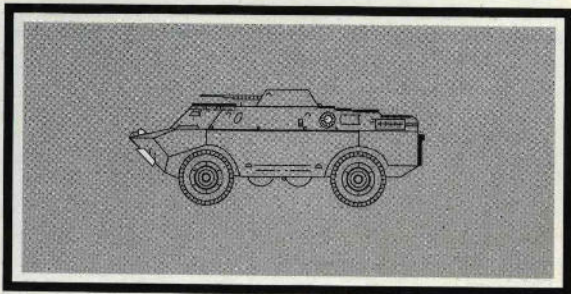
Front Turret: ~7mm sloped
Front Hull: ~10mm steeply sloped
Side Turret: ~7mm sloped
Side Hull: ~7mm sloped
Rear: ~5mm sloped
Other Defenses: None

BRDM-2 Armored Car

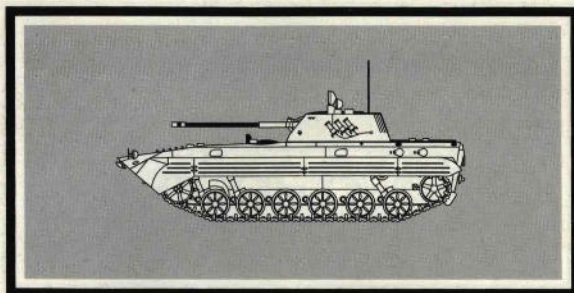
Developed from the BRDM-1, this excellent scout car is used for reconnaissance, by FOs and FACs, and by many frontline commanders who pack the passenger compartment with radio gear. ATGM and SAM carrier versions also exist (see BRDM-3, below). The vehicle has four small, extra wheels in the belly. When moving in rough terrain these are used to prevent "bellying out" — a useful and fairly inexpensive idea. USSR production ceased in the early 1980s, but there are about 15,000 still in service in the Soviet Army.

Weight: 7.0 tonnes
Crew: 2 - Cmdr, Drvr
Passengers: 4 - 2 Scouts with RPG, LMG
Engine: 140 hp gasoline
Max Road Speed: 100 kph
HP / Weight: 20 hp/tonne
Ground Pressure: 4-wheeled (plus 4 belly wheels)

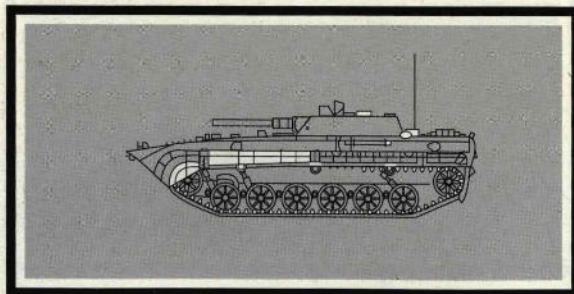
Main Gun: 14.5mm HMG
Loader: Automatic (recoil)
Ammunition: 500 rds of Ball
Missiles: None
Secondary Guns: 7.62mm Coax MG
Rangefinder: Stadiametric
Night Gunsight: IR Searchlight or Image Intensifiers



Front Armor: ~7mm sloped
Side Armor: ~7mm sloped
Rear Armor: ~7mm flat
Other Defenses: None



Front Turret: ~25mm sloped
Front Hull: ~20mm steeply sloped
Side Turret: ~20mm sloped
Side Hull: ~16mm flat
Rear: ~16mm flat
Other Defenses: Smoke GL launchers on turret, Engine exhaust smoke generator



Front Turret: ~25mm sloped
Front Hull: ~20mm steeply sloped
Side Turret: ~20mm sloped
Side Hull: ~16mm flat
Rear: ~16mm flat
Other Defenses: Engine exhaust smoke generator

BRM-2 Reconnaissance Vehicle

This vehicle is the reconnaissance version of the BMP-2. It doesn't carry ATGMs and the passenger compartment holds only two infantry scouts. The extra space is used for radio equipment. Some versions mount the "Tall Mike" ground surveillance radar (10 km range) with a folding antenna on the turret rear. This vehicle has been gradually replacing BRDM-2s in reconnaissance units since the early 1980s. At the moment BRMs are in "medium" reconnaissance platoons while BRDMs are in "light" reconnaissance platoons.

Weight: 14.5 tonnes
Crew: 3 - Cmdr, Gnr, Drvr
Passengers: 2 Scouts
Engine: 350 hp diesel
Max Road Speed: 80 kph
HP/Weight: 24 hp/tonne
Ground Pressure: 0.59 kg/sq.cm

Main Gun: 30mm Auto-cannon
Loader: Automatic (recoil)
Ammunition: 500 rds of AP, HE
Missiles: None
Secondary Guns: 7.62mm Coax MG
Rangefinder: Stadiametric, some have Ground Surveillance Radar
Night Gunsight: Image Intensifiers

BRM-1 Reconnaissance Vehicle

This is a reconnaissance version of the BMP-1. Like the BRM-2, it has no ATGM, only two scouts as passengers, more radio gear, and frequently a ground surveillance radar on the turret. This version was produced in small numbers during the late 1970s, outfitting the new medium reconnaissance platoons. It has been superseded by the BRM-2 (above).

Weight: 14.5 tonnes
Crew: 3 - Cmdr, Gnr, Drvr
Passengers: 2 Scouts
Engine: 300 hp diesel
Max Road Speed: 70 kph
HP/Weight: 20.5 hp/tonne
Ground Pressure: 0.57 kg/sq.cm

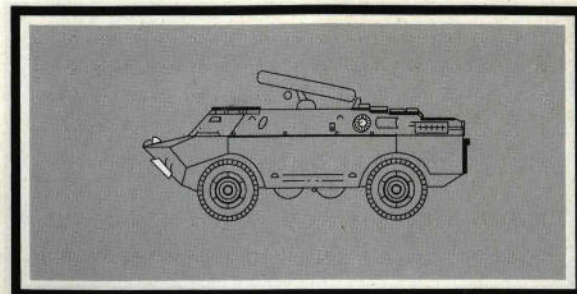
Main Gun: 73mm SB
Loader: Human (by gunner)
Ammunition: 40 rds of HEAT
Missiles: None
Secondary Guns: 7.62mm Coax Machine-gun
Rangefinder: Stadiametric
Night Gunsight: IR Searchlight, Image Intensifiers on some

BRDM-3 Missile Carrier

This is a missile carrier version of the BRDM-2 scout car. Some non-Russian Warsaw Pact vehicles carry a mixture of AT-4s and AT-5s, or just AT-4s. Older versions carried AT-3s instead. The missiles are mounted on roof launchers. Their optical controller can be dismounted and carried a short distance, allowing the vehicle to fire from full defilade. Of course, this also means the gunner lacks armor protection. The 1 or 2 passengers often carry light machine-guns and/or RPGs for close-in defense. Overall the vehicle is fairly reliable, inexpensive and effective.

Weight: 7 tonnes
Crew: 2 - Cmdr, Drvr
Passengers: 1-2
Engine: 140 hp gasoline
Max Road Speed: 100 kph
HP / Weight: 20 hp/tonne
Ground Pressure: 4-wheeled (plus 4 belly wheels)

Main Gun: None
Missiles: AT-5 "Spandrel" ATGMs
Ammunition: 5 in launchers, 10 reloads
Secondary Guns: None
Rangefinder: SACLOS for missiles
Night Gunsight: Image Intensifier



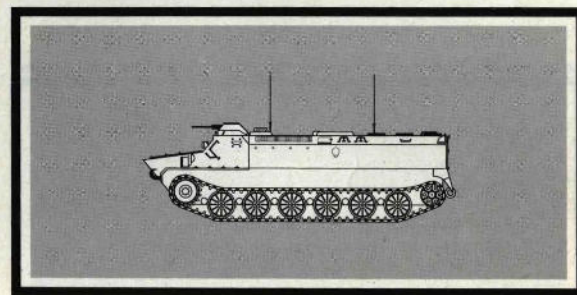
Front Armor: ~7mm sloped
Side Armor: ~7mm sloped
Rear Armor: ~7mm sloped
Other Defenses: None

MT-LB Armored Personnel Carrier

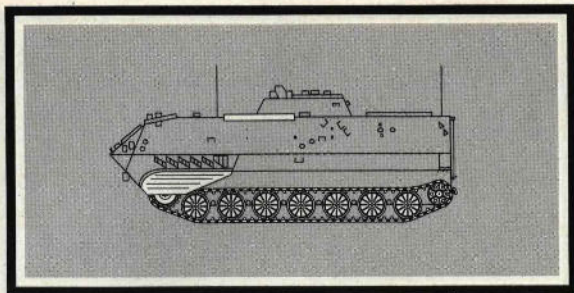
This very agile APC is based on the 1960s MT-L arctic tractor. The attributes that made the MT-L so successful in swamp and tundra were retained in the APC version, notably wide tracks for low ground pressure. The MT-LB is used as an artillery tractor and general-purpose cargo carrier. It is not used (yet) in motor rifle units to carry infantrymen. Its chassis forms the basis of many variety of specialty vehicles, including the MT-LBu FO/FAC/Command vehicle and the SO-122 SP artillery piece.

Weight: 11.9 tonnes
Crew: 2 - Drvr, Gnr
Passengers: 11 Passengers
Engine: 240 hp diesel
Max Road Speed: 61 kph
HP / Weight: 20.1 hp/tonne
Ground Pressure: 0.4 kg/sq.cm

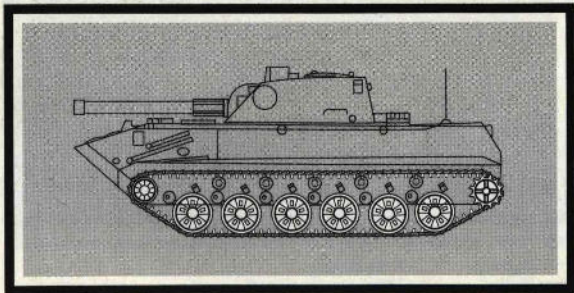
Main Gun: 7.62mm MG
Loader: Automatic (recoil)
Ammunition: 2500 rds of Ball
Missiles: None
Secondary Guns: None
Rangefinder: Iron Sights
Night Gunsight: White or IR Searchlight



Front Turret: ~7mm sloped
Front Hull: ~14mm steeply sloped
Side Turret: ~7mm sloped
Side Hull: ~7mm flat
Rear: ~7mm flat
Other Defenses: None



Front Turret: ~7mm sloped
 Front Hull: ~14mm steeply sloped
 Side Turret: ~7mm sloped
 Side Hull: ~7mm flat
 Rear: ~7mm flat
 Other Defenses: Smoke GLs on hull



Front Turret:	~25mm sloped
Front Hull:	~20mm steeply sloped
Side Turret:	~20mm sloped
Side Hull:	~16mm flat
Rear:	~16mm flat
Other Defenses:	Engine exhaust smoke generator

MT-LBu Armored Command & Reconnaissance Vehicle (ACRV)

Weight:	14 tonnes
Crew:	5 - Drvr, Gnr, Nav, Laser Operator, Radioman
Passengers:	2
Engine:	240 hp diesel
Max Road Speed:	60 kph
HP/Weight:	17.1 hp/tonne
Ground Pressure:	0.45 kg/sq.cm

Main Gun:	12.7mm or 7.62mm Roof MG
Loader:	Automatic (recoil)
Ammunition:	500 to 2000 rds of Ball
Missiles:	None
Secondary Guns:	None
Rangefinder:	Laser Designator
	some also have Ground Surveillance Radars
Night Gunsight:	Image Intensifier

2S9 SO-120 Self Propelled Mortar

Weight:	9 tonnes
Crew:	4 - Cmdr, Gnr, Drvr, Ldr
Passengers:	None
Engine:	300 hp diesel
Max Road Speed:	60 kph
HP/Weight:	33.3 hp/tonne
Ground Pressure:	0.78 kg/sq.cm

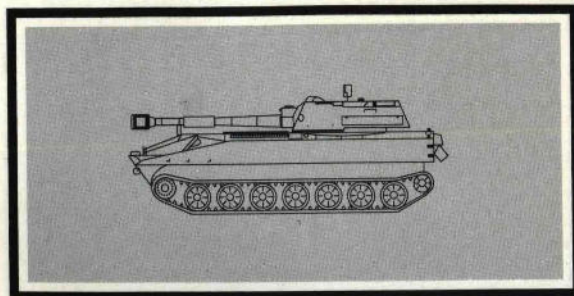
Main Gun:	120mm breech-loading mortar
Loader:	Human
Ammunition:	60 rds of HEAT, HE
Missiles:	None
Secondary Guns:	None
Rangefinder:	Laser
Night Gunsight:	Image Intensifier

2S1 SO-122 Self-Propelled Medium Artillery

Designed in the late 1960s and built on the MT-L chassis, this weapon began replacing towed artillery in 1971. However production was slow and only by the mid 1980s was the transition complete in first line units. The advantages of armored SP (self-propelled) artillery over towed weapons are immense. The vehicles are much less vulnerable to counter-battery fire. First because they can move to a new firing position faster, and second because their armor protects the crew from shrapnel if counter-battery fire does find them. The Soviet nickname for this vehicle is "Gvozdika" (Carnation).

Weight: 16 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 240 hp diesel
Max Road Speed: 60 kph
HP/Weight: 15 hp/tonne
Ground Pressure: about 0.5 kg/sq.cm

Main Gun: 122mm howitzer
Loader: Human, power assists
Ammunition: 40 rds of HE, HEAT, Smoke
Missiles: None
Secondary Guns: None
Rangefinder: Stadiametric
Night Gunsight: IR Searchlight



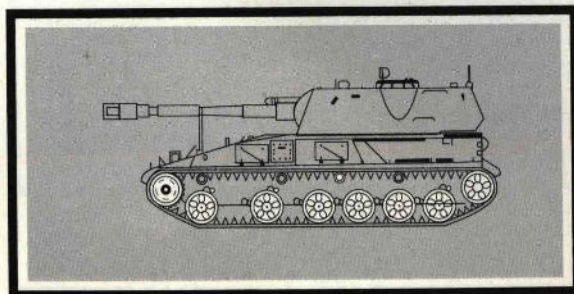
Front Turret: ~15mm flat
Front Hull: ~20mm sloped
Side Turret: ~7mm flat
Side Hull: ~7mm flat
Rear: ~7mm flat
Other Defenses: None

2S3 SO-152 Self-Propelled Heavy Artillery

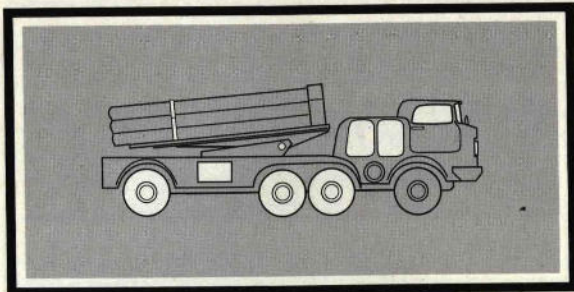
Built on the same chassis as the SA-4 missile carrier, this heavy artillery vehicle started replacing towed guns in the middle 1970s. The 152mm gun appears to have a mechanical loader that requires some small human assistance. Additional crewmen outside the vehicle can replenish the loader while the gun is firing, but this replenishment is done manually. The Soviet nickname for this vehicle is "Akatsiya" (Acacia).

Weight: 27.5 tonnes
Crew: 4 - Cmdr, Gnr, Drvr, Ldr
Passengers: None
Engine: 520 hp diesel
Max Road Speed: 50 kph
HP/Weight: 18.9 hp/tonne
Ground Pressure: 0.6 kg/sq.cm

Main Gun: 152mm gun/howitzer
Loader: Mechanical with external refill ports
Ammunition: 46 rds of HE, HEAT, HE/RAP, Smoke, Cannister, Nuclear
Missiles: None
Secondary Guns: None
Rangefinder: Stadiametric
Night Gunsight: White or IR Searchlight



Front Turret: ~15mm flat
Front Hull: ~20mm sloped
Side Turret: ~7mm flat
Side Hull: ~7mm flat
Rear: ~7mm flat
Other Defenses: None



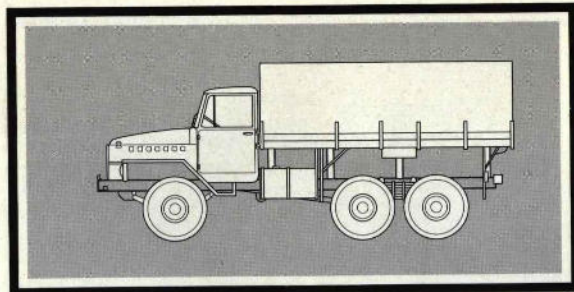
Armor: None
Other Defenses: None

BM-27 Rocket Launcher

This late 1970s vehicle is the Soviet equivalent to the MRLS. It also has submunition warheads. Each launcher is served by two reload vehicles, each of which has another 16 rockets plus a crane to aid reloading. Unlike the MRLS, the launcher vehicle does not contain any fire control equipment. The battery commander has his radios and computers in a separate vehicle. The BM-27 is also unarmored and on a wheeled, rather than tracked, chassis. All this means the BM-27 is much cheaper to produce than the MRLS. The Soviet Army nickname for this vehicle is "Uragan" (Hurricane).

Weight: 22.7 tonnes
Crew: 6 - Cmdr, Gnr, Drvr, 3 Ldrs
Passengers: None
Engine: two 180 hp gasoline
Max Road Speed: 65 kph
HP / Weight: 15.8 hp/weight
Ground Pressure: 8-wheeled

Rockets: 16 220mm Rockets
Loader: Human, crane assistance
Ammunition: HE, Minelets, Chemical
Missiles: None
Secondary Guns: None
Rangefinder: None
Night Gunsight: None



Armor: None
Other Defenses: None

URAL-375D Truck

This 1970s vehicle was a landmark design in Russian trucks. It was the first vehicle to have good cross-country performance, and its towing ability is incredible (10 extra tonnes). As a result, it replaced not only other trucks, but also most artillery tractors then in service.

Weight: 8.4 tonnes
Crew: 1 - Driver
Passengers: 2 in front, 24 people or 5.0 tonnes in back
Engine: 175 hp gasoline
Max Road Speed: 90 kph
HP / Weight: 20.8
Ground Pressure: 6-wheeled

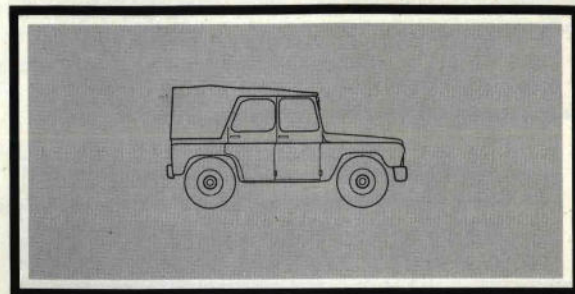
Weapons: None

GAZ-469 Jeep

This is the standard Soviet Army "jeep". It is frequently found in the front lines carrying radiomen, junior officers, staff officers, etc. Until recently it was also teamed with motorcyclists in combat reconnaissance units. Even today battalion and regimental headquarters frequently have these jeeps for scouting and liaison work.

<i>Weight:</i>	1.4 tonnes
<i>Crew:</i>	1 - Driver
<i>Passengers:</i>	1 in front, 5 people or 0.6 tonnes in back
<i>Engine:</i>	75 hp gasoline
<i>Max Road Speed:</i>	120 kph
<i>HP/Weight:</i>	53.5 hp/tonne
<i>Ground Pressure:</i>	4-wheeled

Weapons: None



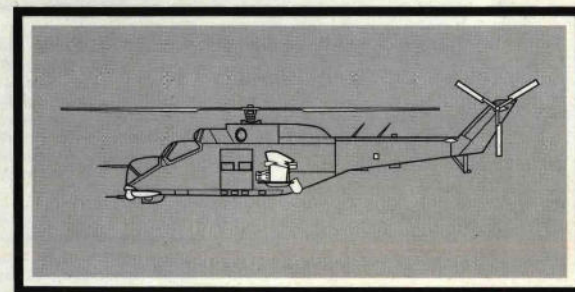
Armor: None
Other Defenses: None

Mi-24 "Hind E" Attack Helicopter

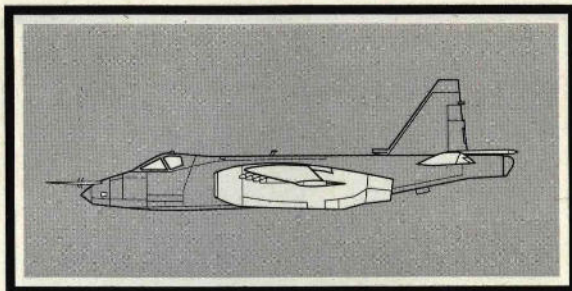
Originally designed in the late 1960s, the Mi-24 is the fastest combat helicopter in the world today, holding numerous speed records. The original "A" model was a transport helicopter, but the "D" and "E" versions were substantially redesigned as gunships. There is a tandem gunner-pilot crew, a gatling HMG chin turret, an ATGM system, and heavy armor. These first appeared in 1976-77. Some "E" versions replace the remote-control HMG turret with twin 23mm fixed forward-firing cannons. The helicopter is large, powerful, and difficult to bring down. Although faster, it is not as maneuverable as the AH-64 or its small successor, the Mi-28 (which will enter service in the early 1990s). The unofficial Russian nickname for this craft is "Gorbach" (Hunchback).

<i>Weight:</i>	11 tonnes
<i>Crew:</i>	2 - Pilot, Gnr
<i>Passengers:</i>	8 Infantrymen
<i>Engine:</i>	two 2200 shp turboshafts
<i>Max Speed:</i>	370 kph (200 kts)
<i>HP/Weight:</i>	400 hp/tonne
<i>Ground Pressure:</i>	None

<i>Main Gun:</i>	12.7mm 4-barrel Gatling MG
<i>Loader:</i>	Automatic (recoil)
<i>Ammunition:</i>	Ball
<i>Missiles:</i>	AT-6 Spiral ATGMs
<i>Ammunition:</i>	4 ready to fire, no reloads
<i>Secondary Guns:</i>	four 57mm rocket pods or four bombs
<i>Rangefinder:</i>	Stadiametric
<i>Night Gunsight:</i>	Image Intensifier



Front Armor: ~20mm flat
Side Armor: ~20mm flat
Rear Armor: ~20mm flat
Other Defenses: IR and Radar decoys, IR jammers



Front Armor: ~10mm rounded
Side Armor: ~5mm rounded
Rear Armor: None
Other Defenses: IR and Radar decoys, IR jammers

Su-25 "Frogfoot" Attack Jet

Developed in the late 1970s, this aircraft joined the Soviet Air Force in 1983. Like the A-10, it is a purpose-built ground-attack aircraft. Construction is robust and critical components are armored. It saw extensive service in the Afghanistan War, where it performed well despite the difficult terrain. Its main weakness is the relatively lightweight cannons, which have much less penetrating power than the 30mm Avenger in the American A-10.

Weight: about 19 tonnes
Crew: 1 - Pilot
Passengers: None
Engine: two 11,240 lb static thrust turbojets
Max Speed: 880 kph (475 kts)
HP/Weight: 1.1
Ground Pressure: None

Main Gun: two 23mm Auto-cannons
Loader: Automatic (recoil)
Ammunition: approx 1,000 rds of APHE
Missiles: AS-14 Missiles
Ammunition: 2 or 4 carried
Secondary Guns: Rocket Pods and Bombs
Rangefinder: None
Night Gunsight: None

USSR WEAPONS

These weapons use the same format as the US Weapons. See page 135 for a complete explanation.

Ammunition: HVAPFSDS
Muzzle Velocity: 1,680 meters/second
Typical Armor Penetration at-
500 meters: 397mm
1000 meters: 363mm
1500 meters: 330mm
2000 meters: 297mm
3000 meters: 230mm

Mounting: T-64, T-72 and T-80 MBTs

Designed in the early 1960s, this smoothbore was a significant improvement over the 115mm 2A20. A redesign of the mechanical loader, based on T-64 experience, moved the type number from 2A26 to 2A46. The later version is used in the T-72 and T-80. At about the same time the AT-8 "Songster" was designed. This ATGM can be fired through the gun barrel. However, one weakness remains. The 125mm returns to a specific elevation after each shot, positioning the breech for the mechanical loader. But this is a small weakness compared to the problems of the 115mm in the T-62 and the 100mm in the T-54/55.

Ammunition: APFSDS
Muzzle Velocity: 1,615 meters/second
Typical Armor Penetration at-
500 meters: 326mm
1000 meters: 302mm
1500 meters: 279mm
2000 meters: 255mm
3000 meters: 207mm

Mounting: T-62 MBT

Designed in the late 1950s, the 115mm was a highly innovative gun. Nobody had seriously imagined that a major power would dare abandon a rifled gun for a smoothbore, even though it was a sensible way to fire HEAT and Sabot. Within 1,500 meters the gun is very accurate. One Israeli General ("Bren" Aden) considers it superior to the NATO 105mm. Unfortunately its installation in the T-62 produced a host of problems and difficulties that greatly reduced the rate of fire and seriously compromised the tank's capabilities.

Ammunition: HVAPDS
Muzzle Velocity: 1,415 meters/second
Typical Armor Penetration at-
500 meters: 150mm
1000 meters: 125mm
1500 meters: 100mm
2000 meters: 75mm
3000 meters: 25mm

Mounting: T-54 and T-55 MBTs

Ammunition: HEAT-FS
Muzzle Velocity: 905 meters/second
Typical Armor Penetration against-
Flat Steel: 475mm
Sloped Steel: 385mm
Rounded Steel: 305mm
Reactive Plating: 210mm
Composite Armor: 188mm

Ammunition: HEAT-MP
Muzzle Velocity: 1,000 meters/second
Typical Armor Penetration against-
Flat Steel: 432mm
Sloped Steel: 350mm
Rounded Steel: 277mm
Reactive Plating: 191mm
Composite Armor: 171mm

Ammunition: HEAT_{MP}
Muzzle Velocity: 900 meters/second
Typical Armor Penetration against-
Flat Steel: 380mm
Sloped Steel: 308mm
Rounded Steel: 244mm
Reactive Plating: 168mm
Composite Armor: 150mm

Data Format

Guns

125mm 2A26 and 2A46 Smoothbore

115mm U-5TS (2A20) Smoothbore

100mm D-10TG Rifle

Designed right after WWII, the D-10 series was the premier high-velocity cannon of the 1950s Russian Army. Unfortunately, its ammunition was substandard. It took until 1968 before a sabot round (HVAPDS) was introduced, by which time western armor and newer weapons had made the D-10s obsolete. The Israelis had a low regard for the weapon too. In T-54s and T-55s captured in the 1967 War, Israel replaced all the 100mm D-10s with 105mm NATO rifles.

73mm 2A28 Low-Pressure Smoothbore

Ammunition: HEAT
Muzzle Velocity: 400 meters/second
Typical Armor Penetration against-
Flat Steel: 300mm
Sloped Steel: 243mm
Rounded Steel: 193mm
Reactive Plating: 133mm
Composite Armor: 119mm

Mounting: BMP-1 IFV

This gun, main armament of the 1970s BMPs, is not really a cannon but a closed-breech rocket-launcher. Its PG-9 HEAT round is similar to the rocket launched from the RPG-7, but necessarily smaller (to fit within the 73mm smoothbore barrel). As the 400 m/s muzzle velocity shows, the round travels much slower than a conventional shell, and can be literally blown off course by strong winds. The result is very poor accuracy, especially beyond 800m. The main advantage of the 73mm is that its HEAT has a decent chance of penetrating 1970s tank armor. However, composite and reactive armor now eliminate that advantage.

30mm 2A42 Auto-cannon

Ammunition: AP
Muzzle Velocity: about 1000 meters/second
Typical Armor Penetration at-
500 meters: 50mm
1000 meters: 25mm
1500 meters: 1mm
2000 meters: none

Mounting: BMP-2 IFV, ZSU-30-2

This new Soviet design first appeared in the BMP-2. Like many new auto-cannons, it is based on the pioneering British Rarden that proved the value of a high-velocity, small-caliber, rapid-firing cannon. As mounted in the BMP-2, the gun has dual ammo feeds, one for armor piercing (AP) shells and one for high explosive (HE), allowing the gunner to switch without unloading and reloading. The gun also appears in a gatling variation on the new ZSU-30-2 anti-aircraft tank.

23mm ZU-23 Auto-Cannon

Ammunition: APDS
Muzzle Velocity: 970 meters/second
Typical Armor Penetration at-
500 meters: 30mm
1000 meters: 5mm
1500 meters: none

Mounting: Mi-24 Helicopter, Su-25 Attack Jet

Designed originally for aircraft in the late 1940s, this gun has become a workhorse in the Soviet Army. In addition to being the standard jet aircraft gun for three decades it is heavily used as a light anti-aircraft gun, on both a wheeled mount and in the ZSU-23-4 anti-aircraft tank.

Ammunition: AP
Muzzle Velocity: about 900 meters/second
Typical Armor Penetration at-
 250 meters: 9mm
 500 meters: 1mm
 1000 meters: none

Mounting: Turret mount in BRDMs, BTRs, MT-LBs and others

This super-heavy machine-gun was developed immediately after WWII and fired a high-velocity anti-tank rifle round. It was the first of a new generation of simple, solid, well-made guns that has proved the USSR a leader in automatic weapon manufacture. The gun was originally designed as a long-range anti-aircraft machine-gun, but today is mostly used in a small turrets on various light AFVs with a coaxial 7.62mm PK.

Ammunition: Ball
Muzzle Velocity: 860 or 845 meters/second
Typical Armor Penetration at-
 250 meters: 8mm
 500 meters: 1mm
 1000 meters: none

Mounting: M113A3, secondary gun on many vehicles

The DShK caliber .50 machine-gun was developed in the 1930s, used throughout WWII, and for decades afterward. However, it was a very heavy weapon (35 kg — about 75 pounds). The NSV was a cleaner, more modern design that shaved a full 10 kg (22 pounds) off the weight, as well as being more compact and easier to maintain. The suffix M and T on the type names indicate an armored vehicle mounting.

Ammunition: Ball
Muzzle Velocity: 825 meters/second
Typical Armor Penetration-
 none

Mounting: Coaxial or other secondary gun on many vehicles

The PK machine-gun family was developed in the early 1950s by the Kalashnikov design bureau. It has been an enormously successful weapon that remains the standard light and medium machine-gun throughout the Soviet army and among almost all its client states.

Average Flight Speed: about 150-175 meters/second
Maximum Range: about 20,000 meters
Guidance System: Forward Looking Optical "fire and forget"
Typical Armor Penetration against-
 Flat Steel: 650mm
 Sloped Steel: 527mm
 Rounded Steel: 417mm
 Reactive Plating: 288mm
 Composite Armor: 257mm

Mounting: Su-25 and similar attack aircraft

This is the Soviet equivalent of the American Maverick. It has TV and Laser designator versions. Like many Soviet missiles, it is larger than the US model.

14.5mm KPVT Heavy Machine-gun

12.7mm DShKM or NSVT Heavy Machine-gun

7.62mm PKT Medium Machine-gun

Missiles

300mm AS-14 Air-Surface Missile

125mm AT-8 "Songster" Anti-tank Guided Missile

Average Flight Speed: 250 meters/second
Maximum Range: 4,000 meters
Guidance System: Optical/UHF Radio Guidance
Typical Armor Penetration against-
Flat Steel: 550mm
Sloped Steel: 446mm
Rounded Steel: 353mm
Reactive Plating: 244mm
Composite Armor: 217mm

Mounting: T-64 and T-80

This missile was specially designed to be fired from the 125mm smoothbore gun. Like the AT-6, the missile is optical and wireless. It flies toward whatever target the gunner tracks, like conventional Western wire-guided missiles. However, instead of a wire to send flight commands to the missile, a special radio link is used. Although appropriate for a barrel-launched weapons, the radio might be subject to jamming.

140mm AT-6 "Spiral" Anti-tank Guided Missile

Average Flight Speed: 225 meters/second
Maximum Range: 5,000 meters
Guidance System: Optical/UHF Radio Guidance
Typical Armor Penetration against-
Flat Steel: 600mm
Sloped Steel: 487mm
Rounded Steel: 385mm
Reactive Plating: 266mm
Composite Armor: 237mm

Mounting: Mi-24 "Hind" Helicopter

This missile was designed to be fired from helicopters. Since the early days of HEAT missiles the Soviets have favored radio-guided weapons, and this is another of them (the AT-2 Swatter was also radio-guided). The missile operates like a wire-guided design. As long as the gunner keeps his sight on the target, the missile flies toward the sighting point. The sight unit determines the missile's current location by reading tail flares and compares this to the desired course. Corrections are then sent back to the missile by a UHF radio signal, instead of along a wire. This, of course, makes the missile subject to jamming. On the other hand, it permits the missile to be smaller and fly faster.

130mm AT-5 "Spandrel" Anti-tank Guided Missile

Average Flight Speed: 185 meters/second
Maximum Range: 4,000 meters
Guidance System: Optical (Semi-active command line-of-sight)
Typical Armor Penetration against-
Flat Steel: 500mm
Sloped Steel: 406mm
Rounded Steel: 321mm
Reactive Plating: 222mm
Composite Armor: 198mm

Mounting: BMP-2 IFV, BRDM-3 Missile Carrier

This is the latest and most advanced Soviet wire-guided anti-tank missile. It is too heavy for infantry manpack, so it's only found in vehicle mountings. Strangely, in export vehicles the AT-4 is often substituted for the AT-5. It is unclear whether this is because Soviet clients refuse to buy the AT-5 (due to some unknown deficiency), or because Russia refuses to sell it,

Average Flight Speed: 185 meters/second
Maximum Range: 2,000 meters
Guidance System: Optical (Semi-active command line-of-sight)
Typical Armor Penetration against-
Flat Steel: 500mm
Sloped Steel: 406mm
Rounded Steel: 321mm
Reactive Plating: 222mm
Composite Armor: 198mm

Mounting: Infantry manpack, BMP-1s, BMP-2s, BRDM-3s

Introduced in the middle 1970s, this is the standard medium-weight wire-guided ATGM in East-bloc armies. It has been extensively exported to clients. In a roof mounting it replaced the AT-3 on some BMP-1s. BMP-2s shipped or built outside the USSR have AT-4s on the roof instead of AT-5s. Although infantry-portable, the bulky, heavy missiles and controller are both larger than the American Dragon.

Average Flight Speed: 120 meters/second
Maximum Range: 3,000 meters
Guidance System: Optical (Semi-active command line-of-sight)
Typical Armor Penetration against-
Flat Steel: 400mm
Sloped Steel: 324mm
Rounded Steel: 257mm
Reactive Plating: 177mm
Composite Armor: 158mm

Mounting: BMP-1 IFV, Infantry manpack

The original AT-3 Sagger was introduced in the 1960s. The first model was joystick controlled, which demanded a high degree of gunner skill. In the late 1970s most of these missiles were re-engineered for SACLOS guidance where the gunner need only keep his sight on the target. It is these "improved" that now arm BMP-1s. A "suitcase" version can be carried by infantrymen. The "suitcase Sagger" is standard in the anti-tank platoons of BTR outfitted motor rifle companies. BMP motor rifle companies don't have an anti-tank platoon (since every BMP carries its own anti-tank missiles anyway!).

Average Flight Speed: 350 meters/second
Maximum Range: 800 meters
Guidance System: None
Typical Armor Penetration against-
Flat Steel: 375mm
Sloped Steel: 304mm
Rounded Steel: 241mm
Reactive Plating: 166mm
Composite Armor: 148mm

Mounting: Infantry manpack

The RPG-16 began replacing the RPG-7 in the middle 1970s. Both the launcher tube and the missile are more compact than its famous predecessor. The rocket's HEAT warhead is a two-stage design with better penetration despite the smaller caliber. The rocket is also more accurate, which translates into greater maximum range. However in combat it's rarely used beyond 200m range.

120mm AT-4 "Spigot" Anti-tank Guided Missile

120mm AT-3 "Sagger" (improved) Anti-tank Guided Missile

58mm RPG-16 Anti-tank Rocket Launcher

85mm RPG-7

<i>Mounting:</i>	Infantry manpack
<i>Average Flight Speed:</i>	300 meters/second
<i>Maximum Range:</i>	500 meters
<i>Guidance System:</i>	None
<i>Typical Armor Penetration against-</i>	
<i>Flat Steel:</i>	300mm
<i>Sloped Steel:</i>	243mm
<i>Rounded Steel:</i>	193mm
<i>Reactive Plating:</i>	133mm
<i>Composite Armor:</i>	119mm

This is the most famous infantry rocket launcher since the WWII "Bazooka". Both the reusable launcher and the rocket are bulky, but the range and penetration far exceeds Western equivalents (the American LAW is a pea-shooter in comparison). The large HEAT warhead is actually multi-purpose. It's useful against buildings, bunkers, and entrenchments as well as armored vehicles. The main drawback of the RPG is its vulnerability to wind. Any gust will blow the rocket off course. The sights even include a windage gauge to help the gunner compensate.

USSR ORGANIZATION

The Russian army is a vast organization. Like all 20th Century armies, it uses a "reservist call-up" system that keeps peacetime costs down while potential wartime strength is very large. The USA divides its forces into "regular" army, "reserves", and "national guard". The USSR similarly has three levels of units. Category I divisions are at or near full strength (75-110%), and have the newest equipment. Divisions in GSFG (Groups of Soviet Forces, Germany) are among the strongest, since they are on the "front lines" of Eastern Europe. Most other Category I divisions are on the western or far eastern borders of the USSR. In the late 1970s the Soviet Army had 22 tank and 32 motor rifle divisions in Category I, with 16 and 15 of these (respectively) based in East Germany, Czechoslovakia, Hungary and Poland.

Category II divisions are at 50-70% strength and have most of their equipment in storage. However, these troops do exercise regularly and the equipment is maintained well enough that it would take about one month to field these troops in full fighting order. In the late 1970s it had 30 tank and 25 motor rifle divisions in this Category. Over half the tank divisions were in western Russia, while the rest were scattered around the nation. One or two of these divisions, brought up to strength in advance, participated in the initial 1980 Afghanistan "incursion".

Category III divisions are at 10-33% strength and have no more than 33-50% of their equipment, which is obsolete and in storage. Most of the men are older reservists. It would take three to four months to get these troops ready for combat, largely spent rehabilitating old equipment and militarizing vehicles commonly used in the civilian economy. The combat effectiveness of these divisions is questionable. In the late 1970s the army had 60 motor rifle divisions in Category III.

From WWII to the early 1980s the USSR's army organization has been remarkably constant. The army's core is the tank and motor rifle divisions. Within the division the tank and motor rifle regiments are the combat formations, equivalent to the brigade battlegroups in a US division. In general, the Soviet army uses a triangular organization, although a few "fourth" elements have been added (such as the fourth regiment in most divisions). Combat units have also acquired a wide variety of supporting elements. This is because, unlike the US Army, the Soviets do not cross-attach units. Their "paper" organization is intended to be their actual combat organization.

Warsaw Pact allies generally follow Soviet organization patterns. However, Pact divisions are generally equivalent to Russian Category II divisions at best, sometimes Category III. They have older equipment and are not maintained at full strength. Until the mid 1980s the most modern tank of the Pact allies was the T-62, and many used T-54s and T-55s. However, the T-72 is being manufactured under license in East European nations, resulting in a gradual upgrade of vehicles. Some Pact nations also have their own native APC designs, such as the Czechoslovakian OT-64 used instead of BTR-60s, -70s and -80s.

There are strong signs that the Russian army is about to massively reorganize. New independent all-arms brigades were used heavily in Afghanistan. These formations include armor, infantry and artillery. Two new tank divisions have appeared in western Russia, each with four of these all-arms brigades plus supporting arms. Given the government's thrust toward a less numerous but more sophisticated army, it's possible that the entire military structure may be reorganized during the 1990s.

The Tank Division

Tank divisions represent massed, armored striking power. For decades Soviet army doctrine has been enraptured by a vision of thousands of tanks rolling through shattered enemy lines. The tank division is designed to implement that dream.

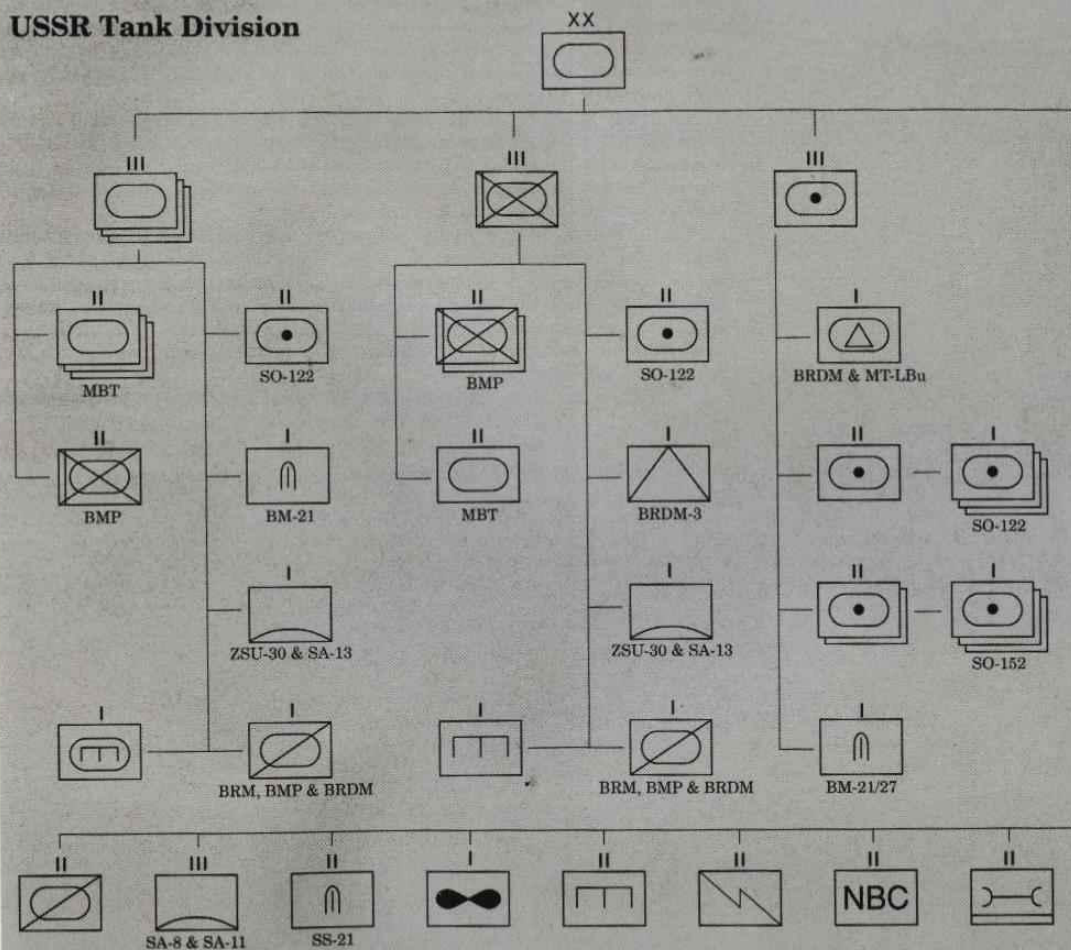
The main fighting elements of the division are the three tank and one motor rifle regiment. The tank regiments are designed to engage in wave attacks, each regiment supported by its integral infantry battalion. The separate motor rifle (BMP) regiment was originally intended for consolidation and general support, but it's also extremely useful on the defense. Some Category II divisions lack this regiment, as it's a relatively recent addition. The fact that 9 of the 10 tank battalions have very modest infantry support makes this organization very "tank heavy". This makes it most unsuitable in bad terrain or holding fixed defensive lines. This is undoubtedly the reason why no tank divisions were sent into Afghanistan.

If a tank division is short of modern equipment, one or two regiments will continue using older model vehicles. For example, in some divisions one regiment has T-80s while the others still have T-72s or T-64s. However, the motor riflemen in Category I divisions are always mounted in BMPs.

The division has far more artillery firepower than its American equivalent. However, the guns and rockets of the artillery regiment are intended for massive assault bombardments. They are not used for "on call" general support. The artillery and mortars attached to each regiment are intended for this purpose. Most Category II and some Category I divisions still use artillery pieces towed by armored tractors instead of the SO-122 and SO-152 armored vehicles, especially in the artillery regiment. This makes them especially vulnerable to counter-battery fire.

Note that unlike the US Army, Soviet divisions do not have a strong helicopter component. In the Soviet Army helicopters are organized into independent regiments controlled by the Army HQ. These regiments are assigned much like heavy artillery or other reserves. The helicopter regiments have no integral ground troops, so air-ground coordination develops more slowly. In Afghanistan it took about two years for infantry and helicopters to develop smooth communications and sound tactics.

USSR Tank Division



The Motor Rifle Division

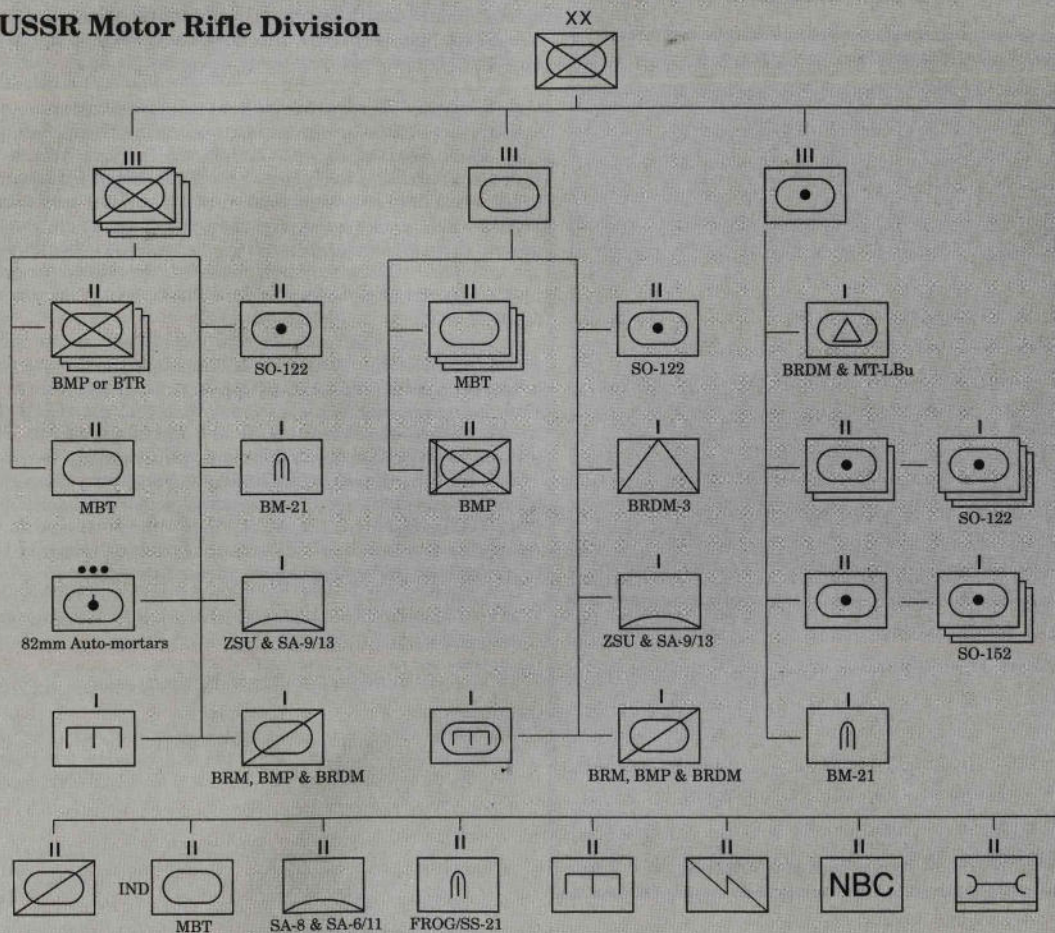
"Motor rifle" is the Russian equivalent of "mechanized infantry". The troops are the heart of the Russian army. On the attack they're expected to support the tank divisions or follow behind them, consolidating the breakthroughs. On the defense, they're expected to man the front lines and stop the enemy. Except for one airborne division and various specialist troops, the entire Soviet force in Afghanistan was motor riflemen.

Frontline Category I "MR" (motor rifle) divisions typically have one BMP regiment and two BTR regiments. As BMP production continues it's likely that more and more regiments will be rearmed with BMPs. Arctic divisions usually have all regiments mounted in MT-LBs rather than BMPs or BTRs. Category II and III divisions are entirely mounted in BTRs.

Each division also has its own tank regiment, giving it a useful offensive punch or powerful counterattack force. The division also has some special tank battalions. Three of these are in the motor rifle regiments (one per regiment). These battalions have four tanks per platoon instead of three. The other special battalion is the "Independent" (IND) battalion controlled by the division. This battalion has five companies instead of the normal three, plus engineer vehicles for laying bridges and clearing mines.

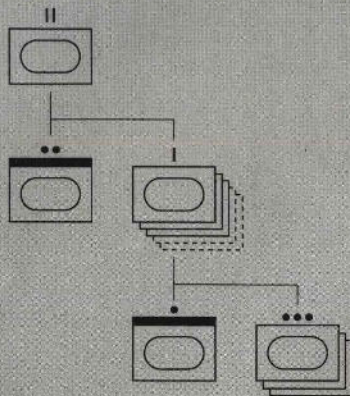
The remainder of the division is similar to the tank division in organization. Only a few motor rifle divisions have been entirely re-equipped with the new armored SP guns (SO-122s and SO-152s). Most still have towed artillery, especially within the artillery regiment.

USSR Motor Rifle Division



The Tank Battalion

USSR Tank Battalion



Soviet tank battalions are very spare, lean organizations with just tanks. Normally they have three companies, but the special independent battalion in the motor rifle division has five, plus engineers. There are rumors of four-company battalions for the new combined-arms brigades.

Note that because the Russians fight as they're organized, the theoretically powerful tank battalion has some serious weaknesses. If the tanks need to coordinate with infantry, they must do it at high (battalion and regimental) levels. Individual platoons and companies do not regularly intermix to the same degree as American units. Similarly requests for artillery fire, smoke screens from mortars, etc., must be either passed through the battalion HQ, or made to an artillery fire control vehicle in the vicinity. There is no provision for giving platoon or company commanders direct communication to support arms.

Finally, both the company and the battalion commander are expected to command from their own tank. The executive officer does not have a tank (as in American units), but instead rides an unarmored vehicle in rear with the rest of HQ staff. Russian officers are taught to "lead from the front", but if he's injured or killed there's no XO beside him, ready to take over.

On the other hand, battalions upon battalions of tanks are hard to stop, especially if their reactive armor is impervious to the ATGMs universally used by Western infantry. Although weak on a low-level tactical scale, the massed armor of tank battalions would be decisive when used in mass.

Unlike the tank battalion, Russian motor rifle battalions have a full assortment of appropriate supporting arms. The organization shown here applies both to BMP and BTR battalions with one exception. Only the BTR battalions have an anti-tank platoon. This is a sensible provision, since the BTRs lack ATGM armament, while BMPs have them "built in".

The mortar battery is traditional in the Russian army, and until the early 1980s was the ancient but still effective 120mm model. Today the Russians have a new clip-fed, auto-loading 82mm mortar (the AM 2B9 *Vasilyek*) that generates far superior firepower and accuracy. These auto-mortars were extremely effective in Afghanistan.

Another new addition is the AGS platoon. The AGS-17 is a 30mm rapid-fire grenade-launcher with a 29-round drum magazine. Firing in quick bursts, it can deliver a miniature artillery barrage out to 1200 meters, making it an ideal infantry support weapon. Although the AGS is just barely man-portable with a tripod, it's commonly mounted on BMP or BTR turrets or rear roof. In Afghanistan these weapons proved effective and popular (among the Soviets).

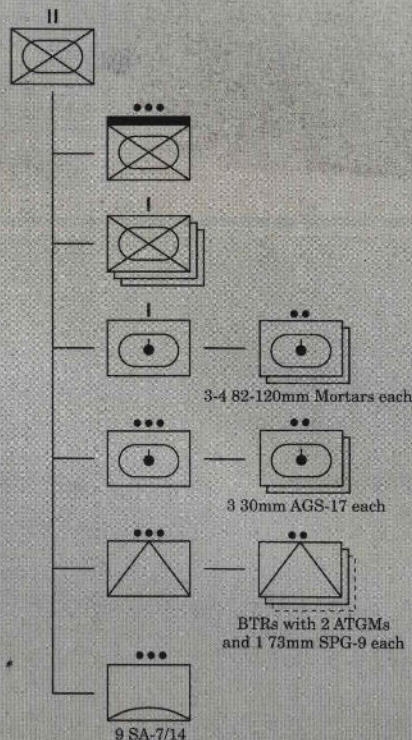
The anti-tank platoon of BTR battalions includes not only AT-3 or AT-4 missiles, but also SPG-9 guns. The SPG-9 is a tripod mount version of the 73mm low-pressure gun in the BMP-1. It is intended to provide close-range anti-tank firepower, in case the enemy gets inside the ATGMS' minimum range. This was especially important for the older, joystick model AT-3s whose minimum range was at least 500 meters!

The air defense platoon is armed with shoulder-launched SAMs (the SA-7, SA-7A, SA-7B, SA-14 or SA-16). It is normally broken up and distributed three per rifle company (one per rifle platoon, as shown in the company organizations below). This gives every motor rifle platoon its own air defense weapon.

Overall, the motor rifle battalion is a good all-around fighting force, especially when mounted in BMPs. It formed the core of the Russian army in Afghanistan.

The Motor-Rifle Battalion

USSR Motor Rifle Battalion



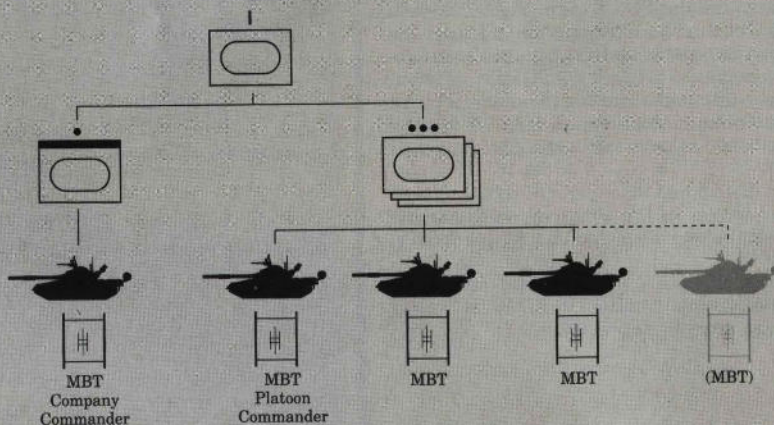
The Tank Company

The Russian tank company organization today is the same as the one used during World War II: three tanks per platoon, three platoons and a command tank make the company. In the battalions attached to motor rifle regiments the platoon has a fourth tank.

Russian tank platoons have always operated as a unified group. In fact, the entire company of ten tanks usually operates together, with the platoons either side-by-side, in triangular pattern (two up and one in reserve), or in a column (one behind another). This is because the individual platoons may not have officers to lead them. Russian commanders almost never assign independent tasks to officerless units due to the mediocre quality of Russian sergeants.

Sometimes a tank company, or even an officer-led tank platoon may be assigned to spearhead or support another unit. This is most common in motor rifle regiments where the regimental commander (an infantryman) wouldn't mind dividing up his tank battalion. This approach was used numerous times in Afghanistan.

USSR Tank Company



The Russian motor rifle company is a miniature motor rifle battalion. The company includes not only fighting infantry, but also a heavy weapons platoon. In the modern BMP units the platoon carries AGS-17 AGL (automatic grenade launchers). Although this might seem redundant given the BMP's 30mm autocannon, the grenade launchers are very useful when the infantry dismounts and moves into terrain too rough for the armored vehicles.

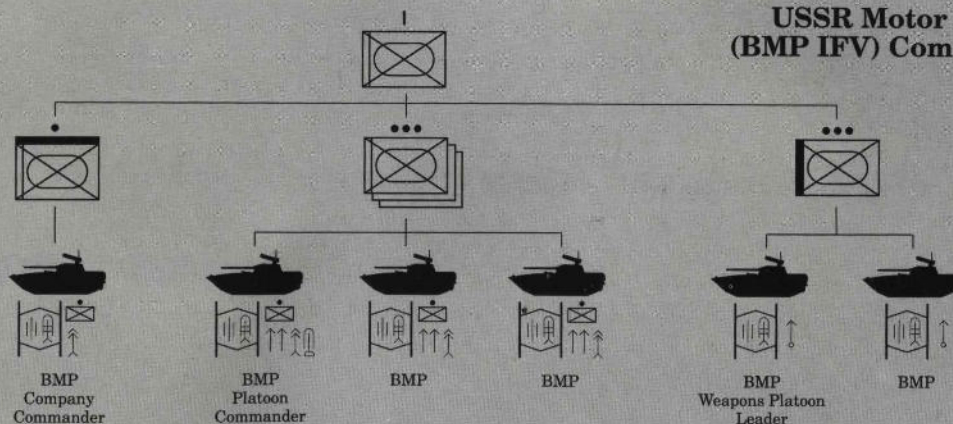
Russian infantry squads in BMPs are small: generally 6 men, plus the commander who often remains mounted. However, the squad carries two light machine-guns, giving them greater dismounted firepower than the Americans with one machine-gun. This is an important distinction. Combat experience throughout this century proves that high-volume firepower weapons (such as machine-guns) are much more effective than individual rifles. Therefore adding a second machine-gun to each squad means that squad vs. squad, the Russians have a large advantage in firepower.

The squad also carries an RPG rocket launcher, a more useful and effective weapon than the American LAW. On the other hand, the squad has no equivalent to the American Dragon ATGM. Its only ATGMs are on the BMPs. However, on the BMP-2 the missiles can be dismounted.

Unlike many western infantry companies, the entire motor rifle company is expected to fight, even the company commander. There are no additional HQ vehicles to clutter or confuse the issue. The Captain's entire staff is his trusty R-126 radio set, which he carries himself!

The Motor Rifle (BMP) Company

USSR Motor Rifle (BMP IFV) Company



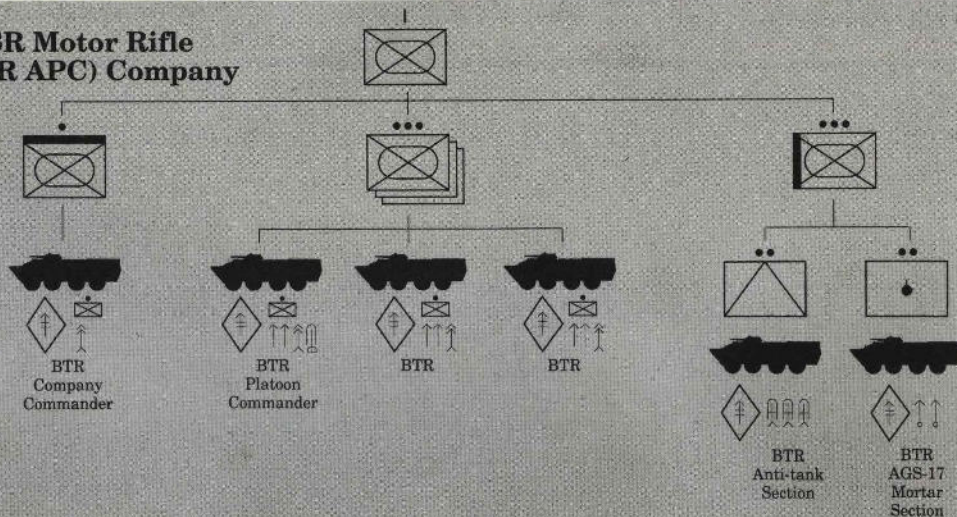
The Motor Rifle (BTR) Company

The BTR equipped motor rifle company is very similar to the BMP company. The infantry squads are organized the same way as BMPs, with the same strengths and weaknesses.

The BTR company does have one obvious difference: a stronger weapons platoon. The platoon has two AGS-17 AGLs, both carried in a single BTR. The other vehicle transports three "suitcase sappers" (AT-3) or AT-4 teams. These are used dismounted (only). On the defensive the teams fan out, one per platoon. On the attack they follow along behind, ready to dismount if enemy tanks appear.

Although the BTR is wheeled and therefore less mobile cross-country, a BTR company is probably better at rough-terrain fighting. This is because the squad cannot really fight from their vehicle. In combat they immediately dismount and fight afoot, including the squad leader. In fact, because dismounting under fire is hard from the BTR-60 or -70, they frequently dismount *before* combat. Only a driver and gunner remain aboard the vehicle. The overall result is a stronger, better-led, more self-reliant group of men afoot. This is the right prescription in dense forests, mountains and urban areas — places where vehicles cannot travel. This tactical distinction, as much as the expense of BMPs, may explain why the Soviet army still builds BTRs for new BTR-equipped units.

USSR Motor Rifle (BTR APC) Company



APPENDIX

GLOSSARY

A-xx: US aircraft model designator for attack jets, such as the A-10.

AA: Anti-aircraft. Guns designed to shoot down aircraft.

AAA: Anti-aircraft Artillery. Heavy cannons designed to shoot down aircraft. They have been almost entirely replaced by SAMs.

Abrams: Official nickname of the M1 series tanks. Frequency of use is in inverse proportion to one's everyday proximity.

AFV: Armored Fighting Vehicle, an armored vehicle designed for front line combat. This includes tanks, armored personnel carriers, anti-aircraft tanks, SAM missile carriers, etc.

AH-xx: Attack helicopter, such as the AH-1 "Cobra" or the AH-64 "Apache".

AP: Armor Piercing, a type of ammunition.

APC: Armored Personnel Carrier. A tracked or wheeled vehicle that transports an infantry squad. The carrier mounts nothing more than light weapons and light armor.

AT: Anti-tank.

AT-x: NATO name for a Russian anti-tank missile model, such as AT-3, AT-5 or AT-8. The "AT" numbering series reflects NATO designations. Soviet designations are different. NATO also assigns a one-word nickname beginning with "S", such as "Sagger" or "Songster".

ATGM: Anti-Tank Guided Missile, invariably with a HEAT warhead and usually wire guided.

ATGW: Anti-Tank Guided Weapon, used by the British instead of ATGM.

Attack Jet: A jet aircraft whose sole purpose is to attack ground targets. It is not designed for air-to-air combat.

Battalion: A military organization with two or more companies. A battalion is subordinate to a Regiment (if Russian) or Brigade (if American). It typically has 500 to 1500 men.

Battery: A group of artillery pieces controlled by a battalion HQ. Batteries traditionally have 4 to 8 guns, and may be divided into two sections.

Battlesight: Actually a sight configuration of a cannon's optics, but in practice it means the sighting range where the ammunition flight path matches the center

cross-hairs on the sight. That is, the "straight line" limit of the ammunition. For example, the M1A1's 120mm Sabot shell can be fired "battlesight" to 1500 meters.

Blitzkrieg: Fast-moving armored warfare. In German "blitz" means "lightning" and "war" means "krieg".

BMP-x: Bronevaya Maschina Piekhota. The first IFV (infantry fighting vehicle) was the BMP-1. BMPs carry an infantry squad, turreted cannon with coaxial MG, and an ATGM.

Boresight: Originally sighting through the gun tube to the target, it now means the process of exactly aligning a cannon with its sight unit.

Bradley: Official US Army nickname for the M-2 and M-3 armored vehicles.

BRDM-x: Bronevaya Razvedyvatelnaya Dozornaya (armored reconnaissance patrol vehicle). Soviet armored cars. They are also used as general-purpose carriers for commanders, FOs and FACs. Modified versions are used as missile carriers.

BRM-?: Bronirovannaya Razvedyvatelnaya Mashina (armored reconnaissance vehicle). Soviet light reconnaissance tanks based closely on the BMP. Missiles and infantry carrying space are removed, radars and radios are added.

Brigade: In the US Army, military organization containing two or more battalions, and subordinate to the division. Although a division has three or four combat brigade HQs, brigades do not have any standard composition. Brigades typically command about 3,000 to 6,000 men.

BTR-xx: Bronetransportr (literally, armored personnel carrier). Soviet wheeled armored personnel carriers, including the BTR-60, BTR-70 and BTR-80.

Buttoned: Hatch or hatches closed.

C³: Communication, Command and Control. This is a common military buzzword for the process of command in battle.

C³I: Communication, Command, Control and Intelligence. A recent expansion of C³ (see above).

CFV: Cavalry Fighting Vehicle. This is a variant of the IFV (infantry fighting vehicle) that is lightly armored, armed with a cannon and missiles. Instead of carrying infantry, it carries a couple scouts and reconnaissance equipment.

Chobham Armor: A type of composite armor developed in laboratories in Chobham, England. It is generally considered to be the finest armor available in the world. Its exact composition and construction is secret.

CO: Commanding Officer. The commander of a military unit.

Coax: Coaxial. Strictly speaking, a mounting that shares the same axis of movement. It generally means a machine-gun mounted beside a main gun. The machine-gun elevates and depresses with the main gun. It does not move independently. The gunner has his choice of firing the main gun or the coaxial machine-gun.

Company: A military organization with two or more platoons. Companies are controlled by a battalion HQ. Cavalry companies are sometimes called "squadrons". An infantry company has about 100 to 300 men. AFV companies have about 10 to 20 vehicles.

Composite Armor: A new type of armor that layers hard steel with heat-resistant ceramic. It stops HEAT penetration far better than normal steel.

Corps: A military organization with two or more Divisions. In the US Army it is the largest battlefield command. The US Army has two Corps stationed in Europe.

DIVADS: Divisional Air Defense System, a US Army program for an AA tank more powerful than the 20mm VADS and PIVADS. The program was cancelled by Congress when the tank failed its gunnery trials and both the US Army and the manufacturer apparently tried to conceal this failure.

Division: A military organization subordinate to a Corps (if US) or Army (if Soviet). A Division normally contains three or four Regiments (if Soviet) or Brigades (if US). Divisions have 10,000 to 25,000 men; American divisions are generally larger than Russian.

FAC: Forward Air Controller. An officer with army and air force radios who coordinates air support for front-line troops. Based on requests and what he can see, the FAC gives pilots specific instructions about where and how to attack.

FEBA: Forward Edge of the Battle Area. Older NATO abbreviation for the front line or battle line with the enemy.

FitRep: Fitness Report. A report by commander that recommends subordinates for promotion (or not, as appropriate).

FLIR: Forward Looking Infrared. A device commonly used on aircraft that reads the heat signatures of ground items. Similar to a thermal imager, but optimized to show ground detail and large objects.

FLOT: Forward Line of Troops. Current NATO abbreviation for the front line (battle line) nearest the enemy.

FO: Forward Observer. A sergeant or officer who requests artillery fire, spots and corrects its fall. He has radio communication with the artillery, which is usually miles behind the front line.

GPS: Gunner's Primary Sight, the main sight used by the Gunner on the M1 series tanks. The sight can use normal light or thermal imaging.

Guards: An honorary distinction in the Soviet Army. During WWII it was given to Regiment- and Division-sized units that distinguished themselves in combat. Since then it has been used to denote first class formations, who generally receive new equipment faster and who are closer to full combat strength. They are the elite of the Soviet Army.

HE: High Explosive. A type of warhead used mainly in cannon shells.

HEAT: High Explosive, Anti-tank. A "shaped charge" warhead designed to punch through steel armor. It is also effective against non-armored targets.

HMG: Heavy Machine-gun. Usually 12mm to 15mm bore diameter.

IFV: Infantry Fighting Vehicle. A light armored vehicle that carries a cannon turret, an ATGM, and a squad of infantry.

Image Intensifier: A night vision aid that multiplies the available light to thousands of times its normal intensity. Also known as a "starlight scope" because a small amount of moonlight or starlight is needed.

IR: Infrared. A portion of the electro-magnetic spectrum where the intensity of the signal is directly related to the heat of the object.

ITV: Improved TOW Vehicle, M901. An M113 APC with an elevating ATGM turret on its roof.

Lase: The act of firing a laser beam at a target.

Laser: A beam of coherent light. Military ranging and designating lasers can cause eye damage in certain circumstances, but aren't yet powerful enough to reliably injure, kill or destroy.

LAW: Light Anti-tank Weapon. A US Army man-portable anti-tank rocket with a small HEAT warhead. It's notable for its small size and weight.

LMG: Light Machine-gun. Lightweight 5-8mm machine-gun that can be fired while standing, box or clip ammunition supply is usually smaller than the ammunition belts used in MMGs and HMGs.

Main: Among tankers this generally refers to the main gun on a tank, usually a large rifled or smoothbore cannon.

MBT: Main Battle Tank. A generalized replacement for all "medium" and "heavy" tanks.

MG: Machine-gun. Often implies a medium machine-gun (see MMG).

MMG: Medium Machine-gun. Usually 7mm to 9mm bore diameter.

Mi-??: Helicopters designed by the Mil bureau. This is the main design bureau for Soviet helicopters, including the Mi-24. NATO assigns code names to all these designs, such as "Hind" for the Mi-24. Letter subdesignations (such as "Hind D") are also NATO selections.

Mortar: A small, light quasi-artillery piece that fires "bombs" in a high arc.

MRLS: Multiple Rocket Launching System. The new Western artillery rocket launcher.

NATO: North Atlantic Treaty Organization. A military mutual defense treaty that includes the United States, United Kingdom, West Germany, Canada, Belgium, Denmark, Holland, Norway, Italy, Spain, Portugal, Greece and Turkey. Greece is a very uncertain member, due to her longstanding difficulties with Turkey. France is notable by its absence. Militarily, in central Europe NATO is important because it formalizes an arrangement whereby British and American military forces are based throughout West Germany.

Obsolescent: Outdated but not yet useless; not quite obsolete. Obsolescent equipment is often used in (theoretically) less demanding roles.

Obsolete: So outdated it's no longer useful, functionally useless.

OH-xx: Observation Helicopter. A US Army designation for all scout helicopters, such as the OH-58.

Pact: Common abbreviation for Warsaw Pact (see that entry).

Platoon: A military organization subordinate to a company. Platoons frequently include two or three sections (of vehicles) or two to four squads (of infantry). Platoons typically have 25 to 50 infantrymen and/or 3 to 5 vehicles. Cavalry platoons are sometimes called a "troop".

Platoon Sergeant: Highest ranking sergeant in a platoon, normally func-

tions as second-in-command of a platoon. If the platoon's commander is an inexperienced Second Lieutenant, the platoon sergeant can be the de facto commander. In an American tank platoon the platoon sergeant leads the second section from the #4 tank.

PIVADS: Product Improved Vulcan Air Defense System. A VADS AA gun carrier with an improved gunsight system.

Reactive Armor: Also known as "blazer" armor, it is external add-on armor boxes that explode outward when hit by a powerful warhead. Reactive armor is very effective at reducing or preventing HEAT penetration.

Recon: American slang for reconnaissance. Scouting enemy positions.

Reece: British slang for reconnaissance.

Regiment: A military organization. In the Soviet Army it is a combat organization subordinate to a Division. It has a number of battalions, traditionally three, and numbers 2,000 to 4,000 men. In the US Army it is not a combat organization, but instead an administrative one. One or more battalions are given a regimental name. However, a US regiment does not have a combat headquarters and need not fight together in battle. The exception is Armored Cavalry regiments. These independent brigade-size units are combat formations.

RPG: Reaktivniy Protivotankoviy Granatomet (rocket anti-tank grenade launcher), also known in the West as a rocket-propelled grenade. These soviet weapons have a launching tube and separate HEAT warhead rockets. Both are bulky but lightweight.

S1: Staff Officer - Adjutant. The principal staff officer at a battalion headquarters. His duties include personnel assignments.

S2: Staff Officer - Intelligence. One of the staff officers at a battalion headquarters. He finds and summarizes all information about the enemy.

S3: Staff Officer - Operations & Training. One of the staff officers at a battalion headquarters. He organizes and coordinates battalion operations.

S4: Staff Officer - Logistics. One of the staff officers at a battalion headquarters. He is responsible for all logistical support (food, ammunition, fuel, repairs, replacements, etc.).

Sabot: Common American term for any "discarding sabot" type anti-tank ammunition, such as APFSDS (armor piercing, fin stabilized, discarding sabot).

SACLOS: Semi-Active Command Line-Of-Sight. A common control system for anti-tank guided missiles. The gunner simply keeps the sight on the target and the missile flies to that point.

SAM: Surface to Air Missile. Any ground-launched missile designed to shoot down helicopters, jets, or other aircraft. The category includes small manpack SAMs such as the Stinger, as well as large missiles on big transporters or in fixed emplacements.

Section: The smallest military organization above a single man or vehicle. Vehicle platoons are sometimes divided into two or three sections, each with two or three vehicles. Infantry squads are sometimes divided into two or three sections, each with two to four men.

Speedometer: A driving gauge that shows the current speed of the vehicle. US Army land vehicles are marked in "kph" (kilometers per hour); aircraft, including helicopters, are traditionally marked in kts (nautical miles per hour). Conversions are 1.61 kph = 1 mph; 1.83 kph = 1 kt.

Stadia: Common abbreviation for Stadiametric, a type of gunsight where mil markings placed on the sight help the gunner estimate range.

Stabilization: In tanks, a system where the gun barrel is kept steady regardless of hull movements. Full stabilization systems include horizontal stabilization (turret turns left and right to compensate for hull movement) and vertical stabilization (barrel moves up and down as the hull rocks forward and back). Stabilization makes gunnery much easier. If the vehicle ride is especially rough, stabilization may not fully compensate.

Squad: A military organization of infantrymen subordinate to a platoon. It contains 6 to 14 infantrymen, and is sometimes divided into two or more sections.

Squadron: A cavalry organization equivalent to a company (see that entry).

Su-xx: Sukhoi aircraft; a soviet aircraft design bureau that is generally known for its fighter-bomber aircraft.

Superelevation: Elevating a gun barrel above a straight line to the target. With correct superelevation the shell arcs through the air for greater range. Superelevation is required whenever a gun fires beyond battlesight range.

T-xx: Tank or Tankovyi. Russian MBTs use this model designation. Model numbers are roughly approximate the initial year of production.

Tachometer: A driver's gauge that shows the engine's RPMs (revolutions per minute, usually in the thousands). This represents the power output of the engine. If RPMs increase beyond a "red line" level the engine can be damaged or destroyed.

TC: Tank Commander, the senior crewman in a tank.

Thermal Sight: Also known as a Thermal Imager, it translates the heat of objects into a visual image.

TOW: Tube-launched, Optically-tracked, Wire-guided — an acronym used for the US Army's standard heavy ATGM. The latest version is the "TOW 2".

"Track": A common US Army nickname for the M113 popularized during the Vietnam War. Sometimes it is used generically to mean any AFV.

Troop: A cavalry organization equivalent to a platoon (see that entry).

Unbuttoned: Among tankers, having a hatch or hatches open, generally with the crewman's head showing, sometimes with arms and torso outside as well.

"Up!": Term used by American tank crews. When the loader is finished loading the main gun he says "Up." This tells the gunner that he can fire again.

USAREUR: United States Army in Europe

VADS: Vulcan Air Defense System. The US Army's M163 AA gun carrier.

WP: Warsaw Pact.

"Warpac": Nickname for the Warsaw Pact used by some military and wargaming personnel. Not in common use, and not entirely polite.

Warsaw Pact: Formed in the 1950s as a counter to NATO, the Pact is a mutual military treaty between the Soviet Union, Poland, East Germany, Czechoslova-

kia, Hungary, Romania and Bulgaria. The organization is dominated by the USSR, and in wartime it is believed that Soviet officers may take command of their allied Divisions. Just like the Americans and British in NATO, Soviet troops have permanent bases in Pact nations, especially East Germany and Poland.

XO: Executive Officer. The second-in-command of a military unit. Strictly speaking it applies only to command levels where the second-in-command is also an officer, but it's often used in other situations, such as "Meet my XO, Platoon Sergeant Smith."

DESIGNER'S NOTES

The MPS Labs crowd (the R&D group within MicroProse) has known for years that a simulation of modern tanks would be great fun. Once *Gunship* proved the success of our ideas about 3D graphics, "Tank" was "go".

The concept for *M1 Tank Platoon* was fairly obvious from the start. We were interested in a full representation of tank warfare, not just a "battlezone" shooting gallery. Basing the game around an entire platoon, rather than just one tank, was a natural choice. Including the standard panoply of support AFVs on both sides was another obvious choice. Once we started, it was hard to resist throwing in helicopters and ground attack jets. After all, these too are common on the modern battlefield.

The selection of Europe, in particular the Germanies, for the battle area was made for us. It is the only part of the world where M1s are deployed in quantity (aside from the USA). It's unlikely that the M1 would see action in the Middle East — it's too heavy to air transport, so it would travel by sea. That takes a couple months at least. Even if it did arrive in time for a fight, the opposition has vastly inferior equipment.

Meanwhile, in Europe the Warsaw Pact has a strong, modern army with the latest vehicles. Both the M1 and its potential Russian opponents were designed for combat in Europe. And most of all, the M1 and the T-80s are there right now, only a few miles away from each other.

No political statement is intended by this choice of locale. In fact, Russians and East Europeans are pretty nice people. But that's not the subject of this simulation. *M1 Tank Platoon* is not a game about modern politics. It only seeks to explore and portray what happens at tactical levels *if* a conventional war occurs between American and Warsaw Pact forces.

People & Machines

Scott Spanburg started programming *M1 Tank Platoon* in November of 1987. It took him almost a year to develop the 3D graphics system. Some of that time was experimentation to find a system for rolling countryside that was fast enough to run on 4.77 MHz 8088 machines. The remainder was the painful working out of code and data systems. The entire "real time" battle in this simulation is written in assembly (machine) language. Although more time consuming than "C" (the current popular language for IBMs), it gives faster code in less memory space. "Tank" is unparalleled in what it attempts for *all* IBM-compatible PCs, not just the high-speed ATs and 386s.

Scott is a careful programmer with a penchant for realism. Tank acceleration and deceleration are represented by actual physics, complete with resistance and momentum. Shells and missiles actually fly through the air at realistic speeds with realistic inaccuracies, striking targets or the ground as appropriate. Many simulations just "fake" these effects. *M1 Tank Platoon* actually computes what happens, as it happens.

The scale of the game and all its data research were done by designer Arnold

Hendrick. An experienced wargamer will see similarities between *M1 Tank Platoon* and miniature wargaming. In a sense this simulation is a miniatures fantasy brought to life. Now you're really there, inside a tank, guiding a battle. The number of vehicles and terrain detail are determined by computer horsepower. Arnold originally wanted battles with full platoons of mech infantry and companies of Russians, but it was soon obvious that even 80286 machines would choke on that scale. The use of an American platoon with supporting sections, opposed by a few Pact platoons, is the best alternative given current computer hardware. When everybody we know has an 80386 in the spare bedroom it will be time to reconsider.

About a half year was spent developing the battle generation system, which is based on current organization and combat practices of both armies. Darrell Dennies did yeoman work setting up data structures to reflect Arnold's convoluted thinking and mountainous tables. Needless to say, much of this data is reproduced in more orderly form here in the manual. We're especially proud of the battlefield generation system, which should produce over a million different battlefields. If you spent 8 hours every day playing *M1 Tank Platoon*, it should take about 179 years to exhaust all the possible battlefields. Of course, the OBs (orders of battle) for each side are also variable, so for all practical purposes it's virtually impossible to fight the same action twice.

The great unsung hero in this product, like many computer simulations, is the artist. Max Remington controlled every aspect of the visual presentation, from the tank control panels to the 3D data structures that portray the vehicles. He spent months of time working, reworking and refining the visuals. The most familiar sight throughout the project was Scott sitting in his office, programming, with Max sitting beside him, politely asking for yet another adjustment. More than any other MPS labs product to date, "Tank" was blessed with a "persistence of vision" on all levels.

The quality assurance department, popularly known in the Labs as "playtest", also wanted to be remembered. Besides being bug-hunters without peer, they periodically insist on certain features. Sometimes we even agree, reluctantly. The *Outside Any* feature was added because they demanded it.

MPS Labs traditionally does its own independent research on all simulation topics. We only use information available to the general public. In this case we requested a wide variety of manuals from the US Army under the Freedom of Information Act. Many of them were provided, a few were not. Information on weapon performance and armor thickness was *not* forthcoming from the US Army, but estimates are available elsewhere.

We consulted a number of combat soldiers, but the kindest was Lt. Col. Gregor. An experienced tankerman and now instructor, he took considerable personal time to discuss how tanks operate and what happens in real armored combat. His insights were invaluable, even though he had virtually no control over the final result. Apparently he trusted us to do the best we could. Like any good officer, he always

Research

avoided topics even remotely approaching restricted information. He insisted, quite rightly, that we do our homework honestly.

Overall our goal is to portray a fair and independent-minded view of modern armored combat. We are not involved in any military contracting. *M1 Tank Platoon* doesn't have to please General Narrowview, and it need not pass the scrutiny of military security. In fact, the latter would probably never believe that the data in this game was acquired fairly. They'd probably censor large parts and force unpleasant changes in much more.

A simple example of this is the inside views of the M1. The US Army refused to let us inside a tank. They claimed security restrictions prohibited it. Of course, this didn't stop them from letting both Presidential candidates ride inside during the 1988 campaign. Irrked but not defeated, we found a military modeler's book with detailed color photos of each crew position from various angles. We used the Freedom of Information Act to request and finally receive (at an exorbitant price, alas) the operator's manual for the tank. This had detailed B&W drawings of each and every control. In the end we learned much more than a 10-minute "clamber about" would have gained, and we're perfectly free to show it all to you. If we'd been under military contract or security restrictions, we'd almost surely be forced to change the screen graphics to something less realistic.

That's why we're happy to be independent of military entanglements. This product is financed entirely by your loyal purchases. We answer to nobody but you, our customer. Even the company president, Bill Stealey, gives us exceptional independence and intellectual freedom to call things as we seen them. In past products he's sometimes regretted it, but the policy hasn't changed.

Realism

In our computer simulations we're always aware of who's using them: you. We don't expect you to spend hundreds of hours pouring over manuals and learning all sorts of useless procedures. *M1 Tank Platoon* deliberately limits itself to combat operations. There are hundreds of dials and switches on the M1 tank we didn't include because they aren't significant in combat.

Another example is air and artillery support. These procedures are obviously simplified. In reality, being a FO or FAC is a full time job with lots of complex considerations. We felt learning how to be a good tank leader was hard enough. From a tank's standpoint, artillery or air is "magic" — he requests aid from the appropriate professional, and it's forthcoming (or not, as the case may be!). We kept the types of support straightforward and standard — esoterica like CGLP Copperheads and instant minefields are rare and special tools that a lowly tank platoon commander might never see in action.

On the other hand, certain things must be realistic. The rangefinding and gunnery procedures in this game are as realistic as we can manage on a microcomputer. We were highly amused when a competitor published a computer "simulation" of this same tank and obviously borrowed the firing procedures from our *Gunship* helicopter simulation! In other "tank simulations" you drive around in a single vehicle, shooting up dozens of Russian-built opponents, then return for

new orders from a Colonel or General. Fighter pilots may live a life of solo-missions-then-return-to-base, but ground combat is quite different.

On the other hand, one of our technical advisors was distressed because our discussion of battlesight gunnery is over-simplified. The concept and relativity of using a battlesight is more complex in general, and more much complex on the M1 than presented here. Basically, even at battlesight ranges trajectories aren't entirely flat. Furthermore, on the M1 the gunsight optics are actually generated electronically by the Laser or the Thermal imaging systems (which causes problems if either or both is knocked out). Due to memory space and processing power limitations, not to mention topic's complexity, we decided on the simplified presentation you see here. We also skimmed on other topics dear to some people's hearts, such as the barrel depression limits in Soviet tanks.

We deliberately limited ourselves to present day military equipment. The brand new Russian Mi-28 Havoc attack helicopter, recently demonstrated at the 1989 Paris airshow, is not included because operational deployment is years away. Although the Pentagon is making vague noises about future Soviet tanks (the "FST" series), absolutely nothing is known about them. In fact, the Soviets may well be reading the DoD's annual reports, just to gain an inkling of what sort of tanks they ought to be designing!

In summary, we feel *M1 Tank Platoon* is a good, realistic yet understandable portrait of armored tactics today. It's complicated at times, but only where complexity is important. We want you to experience what could really happen. We want you to control the battle, to make the important decisions, to take over for the critical shot or critical maneuver. *M1 Tank Platoon* is the first "wargame" where you're really there, inside the tank, directing the battle as it occurs around you. We like it a lot. We're sure you will too.

FURTHER READING

A wide variety of sources were consulted for this simulation. We found that no single source had all the information necessary, but by combining sources a fairly clear and coherent picture emerged. Among the many books and magazines used, the following stand out as the most interesting:

Books

Advanced Technology Warfare, by Friedman, Miller, Richardson, Gunston, Hobs and Walmer, 1985, Salamander Books, London / Crown Publishers, New York. This book is a good general introduction to the nifty technology used in modern warfare, but its coverage of ground combat is light and you may not get a balanced viewpoint without other reading.

Combined Arms (Modern Miniature Wargaming), by Frank Chadwick, 1988, Game Designer's Workshop. This is a well-researched, up-to-date and rather interesting set of miniature wargame rules (the players need to provide a large tabletop and lots of tiny tanks and men!). Chadwick's expertise in modern military affairs is legendary, but unfortunately most of his data is heavily filtered to fit the game format.

Modern Land Combat, David Miller & Christopher F. Foss, 1987, Salamander Books, London / Portland House, New York. Although the book concentrates on attractive color pictures of common ground vehicles and weapons, it does include a useful overview on modern land combat. It has the added advantage of being fairly up to date.

The Modern US Army, Richard O'Neill, editor, 1984, Salamander Books, London / Arco Publishers, New York. This book presents a good overview of the US Army's organization, weapons and doctrine in a small, inexpensive format. However, it is somewhat dated: some weapons mentioned have been cancelled.

Team Yankee, Major H.W. Coyle, 1987, Presidio Press, Novato, California. This novel depicts a tank company commander's experiences during World War III in Europe. It provides an enjoyable and unmatched insight into the various types of tank combat situations. We highly recommend it.

Weapons and Tactics of the Soviet Army — New Edition, by David Isby, 1988, Jane's Publishing Company Ltd., London. The second and updated edition of Isby's 1981 work is without doubt the most detailed book ever written about the Soviet Army. It is a model of clear, concise description and analysis. If you're just buying one book on the subject, buy this. Although he writes and talks like a British aristocrat, Isby is actually an American lawyer.

USAREUR, by Michael Skinner, 1989, Presidio Press, Novato, California. Mr. Skinner is developing a reputation for a "soldier's eye view" of military affairs. This well written and attractively photographed volume provides many useful insights into the equipment and mentality of The United States Army in Europe.

Periodical Publications

Armor, published bi-monthly by US Army Armor Center, Fort Knox, Kentucky. This is the professional journal for officers in the armor branch. If you're a

tank fan its articles provide interesting insights and stories. However, the majority of articles are about leadership and managing men, not the tactical nitty-gritty of modern war.

International Defense Review, published monthly in English by Interavia SA, Geneva, Switzerland. This journal attempts to provide in-depth articles on armed forces and military affairs around the world. Although it's full of interesting opinions for businessmen of the arms industry, its information is rarely broad enough or deep enough to interest a wider readership. But if nothing else, it at least makes an interesting addition to your living room coffee table.

Jane's All the World's Aircraft, edited by John W.R. Taylor, published annually by Jane's Information Group, Surrey, England. This was our chief source of data on helicopters and attack jets, although we cross-checked it with a number of other volumes. For both civilian and military aircraft data, this book is an unmatched resource.

Jane's Armor & Artillery, edited by Christopher F. Foss, 1988-89 edition, published annually by Jane's Information Group, Surrey, England. This is the key volume of the Jane's series for tanks. It covers all major classes of AFVs, along with towed artillery. Each vehicle is illustrated with pictures, drawings, and technical details. Due to the brisk international arms trade the entries are remarkably detailed and complete. We used the 1988-89 edition and a selection of earlier volumes. Don't forget to check out the addenda — in 1988-89 it included some excellent information about the ZSU-30-2.

Jane's Defence Weekly, published weekly by Jane's Information Group, Surrey, England. This journal is a very useful magazine on military equipment. It caters to arms manufacturers, and therefore concentrates on new weapons development. No one issue is particularly helpful, but over a period of months you can acquire a remarkable store of information.

Jane's Infantry Weapons, edited by Ian V. Hogg, 1988-89 edition, published annually by Jane's Information Group, Surrey, England. This volume contains all the details you could desire on pistols, rifles, machine-guns, auto-cannons, mortars, and man-packed rockets and missiles, binoculars, body armor, etc. In short, it's your one-stop shopping guide for infantry armaments.

Jane's Weapons Systems, formerly published annually by Jane's Information Group, Surrey, England. This extremely useful volume provides details about all sorts of guns, missiles, and electronic equipment used on the land, air and sea. Unfortunately, Jane's has ceased publishing this information in a single volume and has instead divided it up into separate volumes for air, land and sea, making the information so expensive (at \$100 to \$150 per volume!) that only corporations with fat defense contracts could possibly afford it.

Soviet Military Power, published annually by the US Department of Defense, Washington DC. This propaganda document appears each year as part of DoD's publicity broadside for more and better weapons (not that America doesn't occasionally need them!). Although extremely general, it always reveals at least one new Soviet weapon system each year.

Military Publications

Although extremely useful, military publications are very difficult to track down. This is because you're obliged to find the particular base which publishes the work and write to the correct office there. They are entitled to deny access if the book contains classified information, otherwise they must provide it per the Freedom of Information Act. The process of finding the correct base, determining if you're allowed access to the manual, determining the price, and finally getting it shipped can take anywhere from two months to over a year.

The manuals listed below are just the high points. We have many others, some dating back to the Vietnam War era, which gave us a "base line" by which to judge what's new and what isn't.

Important Note: MicroProse appreciates the kind assistance of officers and men at many military installations around the country. To avoid causing deluges of requests to their offices, it is out policy to *not* reveal manual numbers or the publishing agencies. Do *not* call us for this information. You'll have to discover it elsewhere. It can be done if you're persistent.

Military Symbols, May 1970. Our edition is clearly outdated, but military symbols don't change that fast. Some symbols listed here as non-standard have since become standard in the US Army. It is the source of symbology used in the organization diagrams elsewhere in this manual.

Operator's Manual, Tank, Combat, Full-Track, M1, November 1981. This is the operating manual for the M1 series tank. Ours came with a pile of updates, some rather crucial. It's intended for the actual vehicle crewmen, not mechanics, and therefore does not include classified data. The line drawings of the vehicle interiors were invaluable for determining not only what the M1 looks like, but also how it operates in real life. Tracking down this handbook was a major effort that paid off well, despite the amazingly high price.

Organizational & Tactical Reference Data for the Army in the Field, June 1988. This training textbook from the Command and General Staff College provides useful insights into how the army is transitioning to the new organizations. Bear in mind that actual unit identifications have been changed to fictional ones, to avoid any security problems.

Tank Combat Tables, November 1986. This handbook gives complete details on how to operate the M1's gun, as well as how to set up and run a gunnery range. Unfortunately, it's not been updated for the new 120mm gun. We also used its M60 predecessor volume from 1977, which included a number of tactical insights and attack drills since removed. Overall this manual is the guide to firing a tank's guns.

The Tank & Mechanized Infantry Battalion Task Force, June 1988. This is the battalion commander's new tactical "bible", issued curiously enough by an infantry school. Although not crucial to our design work, it provided extremely useful insights into how the US Army is attempting to implement the concepts of "Air-Land 2000".

Tank Platoon, October 1987. This is the tank platoon commander's "bible". It describes everything you need to know (and lots you'd rather not) about running a tank platoon. It was an indispensable reference for this simulation.

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