

TRACKED ARMORED PERSONNEL CARRIERS

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VCTP

Notes: This is an Argentine armored personnel carrier based on the same chassis as the TAM tank. Most of the design work was done by Germany's Thyssen-Krupp AG, who had already developed the TAM light tank for Argentina. The idea of an APC based on the TAM chassis was the idea of the Argentine Army, and this was done to decrease the cost of the VCTP as well as the cost of maintenance by producing a vehicle that had a large percentage of parts that were the same as the TAM. It also meant that mechanics trained to work on the TAM could be quickly trained to also work on the VCTP, and a driver who could drive a TAM could drive a VCTP. The Argentine Army originally intended to replace all of their APCs and many of its scout vehicles with the VCTP, for a total of 350 VCTPs and VCPCs; however, only 210 (of all versions) were actually produced, due to budgetary problems. Production was carried out in Argentina by TAMSE, in a plant that was fitted out under the supervision of technicians from Thyssen-Krupp. The VCTP is part of a family of vehicles, including the VCPC command post carrier and the VCTM mortar carrier. (There were to be more members of this family produced, but they died a premature budgetary death.)

The VCTP

The general layout of the VCTP is very much like that of another German vehicle, the Marder IFV. The small, 1-man turret incorporates a simplified version of the fire control system of the Marder; in fact, many systems of the VCTP use simplified versions of those found in the Marder.

The main armament is a 20mm Rheinmetall Rh-202 autocannon, as found on the Marder 1A3 IFV; a pintle-mounted machinegun is found at the commander's hatch. (Some sources list the autocannon used as the 20mm Oerlikon KAA. Most sources, including most reliable sources, say the autocannon on production vehicles is indeed an Rh-202, though early prototypes did mount a KAA.) The Rh-202, being a dual-feed weapon, has ammunition belts feeding from both sides of the autocannon; on the VCTP, 100-round belts are normally carried already loaded into the VCTP as ready ammunition. Two more belts are in the turret, with the rest of the ammunition being stowed in the front of the passenger compartment. The VCTP also has a remote control machinegun over the rear of the passenger compartment, again a feature found on the Marder. The commander has an IR night sight, and functions as both the commander and gunner; he has a coincidence rangefinder and a small ballistic computer. The commander's controls for the autocannon are situated so that he can fire them even when his head and shoulders are outside of the hatch. The commander's hatch is ringed with vision blocks, with the night vision head to the front and slightly to the left of his hatch. On each side of the hull, just to the rear of the driver's compartment, there is a cluster of four smoke grenade launchers, with the grenades being manually fired by the commander.

The driver is on the left front hull, with the commander on the right side of the turret. The driver has a standard vision block to his front and two wide-angle vision blocks on either side of that block; the center vision block can be removed and replaced with a night vision block that comes with the VCTP and is normally kept in a case on the left wall of the driver's compartment. The suspension of the VCTP is the same as that of the TAM, which gives the VCTP a reasonable cross-country ride and good road ride. The engine is a German-designed MTU MB-833 diesel engine, developing 720 horsepower. The VCTP has a surprisingly large pair of fuel tanks in the walls of the passenger compartment, and a pair of reserve fuel tanks (200 liters each) may be fitted to either side of the hull rear. The VCPC is amphibious with 3 minutes of preparation; this preparation consists of the deployment of a trim vane and the turning on of a bilge pump. A swimming VCPC does, however, have alarmingly little freeboard.

The passenger compartment is surprisingly roomy, though less so when carrying its normal complement of 10 troops. Bench seats are found on either side of the compartment, with a squad leader's individual seat at the front of the passenger compartment which faces to the rear. Entry and exit is by a door in the rear of the hull; there are also small roof hatches (large enough for two troops to stand in each of them) on the hull deck over the center of the passenger compartment. Three firing ports are found on each side of the passenger compartment; these can accept the individual small arms used by the Argentine Army, including machineguns. There are no firing ports at the rear of the vehicle, but there is a vision block, and a periscope is also a part of the rear machinegun turret. Vision blocks are just above these firing ports.

The VCPC

The VCPC differs from the VCTP only in the lack of a turret and in the interior arrangements. As a command post carrier, the VCPC carries up to six radios (which may be short, medium, or long-range), map boards, and drawers and compartments for stowing the various equipment needed by command post personnel. An additional AM-band very long-range radio is often carried, as well as one or more rugged military-type laptop computers. (For the stats below, I have included the AM radio and one laptop.) Additional hand-held observation devices, ranging from binoculars to a thermal imager, are carried. (I have included a hand-held image intensifier and thermal imager in the price below, though they are not listed, as they are not integrated equipment.) The driver's compartment is the same; the commander's station is simply a hatch where the turret would normally be, with a pintle-mounted machinegun. This machinegun is sometimes found with a gun shield to the front or even all-around gun shields. The rear remote-control machinegun of the VCTP is deleted on the VCPC. Roof hatches of the same type as on the VCTP are found over the passenger compartment in the same place as on the VCTP (just to the rear of center.) The smoke grenade launchers and firing ports of the VCTP are retained. Due to the additional equipment in the passenger compartment of the VCPC, the capacity of the passenger compartment is reduced to six, and the rear-facing squad-leader's seat is deleted.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
VCTP	\$123,140	D, A	1.01 tons	28 tons	2+10	16	Passive IR (D, C)	Shielded

VCPC	\$213,056	D, A	825 kg	26 tons	2+6	19	Passive IR (D)	Shielded
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
VCTP	178/125	43/26/4	640+400	378	Trtd	T3	TF9 TS4 TR4 HF14 HS6 HR6
VCPC	178/125	43/26/4	640+400	378	Trtd	T3	HF14 HS6 HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
VCTP	+2	Fair	20mm Rh-202 autocannon, MG-3 (R), MG-3 (C)	1400x20mm, 5000x7.62mm
VCPC	None	None	MG-3 (C)	2500x7.62mm

Australian M-113A1 Mods

Notes: The Australian Army began using the M-113A1 in the mid-1960s; they first used them in Vietnam as part of the small Allied force that was helping the US effort in the Vietnam War. Early Australian M-113A1s were stock, but were quickly outfitted in a manner similar to ACAVs (an M-2HB surrounded by a light armor shield, and a pair of M-60 machineguns on either side of the passenger compartment deck hatch equipped with gun shields to the front). However, soon after the Australian Army began operating in Vietnam, they began modifying their M-113A1s to better suit conditions, improve firepower, and improve crew and passenger protection. For budgetary reasons, the Australians stayed with the M-113A1 version as a base design; many Australian troops also felt that the M-113A1 was good enough for their purposes and that buying the M-113A2 version was unnecessary. However, later Australian upgrades have made the base M-113A1s into vehicles that are in most cases better than the M-113A2 and with later upgrades, better than the M-113A3.

Australian soldiers were at first ambivalent about the M-113A1. But their philosophy is best summed up in the words of one trooper, who said, "A second-class ride is better than a first-class walk."

Standard M-113A1s

The stock version of the M-113A1 and the M-113A1 ACAV's statistics and some of the information about them is repeated below from the US Tracked APCs page. Some of these vehicles also received a "belly armor" upgrade, similar to the added hull floor armor used on some US M-113s. The engine chosen for the M-113A1 was a slightly modified form of the General Motors 6V53 diesel, which developed 215 horsepower (slightly more powerful than US M-113A1s, which had 212 horsepower); the transmission of the M-113A1 is also matched to the engine. The different engine and transmission gives the Australian M-113A1 much better speed than the US version. The M-113A1 has an integrated transmission and power pack. The driver operates the vehicle with tillers and a gas pedal; braking is done by pulling back on both tillers at the same time, while steering is done by pulling on one or the other tiller to brake either the left or right sprocket and final drive. The driver also has a couple of handles above and in front of the tillers; these are pivot steer handles, and allow the M-113A1 to turn in place. The transmission is automatic. The fuel tanks are in the walls of the passenger compartment, inside the armor envelope. Australian M-113A1s has a crew compartment heater as well as a battery pre-heater. The forward vision block can be removed and replaced with an IR vision block; this device is normally strapped on the wall on the left side of the driver, and can only be used if the driver lowers his seat to be completely under armor.

The Australians quickly added an ACAV-type configuration; unlike early US M-113 ACAVs, the Australians largely used a purpose-built kit manufactured in Australia. The commander's M-2HB machinegun is surrounded by gun shields, which are slightly heavier than those put on US M-113 ACAVs (but unfortunately cannot be reflected by *Twilight 2000* v2.2 rules; it would translate out to an AV of about 2.3). The gun shields for the M-60s mounted on either side of the passenger compartment hull deck hatch protect against hits from the front of the gun only and have an AV of 2.

Some Australian M-113A1s were equipped with extra hull floor armor, which adds 2 points of armor to the floor of the M-113A1. These were usually not added to other Australian M-113A1 versions, to hold down weight. The Australians also followed the lead of some US units by lining the floor of the passenger compartment with sandbags.

The M-113A1 APC/LRV

The APC/LRV (LRV for Light Reconnaissance Vehicle) first appeared in the late 1960s. The APC/LRV is a standard M-113A1, but modified with the addition of a one-man Cadillac Gage T50 turret, similar to that mounted on the V-150 Commando Armored Car. This small turret has a hatch on top and is armed with one heavy and one medium machinegun. The primary motivation behind the APC/LRV was to afford the commander better protection; the increase in firepower from the commander's position was an incidental benefit. The turret does take up a bit of room normally given over to passenger seats, reducing the amount of infantrymen or equipment that can be carried in the rear. The T50 turret does not provide any night vision or enhanced vision capabilities for the commander, but it does have several vision ports and blocks. As with earlier versions of the M-113A1, additional belly armor was sometimes fitted to the APC/LRV. The Viet Cong referred to this variant of the M-113A1 as the "Green Dragon" in the Vietnam War, as they were sometimes beefed up with additional weapons around the rear passenger hatch, making the APC/LRV into sort of an "ACAV Plus."

The M-113A1 FSV

The FSV (Fire Support Vehicle) was at the outset designed to be an interim vehicle designed to provide heavy backup to Australian infantry, with a secondary role as a scout vehicle. It was replaced in the late 1970s by the M-113A1 MRV (below). The Australians had begun withdrawing their British-designed Saladin scout cars from active service in the mid-1960s, and some of the turrets of the Saladins were mounted on M-113A1s. This gave the M-113A1 a 76mm medium-velocity gun with its coaxial machinegun and another machinegun mounted on a pintle at the commander's hatch. Though the turret and ammunition for the main gun takes up most of the room in the former passenger space, there is room for a small dismount squad. The FSV retained its amphibious capability, but only because of Styrofoam blocks and air space enclosed by light aluminum sheet that were attached to each side of the hull and the trim vane. Australian troops referred to the FSV as "The Beast." Some 15 FSVs are still in working order (if not in service) in Australia. Added belly armor was generally not employed, as the weight would have been very detrimental to performance.

The M-113A1 Recoilless Rifle Carrier

The Recoilless Rifle Carrier variant of the M-113A1 was another interim vehicle, designed to supplement the FSV as a fire support vehicle. It was a simple modification; an M-40A2 106mm Recoilless Rifle was mounted to left and slightly to the rear of the commander's station, and manned by a crew that stood in the hatch on the rear hull deck. The on-board ammunition was a modified Carl Gustav M-2 ammunition box (typically plywood with thin sheet aluminum sides), but most crews of these vehicles carried more boxes of ammunition in the passenger area. As with the FSV, the Recoilless Rifle carrier could carry a small dismount squad, but generally didn't, to allow more ammunition to be carried. The M-2HB machinegun at the commander's cupola was retained. As they were stopgap vehicles, they were withdrawn from service soon after the Australians left the Vietnam War.

The M-113A1 MRV

After the Vietnam War, the Australians did not get rid of their M-113A1s; in fact, they continued to modify and improve them (and heavily-modified versions are still in service today). As the FSV was always considered an interim version, a new version was fielded by the Australian Army in the late 1970s. It was essentially the same idea as the FSV, but used the turret of the Scorpion instead of the Saracen's turret. The Scorpion turret used the same caliber gun, but fired its ammunition at a higher velocity. At first called the M-113A1 FSC (Scorpion Turret), the name was later changed to the MRV (Medium Reconnaissance Vehicle, reflecting its intended primary role as a scout vehicle than simply an infantry support vehicle. Other than the more powerful main gun, the Scorpion turret offered night vision for the gunner and commander, radiological shielding for the turret, more space for radios, and a laser rangefinder/ballistic computer combination. The MRV also has a collective NBC system for the crew. The MRV can also carry a small dismount squad. Though the turret is not heavily armored, some appliqué armor has been added to the hull. As with the FSV, the MRV requires flotation cells to be added to the sides and a special trim vane in order to swim, but it otherwise retains the amphibious capability. Suspension upgrades, engine upgrades, and some other improvements made for a lighter vehicle than the FSV, with an attendant slight increase in speed, maneuverability, and fuel economy.

MRVs were later given upgraded armor on the hull floor by adding titanium plates to the underside of the vehicle. This had a similar to the Vietnam-era belly armor upgrades, but was lighter in weight.

The LAND 106 Project

As early as the mid-1980s, the Australian Army sought to upgrade their still-useful M-113A1s to a more modern configuration. They did not feel that outright replacement was necessary; most of their M-113A1 fleet had been well-taken care of and was still quite serviceable. Unfortunately, the projected upgrade program ended up scuttled due to lack of funds, and the M-113A1-based fleet continued to soldier on only with what money was needed to keep the fleet going.

In 1996, the issue of upgrading the M-113A1-based fleet was again taken up by the Australian government. By this point, the Australian Army had 520 M-113A1-based vehicles of all types. This led to the LAND 106 project, which aimed to perform major upgrades on 350 M-113A1-based vehicles, provide less-comprehensive upgrades on about 50 more, and produce some 50 more vehicles that would be essentially new-build vehicles. Other M-113A1s would be simply rebuilt to extend their useful lifetimes. Much haggling ensued, with little more than prototype and drawing-board work being done; it seemed for a while that LAND 106 would also fall by the wayside. However, in 2007, the Australian Army finally received the funding it needed, and upgrade work began in earnest in 2007; this work is estimated to be finished between 2010-2013. Though a little of a budgetary hiccup occurred in 2008, the LAND 106 project is now back on track. When finished, the resulting vehicles will mostly be equivalent in capability to the M-113A3, and more. The overall series description for the most-upgraded variants is the M-113AS series. Complete prototypes appeared in 2004, Low-Rate Initial Production (LRIP) began in December of 2007, in order to conduct field testing; Full-Rate Production began in 2007, with initial deliveries beginning in November of 2007. 431 vehicles are scheduled for major upgrades, an additional 81 vehicles scheduled for lesser upgrades. The upgrades are projected to keep the M-113A1-based fleet viable until at least 2020.

General Upgrade Characteristics

The most comprehensive upgrades are to be done on the basic M-113A1 design. Though work is being simultaneously carried out on several different upgraded versions, work started on the vehicle that would be called the M-113AS4. The M-113AS upgrades the engine, transmission, driver controls, and armor, and also adds some new bells and whistles.

The M-113AS is equipped with a 280-horsepower turbocharged diesel engine, designed by MTU of Germany, and conforming to EURO 3 standards for exhaust, efficiency, and environmental concerns. This is coupled to an automatic transmission designed by Renk of Germany that maximizes the power of the engine. The tracks and roadwheels are also replaced by designs that make the track and roadwheels stronger and lighter. The entire powerpack and drive train are lighter, more compact, and more reliable. The suspension itself is also improved for a better ride and off-round performance. The driver's control tillers and gas pedal are replaced by a steering yoke and a conventional brake and gas pedal, though it is of more ergonomic design than those of the M-113A3. The pivot steering capability is retained. The M-113AS has additional protection in the form of aluminum and steel appliqué armor, with titanium plate reinforcement for the hull floor. The interior of the M-113AS also has additional protection, including a Kevlar anti-spall liner. One constant complaint of M-113A1 crews was vibration and noise (I can tell you from experience that both are extreme). This problem has been

partially solved with mats made from a special rubber compound that provides both shock absorption and noise abatement. The mats are designed to fit each variant precisely, allowing them to stay in place with little fastening. The fuel tanks have been removed from the passenger compartment walls, to either side of the rear hull. The amphibious requirement has been dropped.

An interesting feature added to the M-113AS series is a water distillation and purification unit, which can provide 20 liters per hour of drinking water from local water sources, including salt water.

The Upgrades

The M-113AS4 may be considered the “base” upgrade, though in many senses none are really the base, and most versions of the M-113AS have been upgraded simultaneously. The M-113AS4 is the basic APC variant, and the most numerous member of the LAND 106 program. This version is a stretched model, with six roadwheels on each side and 66.6cm of extra length. Atop the M-113AS4 is a turret designed by Tenix that is equipped with a heavy machinegun. This provides much more protection than the previous commander’s station, as well as much better vision equipment. The turret has electric traverse and stabilization for its machinegun as well as an assist from a laser rangefinder and a ballistic computer.

The M-113AS3 is essentially the same, but is not stretched.

The remaining members of these large-scale upgrades include a fitters vehicle, a light ARV, and a mortar carrier. None of these will be discussed in this section. However, three other versions exist, all based on the M-113AS4: the M-113AS4-AA armored ambulance, the M-113AS4-ACV armored command vehicle, and the M-113AS4-ALV armored logistics vehicle.

These three variants of the M-113AS4 are armed, but do not have the turret of the APC version of the M-113AS4. Instead, they have M-2HBs at the commander’s station surrounded by gun shields. The M-113AS4-AA can carry up to 4 stretcher-borne patients or up to 8 seated patients. It has all the usual medical supplies one might expect from an armored ambulance (the equivalent of 12 personal first aid kits and four doctor’s medical bags), but also has a defibrillator, four oxygen sets to assist patients in breathing, a refrigerator for perishable medical items, and a small heater to warm blankets and therefore assist in treating hypothermia. The M-113AS4-AA also has heating plates to cook warm meals or warm already-existing foods, and warm liquids, and a 30-liter water tank.

The M-113AS4-ACV is equipped with up to six radios (generally a mix of medium and long-range radios) and one very-long-range AM-based radio. The vehicle has map boards, various supplies to issue orders and plot movements, a small-but-tough laptop computer, and-held observation devices (generally an image intensifier and a thermal imager, a laser rangefinder, as well as several pairs of binoculars), a small, 20-liter water tank, and various items for its command vehicle role. The observation devices are included in the price below, but not specifically listed.

The M-113AS4-ALV – well, it’s essentially a large, armored, tracked truck, designed specifically to replenish troop supplies at combat positions. As such, the cargo area is basically wide open, though it does have lockers on the walls to help keep supplies from flying around the interior while the vehicle is moving. It does not have troop seats; it is essentially a large open space surrounded by armor. It does, however, have a small crane able to handle 2 tons to help load and offload supplies.

Some other M-113A1-based vehicles have had a lesser array of upgrades; for example, some MRVs have had an engine upgrade, along with a transmission change; some also have a modernized driver’s station. Some of the M-113A1-based vehicles now in Australian service are simply not slated for any upgrades and will eventually leave service.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-113A1	\$59,436	D, A	1.61 tons	10.92 tons	2+11	5	Passive IR (D)	Shielded
M-113A1 (Belly Armor Kit)	\$59,936	D, A	1.46 tons	11.22 tons	2+11	5	Passive IR (D)	Shielded
M-113A1 ACAV	\$100,922	D, A	1.44 tons	11.27 tons	4+4	5	Passive IR (D)	Shielded
M-113A1 ACAV (Belly Armor Kit)	\$101,422	D, A	1.31 tons	11.57 tons	4+4	5	Passive IR (D)	Shielded
APC/LRV	\$160,991	D, A	1.25 tons	11.9 tons	2+9	5	Passive IR (D)	Shielded
APC/LRV (Belly Armor Kit)	\$161,491	D, A	1.12 tons	12.2 tons	2+9	5	Passive IR (D)	Shielded
FSV	\$253,856	D, A	650 kg	12.37 tons	3+4	6	Passive IR (D)	Shielded
Recoilless Rifle Carrier	\$174,117	D, A	1.09 tons	11.22 tons	4+3	5	Passive IR (D)	Shielded
MRV	\$386,364	D, A	550 kg	12 tons	3+4	7	Passive IR (D, G, C)	Shielded
MRV (Hull Floor Upgrade)	\$387,036	D, A	550 kg	12.3 tons	3+4	7	Passive IR (D, G, C)	Shielded
M-113AS3-MRV	\$335,249	D, A	650 kg	16.1 tons	3+4	7	Passive IR (D, G, C)	Shielded
M-113AS4	\$266,377	D, A	2.66 kg	18 tons	2+9	8	Thermal Imaging (C), Image Intensification (C), Passive IR (D)	Shielded
M-113AS3	\$265,274	D, A	1.66 tons	15 tons	2+7	8	Thermal Imaging (C), Image Intensification (C), Passive IR (D)	Shielded
M-113AS4-AA	\$196,369	D, A	2.5 tons	17 tons	4+8***	9	Passive IR (D)	Shielded
M-113AS4-ACV	\$388,478	D, A	1.5 tons	17 tons	2+6	8	Passive IR (D)	Shielded
M-113AS4-ALV	\$166,095	D, A	3.2 tons	16.5 tons	2	6	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-113A1	152/107	35/21/4	360	124	Stnd	T2	HF6 HS4 HR4
M-113A1 (Belly Armor Kit)	141/100	33/21/4	360	133	Stnd	T2	HF6 HS4 HR4*
M-113A1 ACAV	137/96	32/20/4	360	138	Stnd	T2	HF6 HS4 HR4
M-113A1 ACAV (Belly Armor Kit)	133/93	31/17/4	360	142	Stnd	T2	HF6 HS4 HR4*
APC/LRV	140/98	32/19/4	360	135	Trtd	T2	TF5 TS4 TR4 HF6 HS4 HR4
APC/LRV (Belly Armor Kit)	137/96	31/19/4	360	139	Trtd	T2	TF5 TS4 TR4 HF6 HS4 HR4*
FSV	134/94	31/18/4	360	140	Trtd	T2	TF5 TS5 TR4 HF6 HS4 HR4
Recoilless Rifle Carrier	141/100	33/21/4	360	133	Stnd	T2	HF6 HS4 HR4
MRV	138/97	32/19/4	360	136	Trtd	T2	TF4 TS3 TR3 HF7 HS5 HR5
MRV (Hull Floor Upgrade)	135/95	31/19/4	360	139	Trtd	T2	TF4 TS3 TR3 HF7 HS5 HR5**
M-113AS3-MRV	133/93	30/19	360	129	Trtd	T2	TF4 TS3 TR3 HF7 HS5 HR5**
M-113AS4	119/83	27/17	360	137	Trtd	T3	TF6Sp TS5Sp TR4 HF8 HS6 HR5**
M-113AS3	143/100	32/20	360	121	Trtd	T2	TF6Sp TS5Sp TR4 HF8 HS6 HR5**
M-113AS4-AA/ACV/ALV	126/88	29/18	360	129	Trtd	T3	TF2 TS2 TR2 HF8 HS6 HR5**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-113A1	None	None	M-2HB (C)	2000x.50
M-113A1 ACAV	None	None	M-2HB (C), M-60 (R, L)	4000x.50, 12000x7.62mm

Australian Tracked APCs

APC/LRV	+1	Basic	M-2HB, MAG	3000x.50, 2500x7.62mm
FSV	+1	Basic	76mm L-5A1 Gun, M-1919A4, M-1919A4 (C)	35x76mm, 2750x.30-06
Recoilless Rifle Carrier	None	None	M-40A2 106mm recoilless rifle, M-2HB (C)	16x106mm, 2000x.50
MRV	+3	Basic	76mm L-23A1 Cockerill Gun, L-43A1	30x76mm, 3000x7.62mm
M-113AS3-MRV	+3	Fair	76mm L-23A1 Cockerill Gun, L-43A1	30x76mm, 3000x7.62mm
M-113AS4/AS3	+2	Fair	M-2HB	4000x.50
M-113AS4-AA/ACV/ALV	None	None	M-2HB (C)	3000x.50

*Hull floor armor for this version is 4.

**Hull floor armor for this version is 5.

***Up to eight seated or 4 stretcher-borne patients or personnel.

Sauer 4K 4FA

Notes: The design work on the 4K 4FA series began in 1956, and was one of Austria's first post-World War 2 armored vehicle projects. The first prototype, the 3K 3H, had basically the same shape, but was smaller and had a Sauer 3H 200-horsepower diesel engine. This prototype, completed 1958, was quickly re-worked into the 4K 3H, which had a better internal layout but was otherwise the same as the 3K 3H. The next prototype, the 4K 2P, had essentially the same hull layout as the 4K 4FA that eventually resulted, and was powered by a Sauer 2P 250-horsepower diesel engine. A few minor changes resulted in the first production version, the 4K 4F. The later versions of this series of vehicles differed only in a few minor details and their engines. The 4K 4FA series was used only by Austria; it was to have been completely replaced by the Ulan (the Austrian version of the ASCOD) between 2002-2004, but budgetary problems reared its ugly head, and the 4K 4FA series will have to soldier on for possibly as long as 2015. Some 445 of all versions of the 4K 4FA were built, with production ending in 1968.

The 4K 4FA is powered by a Sauer 4FA 250-horsepower engine that is very similar to the 2P engine of the 4K 4F. (For game purposes, the 4K 4F and 4K 4FA may be considered identical.) A slightly earlier version, the 4K 3FA, differs only in the engine, which is a Sauer 3FA 230-horsepower diesel. The suspension is well-made and gives the crew and passengers a reasonably-smooth ride for an APC of its period, and the good horsepower-to-weight ratio gives the 4K 4FA excellent speed and maneuverability. The interior is rather cramped, primarily due to the narrow width and short height of the 4K 4FA, as well as the fact that the fuel tanks are inside the walls of the passenger compartment. That low silhouette helps protect the vehicle to an extent, but also means that the fuel tanks are rather small. The commander, on the other hand, had a roomy position with a large hatch. The driver's position is in front of the commander's position, and for that reason the 4K 4FA was designed to have no commander's armament, though a pintle mount was later added to many 4K 4FAs, and some also have varying sizes of gun shields. (Such gun shields have AV1 and add \$50 per side of the gunner protected by them.) The rear deck has a large hatchway above the passenger compartment (enough for six troops to stand upright in it); some 4K 4FAs have from 1-4 pintle mounts around that rear deck hatch. At the rear of the vehicle is a large door for egress and ingress. The 4K 4FA does not have any NBC system, nor does it have radiological shielding. No night vision is provided; and the 4K 4FA is not amphibious. Frontal armor is fairly heavy, with side and rear armor being relatively thin; however, the sides do have a decent slope to them, which helps with the protection factor. The 4K 4FA is basically a "battlefield bus."

The 4K 4FA-G1 is a later development; it differs in the commander's cupola, which is basically a low turret that is armed with a heavy machinegun. The 4K 4FA-G2 has the commander's position moved to the right side of the front deck; this has a small turret armed with an autocannon, giving it a (slight) chance to deal with light armored vehicles and helicopters as well as unarmored vehicles and ground troops.

Other APC-type versions of the 4K 4FA include the 4K 4FA-San armored ambulance, which has the sort of medical equipment one might expect from an armored ambulance. Capacity is two stretcher patients plus 4 sitting patients; the crew consists of two medics that double as the driver and commander. Seated patients are strapped in with seatbelts and shoulder belts, while stretcher patients use straps that are attached to the vehicle's walls and keep them in their stretchers while the 4K 4FA-San is moving. Under the bench seat for the seated patients are lockers for medical equipment. The 4K 4FA-San has no mounts for any weapons.

The 4K 3FA-Fü1 is a command vehicle, primarily meant for use at brigade level and higher; it is similar to the 4K 3FA, but the passenger compartment has two medium-range and two long-range radios and the equipment for unit commanders to plot battlefield information. The 4K 3FA-Fü/FIA is essentially the same, but as it is designed for commanders of AAA units, has radios that allow it to communicate with aircraft and FALO teams. Likewise, the 4K 3FA-FüA is virtually the same, but has equipment for its role as an artillery commander's vehicle. The 4K 3FA-FS carries teletype equipment and, as teletype machines are obsolete in modern warfare, have generally been refitted to other roles. There are also a few other command variants. For game purposes, all of these vehicles may be considered identical, except for the details of the equipment they carry.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
4K 3FA	\$16,981	D, A	1.4 tons	12.5 tons	2+8	8	Headlights	Enclosed
4K 4FA	\$17,381	D, A	1.4 tons	12.5 tons	2+8	8	Headlights	Enclosed
4K 4FA-G1	\$17,871	D, A	1.4 tons	13.1 tons	2+8	9	Headlights	Enclosed
4K 4FA-G2	\$22,970	D, A	1.4 tons	15 tons	2+8	9	Headlights	Enclosed
4K 4FA-San	\$12,352	D, A	2 tons	12 tons	2+6*	9	Headlights	Enclosed
4K 3FA-Fü1	\$17,689	D, A	1.2 tons	12.6 tons	2+4	9	Headlights	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
4K 3FA/3FA-Fü1	145/102	35/21	184	102	Std	T3	HF8 HS4 HR3
4K 4FA/4FA-San	154/108	37/22	184	110	Std	T3	HF8 HS4 HR3
4K 4FA-G1	149/104	36/21	184	115	CiH	T3	TF2 TS2 TR2 HF8 HS4 HR3
4K 4FA-G2	135/95	33/19	184	132	CiH	T3	TF5 TS4 TR3 HF8 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
4K 3FA/4FA	None	None	M-2HB (C)	800x.50
4K 4FA-G1	None	None	M-2HB	600x.50

4K 4FA-G2

+1

Basic

20mm Oerlikon G01

600x20mm

*Two stretcher-borne and four seated patients.

Steyr 4K 7FA

Notes: Steyr Daimler-Puch purchased the rights for the production and sale of the Sauer 4K 4FA in 1970, shortly after production ended in 1968. Steyr, however, decided not to produce the 4K 4FA, electing to modify and improve the design first. Many modifications were made, so many that the first prototype was not completed until 1976, with full-scale production beginning in 1977. In addition to Austrian Army use, the 4K 7FA was produced in Greece under license (and called the Leonidas by the Greek Army), and exported to Nigeria and Cyprus, with an additional six 4K 7FAs being bought by Bolivia and ten by Macedonia. A command post version is also used by Botswana. As with the 4K 4FA, the 4K 7FA was to have been almost totally replaced in the Austrian Army by the Ulan in the 2002-2004 time period, but budget problems got in the way. New vehicles of this series have not been produced since the late 1980s.

The 4K 7FA is a little bit longer than the 4K 4FA, but the same width and height; in many ways the 4K 7FA is simply an updated 4K 4FA. Some of the first modifications that Steyr made to the vehicle was replacement of the power pack; the engine and transmission were replaced by those used in the SK-105 light tank, giving the 4K 7FA a 320-horsepower diesel engine and a transmission with better gear ratios, as well as being a semiautomatic transmission rather than the manual transmission of the 4K 4FA. The tracks are a bit wider than those of the 4K 4FA, and are fitted with rubber track pads. These track pads can be replaced with pads that incorporate steel claws for use in icy weather. The shock absorbers have been improved, further smoothing out the ride. The engine compartment has an automatic fire extinguishing system, as does the crew and passenger compartments.

The base version, the 4K 7FA G-127, is armed identically to the base 4K 4FA – a commander's position behind the driver with an M-2HB, which may or may not be provided with gun shields around the commander's position. As the shields used on the 4K 7FA are generally heavier than those of the 4K 4FA, they provide an AV of 2 and cost \$100 per face covered. The commander's cupola has two hatches which open to the left and right; these can also be locked open, giving the commander additional protection for his torso. At the rear of the vehicle, above the passenger compartment, is a hatch for up to six troops to stand in; there are four pintle mounts around the hatch, though normally only two of them are occupied. (The stats below include all four.) To the rear of the commander's hatch four smoke grenade launchers can be mounted.

The driver is in the front left of the vehicle with the engine to his right; his forward vision block can be removed and replaced with an IR vision block. At the rear are the passengers; in addition to the hatchway mentioned above, there is a double-door in the rear of the vehicle. The front-most seat on the right side is generally reserved for the squad leader; he has a rotating periscope (with no magnification) to observe outside from under armor. Steyr would fit the 4K 7FA with up to three firing ports per side, depending upon the customer. Austrian, Greek, and Cypriot 4K 7FAs generally have two firing ports on each side, while Nigerian and Bolivian 4K 7FAs have none. Options include a collective NBC system and air conditioning, but a heater is standard.

The Austrians were for a while considering upgrading the 4K 7FA with an upgrade package that Steyr devised; this package is still being offered for sale to countries who use the 4K 7FA. The upgrade package includes many of the components of the SK-105/A1 upgrade. The package includes appliqué armor to the front and sides, a small turret similar to that on the 4K 4FA-G1 that also includes night vision and a laser rangefinder for the commander, a fully automatic transmission, hydraulic bump stops to improve cross-country mobility, improved batteries, an improved fire extinguishing system, improved cooling system for the engine, sand shields for desert use, and NBC sealing. The front pintle mount is deleted from the mounts that are around the rear deck passenger hatch. The passenger space is a bit more cramped, but can still carry the same amount of troops. Though it is available, no known customers for the package exist.

The 4K 7FA-KSPz is a 4K 7FA G-127 with a rearranged interior. Hinged passenger seats are mounted in the middle, with the troops facing towards the hull; this allows them to better use the firing ports. Two firing ports are also added in the rear doors; twin hinged, swiveling seats are found facing towards the rear for use with those firing ports. Towards the front of the passenger compartment, on the right side, is a hinged, swiveling single seat for the squad leader; he has a periscope at this position that can be turned 360 degrees, but has no magnification. The Greeks and Austrians use relatively small amounts of this version. For game purposes, this version is (except what was just mentioned) identical to the 4K 7FA G-127.

Steyr also designed a more heavily-armed version of the 4K 7FA, called the 4K 7FA MICV 30/1. This version has a turret with a 30mm Rarden autocannon, a coaxial machinegun, and a commander's cupola with a pintle mount. Night vision for the three crewmembers is provided, and the gunner has a laser rangefinder and a ballistic computer, as well as a fully stabilized autocannon and coax. The pintle mounts around the rear deck hatch are deleted. The Greeks and Austrians both seriously considered production of this version, but both dropped the idea and the 4K 7FA MICV 30/1 has found no customers. Steyr does not offer it for sale anymore, but it is an interesting variant, so I included it below.

The 4K 7FA-Fü is a command version of the 4K 7FA-KSPz. It is just like the standard 4K 7FA-KSPz, but has three radios, a battle management computer, a loudspeaker, and less passenger space; it also has only two pintle mounts on the rear deck (on the left and right sides), and the rearmost firing ports on each side are closed off. A hand-held image Intensifier, a thermal imager, and a laser designator are also part of the vehicle's equipment. (These are included in the price below, but not reflected in the stats.)

The 4K 7FA-San is a 4K 7FA-KSPz modified for use as an armored ambulance. In this role, the vehicle carries medical supplies, stretchers, and oxygen equipment, as well as a refrigerator for blood products and medicines, and a defibrillator. It is unarmed. The 4K 7FA-San can carry 8 sitting casualties or 4 sitting and 2 stretcher casualties.

Twilight 2000 Notes: The 4K 7FA MICV 30/1 was just entering production for Swiss and Greek forces at the Twilight War's outset

and is rather rare.

Merc 2000 Notes: The 4K 7FA MICV 30/1 does not exist in the Merc 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
4K 7FA G-127/KSPz	\$57,178	D, A	1.7 tons	14.8 tons	2+8	8	Passive IR (D)	Shielded
4K 7FA Upgrade	\$121,714	D, A	1.4 tons	15.3 tons	2+8	9	Passive IR (D), Image Intensifier (C), Thermal Imaging (C)	Shielded
4K 7FA MICV 30/1	\$144,545	D, A	800 kg	16.3 tons	3+6	10	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
4K 7FA-Fü	\$278,721	D, A	800 kg	15.2 tons	2+5	10	Passive IR (D)	Shielded
4K 7FA-San	\$78,009	D, A	1.1 tons	14.6 tons	*	9	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
4K 7FA G-127/KSPz/San	151/106	36/22	360	178	Std	T3	HF8 HS6 HR4
4K 7FA Upgrade	146/103	35/21	360	184	CiH	T3	TF5 TS6 TR4 HF11 HS8 HR4
4K 7FA MICV 30/1	137/96	33/20	360	196	Trtd	T3	TF5 TS4 TR4 HF8 HS6 HR4
4K 7FA-Fü	147/103	35/21	360	183	Std	T3	HF8 HS6 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
4K 7FA G-127/KSPz	None	None	M-2HB (C), 4xMAG (L, R, RF, RR)	500x.50, 2000x7.62mm
4K 7FA Upgrade	+2	Fair	M-2HB, 3xMAG (L, R, RR)	500x.50, 2000x7.62mm
4K 7FA MICV 30/1	+3	Good	30mm Rarden autocannon, MAG, MAG (C)	475x30mm, 1600x7.62mm
4K 7FA-Fü	None	None	M-2HB (C), 2xMAG (L, R)	500x.50, 1600x7.62mm

*See Notes above.

VBCL

Notes: This is a Belgian modification of the M-108 self-propelled howitzer, for use as a command post. In this role, the turret is replaced with a fixed superstructure to allow standing inside the vehicle. At least three radios, a teletype, scrambling and encrypting modules, a computer with wireless modem and LAN, a GPS receiver, and a 10 kW generator are installed. There is a hatch on the front left deck ahead of the superstructure for the driver, one on the front superstructure deck for the commander, and two large doors on the hull rear for entry. There are several stowage boxes and lockers on the superstructure roof for crew gear. This vehicle is valued for its roominess.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$142,961	D, A	1 ton	12.54 tons	2+4	7	Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
168/117	35/25/4	511	99	Std	T4	HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	1000x.50BMG

Alvis/BAE CVR(T) – APC Variants

Notes: The FV-103 Spartan was not actually intended for use as an APC – instead, it was meant to form a base chassis for specialist vehicles such as engineer, ambulance, command, antitank, or SAM launchers. The Spartan is a part of what is sometimes called the CVR(T) family (as they are all based on the Scorpion chassis) and as shares components with vehicles ranging from the base vehicle to the Scorpion light tank and Scimitar scout vehicle. Even “plain vanilla” versions normally carry personnel such as combat engineers, MANPADS teams, or ATGM teams, instead of being used as simple APCs. The “APC-type” versions are detailed below. As are the rest of the CVR(T), the FV-103 and its variants are light, speedy vehicles with excellent mobility. In addition to Britain, CVR(T)-based vehicle are used by some 19 other countries, and the Spartan was evaluated (though not chosen) for use by the US Marines in the early 1980s (three sold for trials, which the Marines still have in storage). (I have included those proposed US Marine variants below, just as a “what-if.”) Other users include Malaysia and Indonesia. Originally the CVR(T) family was to have 12 members, but ultimately ten versions were built, plus some limited-edition specialized trials vehicles and prototypes. Further development of the Spartan led to the Stormer series. Since the British Army reorganization has given them a surplus of Spartans, they are now often employed as battlefield substitute rough-terrain “jeeps” and scout vehicles. Production of the APC-type versions of the CVR(T) range is complete, and BAE (who bought out Alvis in 1980) no longer markets them, though British Army CVR(T)s are still being upgraded, and parts for them are still being manufactured, with larger components available on special order.

The Spartan has an allwelded steel body and armor; in addition, most other internal metal components (including some of the power train components) are of aluminum and other light alloys. The appearance of the Spartan is that of a “mini-APC.” The layout of the base vehicle is that of a basic boxy APC, with a sharply-sloped front end that included the driver’s position. Behind him on the hull deck is the commander’s position, with a machinegun in a special mount that allows him to aim and fire the machinegun from under armor. Beside the commander’s position, in the hull, is a swiveling seat for the squad leader; he has four vision blocks (to each side of his position) and his own overhead hatch. At the rear are bench seats for passengers, and Alvis swears that they will fit up to eight troops. (A more normal fit is four troops and their specialist equipment.) On the rear deck is a double hatch over the passenger compartment, and the rear of the vehicle has a ramp with a door in it. On the sides of the vehicle are large stowage boxes, as interior space is at a premium; these can be removed if the Spartan needs to be airlifted or airdropped. On either side of the hull front at the point where the glacis begins to slope, there are clusters of three smoke grenade launchers on either side of the front hull. Originally, the Spartan was propelled with a Perkins Jaguar gasoline engine developing 250 horsepower, but they were later re-engined with a 195-horsepower Cummins diesel. Still later versions were re-engined with 250-horsepower Perkins Phaser diesel engines under the CVR(T) LEP, which also upgraded part of the suspension, transmission, and much of the electrical system. Transmission is semiautomatic, or automatic under the CVR(T) LEP version. The Spartan is amphibious with 15 minutes of preparation, as a flotation screen must be erected around the hull. Other upgrades include the 2001 addition of thermal imaging, and general upgrades to the electrical system, transmission, brakes, driver’s position, and roadwheels.

The FV-104 Samaritan is an armored ambulance version of the Spartan. Externally, the most visible differences are the roofline, which is raised 200mm, and the lack of any armament. (The medics typically carry weapons, but the gun mount on the commander’s cupola is deleted.) The vehicle crew consists of the driver, a medic, and the vehicle commander (who is also a medic, as is the driver). The Samaritan has a heater and air conditioner (for casualty comfort, and small refrigerator and heater for rations, liquids, and perishable medical supplies, as well as a defibrillator and two oxygen sets for casualties. Other than the crew, the Samaritan can carry four seated casualties or two stretcher cases, or two seated casualties and one stretcher case. Because of the different shape of the hull, the driver can recline his seat to the rear; this can be done for comfort, but the reclined seat is also necessary if the Samaritan is buttoned up. Other than the aforementioned equipment, the Samaritan has the equivalent of two doctor’s medical bags and twenty personal medical kits, as well as an assortment of bandages, cravats, etc.

The FV-105 Sultan uses the same body as the Samaritan, but is C3-type vehicle, for use in roles ranging from mortar and artillery FDCs to specialized communications vehicles to mid-level command post carriers (it’s most common role). The exterior of the Sultan typically also has large stowage boxes on the sides, rear, and even the top of the vehicle, and the commander’s position is a simple rotating cupola with a pintle-mounted weapon. The raised profile and increased interior space allows for a large map board and a small desk with storage drawers on right side of the passenger compartment, with a bench seat for three people facing that side. The front of the right side is the radio operator’s; he typically monitors one short-range, two medium-range, and one long-range radio. Specialist communications equipment may also be used if the Sultan is operating as an FDC or some other type of specialist communications or command role; the figures below reflect average equipment. The commander’s seat can be moved completely down into the passenger compartment while he is participating in the command-type operations, or all the way up when he is functioning as the vehicle commander. Most Sultans these days have a tactical laptop computer, and the cost below reflects that. The Sultan often also carries hand-held night vision devices, a laser rangefinder, and several sets of binoculars; the prices below reflect a hand-held image intensifier, a thermal imager, a laser rangefinder, and four pairs of binoculars. The driver has a seat like that of the Samaritan. A specially-designed tent can be extended from the rear of the Sultan to provide a larger area for operations, and lights can be strung along the tent’s corners. Many countries do not carry the tent, for tactical reasons (emergency moves are problematic; you either leave the tent behind, spend too much time packing it back up, or drag it behind you).

An electronic warfare (EW) version of the Sultan requires a little more elaboration. This version carries radio detectors and radar detectors, as well as jammers that can jam radios and radars in the frequencies that are most common on the modern battlefield.

In the case of the Samaritan and Sultan, the flotation screen that is erected for amphibious movement is put up only around the sloping front of the vehicle, and takes only 10 minutes to deploy. However, it was found that in practice, the screen did not work very well on those versions due to center-of-gravity issues, and in practice, it is rarely used or even carried.

The Streaker has had an interesting history – it was ordered by the British Army, killed, ordered again, killed, ordered by other countries, and then finally accepted in small numbers by the British Army, both in its basic configuration and as the basis of some other specialist versions (which will not be discussed in this section). Though it was put into production eventually, it was never produced in large numbers. The Streaker is an armored logistics carrier – essentially, a tracked pickup truck, with an armored cab and an open load-carrying area with sides that have light armor, but are not very high. The Streaker's load area has a tailgate and droppable sides so outsized cargoes can be carried; the sides and tailgate can also be propped to stand straight out. At the rear of the cab is a small door for access to the load deck or for ventilation. The Streaker is not normally armed, though the commander's cupola can be equipped with a pintle-mounted weapon, and I have included one in the figures below. The bed has lockable roller, lock-down points, and tie-down points, and can accept most NATO-standard pallets and containers that will fit in the bed. While the rear cargo area is open, the cab is fully enclosed and radiologically-shielded (though not NBC sealed). The driver's position and commander's position are in the same places, with the area behind of then sort-of lopped off. The Streaker has a very high potential speed, hence the name; one internet account of a British Army soldier has the driver putting the vehicle through its paces at maximum speed, while the commander was behind him "getting thrown about and shitting."

The version that the US Marines were studying was to be a light scout vehicle; it was an FV-103 Stormer hull with a turret similar in appearance to that of the LAV-25, but lighter in weight and somewhat smaller in size. These studies were conducted in the early 1980s. The Marines involved in the testing felt that it was an excellent vehicle and were especially impressed with its speed and cross-country mobility, as well as the compact size. The test vehicles had turrets armed with M-242 25mm ChainGuns, coaxial machineguns, a full night vision suite for the gunner and commander with night vision for the driver, and a laser rangefinder and ballistic computer. One of the test vehicles also had a laser designator mounted, and I have used this in the figures below. Instead of the standard Spartan smoke grenade launchers, they had a cluster of four smoke grenade launchers on either side of the turret. Passenger space was greatly reduced, but included enough space for a small dismount team. They used the 195hp Cummins diesel engine. However, the vehicle was not considered to be enough of an asset to warrant large-scale procurement; a particular problem was that the turret made the vehicle top-heavy enough that fording was dangerous. The USMC bought the three test vehicles outright, but retains them in storage; the stats below are therefore presented as a "what-if."

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-103 (205hp Gas)	\$29,740	G, AvG, A	600 kg	8.17 tons	2+8	5	Passive IR (D)	Shielded
FV-103 (195hp Diesel)	\$29,710	D, A	600 kg	8.17 tons	2+8	5	Passive IR (D)	Shielded
FV-103 (250hp Diesel)	\$109,915	D, A	600 kg	8.17 tons	2+8	6	Passive IR (D), Thermal Imaging	Shielded
FV-104 (205hp Gas)	\$34,142	G, AvG, A	600 kg	8.66 tons	*	8	Passive IR (D)	Shielded
FV-104 (195hp Diesel)	\$34,082	D, A	600 kg	8.66 tons	*	8	Passive IR (D)	Shielded
FV-104 (250hp Diesel)	\$114,389	D, A	600 kg	8.66 tons	*	8	Passive IR (D), Thermal Imaging	Shielded
FV-105 (195hp Diesel)	\$213,535	D, A	400 kg	8.66 tons	2+4	9	Passive IR (D)	Shielded
FV-105 (250hp Diesel)	\$293,740	D, A	400 kg	8.66 tons	2+4	10	Passive IR (D), Thermal Imaging	Shielded
FV-105 EW (195hp Diesel)	\$440,185	D, A	300 kg	8.66 tons	2+2	12	Passive IR (D)	Shielded
FV-105 EW (250hp Diesel)	\$520,390	D, A	300 kg	8.66 tons	2+2	13	Passive IR (D), Thermal Imaging	Shielded
Streaker (205hp Gas)	\$20,524	G, AvG, A	3.63 tons	5.45 tons	2+6	3	Passive IR (D)	Shielded (Cab Only)
Streaker (195hp Diesel)	\$20,494	D, A	3.63 tons	5.45 tons	2+6	3	Passive IR (D)	Shielded (Cab Only)

Streaker (250hp Diesel)	\$20,699	D, A	3.63 tons	5.45 tons	2+6	3	Passive IR (D)	Shielded (Cab Only)
FV-103 (USMC Version)	\$235,410	D, A	500 kg	9.33 tons	3+3	9	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV-103 (205hp Gas)	182/127	44/27/4	386	151	Std	T2	HF8 HS3 HR3
FV-103 (195hp Diesel)	174/122	42/26/4	386	107	Std	T2	HF8 HS3 HR3
FV-103 (250 hp Diesel)	212/149	53/33/6	386	138	Std	T2	HF8 HS3 HR3
FV-104 (205hp Gas)	171/119	41/25/4	386	160	Std	T2	HF8 HS3 HR3
FV-104/105 (195hp Diesel)	164/115	40/24/4	386	113	Std	T2	HF8 HS3 HR3
FV-104/105 (250 hp Diesel)	199/140	50/31/6	386	146	Std	T2	HF8 HS3 HR3
Streaker (205hp Gas)	251/176	61/37/6	320	161	Std	T2	HF8 HS3 HR3*
Streaker (195hp Diesel)	240/168	58/36/6	320	114	Std	T2	HF8 HS3 HR3*
Streaker (250 hp Diesel)	297/208	73/46/8	320	146	Std	T2	HF8 HS3 HR3*
FV-103 (USMC Version)	144/100	35/22	386	128	Std	T2	TF5 TS4 TR3 HF8 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV- 103/105/Streaker	None	None	L7A2 (C)	3000x7.62mm
FV-103 (USMC Version)	+2	Good	M-242 25mm ChainGun, M-240D	400x25mm, 1030x7.62mm

*The AV of the load-carrying area is 2 on all sides except the front (which is the rear wall of the cab).

Alvis/BAE FV-432

Notes: In the early 1960s, production of a new range of British armored vehicles, the FV-430 series, began; first issue was in 1962. The APC portion of the FV-430 series was the FV-432. The FV-432 was at first to be called the Trojan; unfortunately, an automobile manufacturer had already registered the name "Trojan" internationally, and the original FV-432 was never given another name (though British troops sometimes referred to it as the "Sloppy Jalopy," referring to its tendency to rust). In form, the FV-432 is a "battle bus," basically an armored box designed to get its troops to battle, but not designed to protect its troops in a full-on fight. The FV-432 is of similar concept to the US M-113, and is in fact a contemporary of the M-113; both entered service at about the same time, and both have had similar longevity in service. For the most part, the FV-432 was used only by the British, but in the 1990s some surplus FV-432 Mk 1/1 and Mk 2s were sold to India, and the British keep some of them on NATO training bases in Canada. It is also a popular vehicle with civilian collectors. Like the Spartan above, the FV-432 was to have been long replaced by the Warrior and specialized versions of the Warrior, but even now in 2017, it still soldiers on in updated versions; the current end of service date is still unspecified, but projected to be well into the 2020s.

The FV-432 Mk 1 & Mk 2

The basic has a driver's compartment on the front left deck; behind him and slightly to the right is the commander's cupola. Depending on the variant, the cupola may or may not have a pintle mount for a light or medium weapon; most of the time this is an L7A2 GPMG, but in the past in second-line or rear-area service (including the Twilight 2000 timeline), a Bren L4 was mounted. Some units adopted the practice of US units in Vietnam – surrounding the commander's cupola with large gun shields. The rear passenger area has a large overhead opening closed by a two-part circular hatch (opening right and left); the passenger area is rather roomy inside compared to the Warrior, Spartan, or other countries' APCs and IFVs, leading some troops to call it "the Hilton." The sides of the passenger compartment have five folding seats. A cluster of three smoke grenade launchers are found on each side of the vehicle at the top of the glacis.

The engine of the original version of the FV-432, the Mk 1, was a Rolls-Royce B-Series 240-horsepower gasoline engine, coupled to a GM TX-200 4A semiautomatic transmission. Though this is not a fully-integrated powerpack, the engine and transmission are

mounted on a common sub-frame and can be removed in one piece. The engine of the FV-432 has always been a sore point; due to the FV-432's weight, an engine with decent horsepower still gives the FV-432 only average power. The engine and crew compartments each have their own automatic fire detection and suppression systems (known as Firewire). Construction is largely of steel; this leads to a vehicle that is rather heavy for its design but the armor is stronger than vehicles made from the aluminum alloy that was available at the time. The tracks are also steel, but with rubber track pads. The FV-432 Mk 1 was designed with amphibious capability, but this requires that a large flotation screen be erected, a trim vane extended, and a bilge pump turned on – an operation that could take up to a half an hour with inexperienced troops. This meant that for the most part, the idea of swimming an FV-432 was discarded, the flotation screen no longer carried, and the bilge pump disabled. Passengers may enter and leave the FV-432 via a large rear door (almost as large as the rear face itself) which has a vision block in it, or a large double hatch in the rear deck. The FV-432 deliberately has no firing ports – it has long been British Army doctrine that troops dismount to fight, and that firing ports are unnecessary. The FV-432 has a collective NBC system, with all crew and passengers able to hook into a central NBC filtration system. This leads to one of the most distinctive features of the FV-432 – the large external NBC filtration pack near the center of the right side under an armored cover.

Though troops have had a number of complaints about the FV-432 and FV-430 series over the years, it has proven to be a rugged and very adaptable vehicle that can fill a variety of roles (underpowered engine notwithstanding) and easy to maintain. (You bring up any subject, and some soldiers will complain about it, anyway...)

A minor variant, the Mk 1/1, primarily dealt with small automotive and electrical problems. The Mk 2 version had a new Rolls-Royce K60 multifuel engine, and a few other mechanical and electrical improvements. Some Mk2s had the commander's station supplemented with a Peak Engineering lightweight turret armed with a single GPMG, giving the position a bit more protection; in such cases the commander's armament was usually removed and the turret controlled by the commander or the infantry squad's leader. (It does not replace the commander's station – it is mounted just ahead of the troop hatches, roughly in the center of the hull deck.) A short-lived version, the Mk 2/1, moved the NBC pack inside of the walls of the vehicle – something that made maintenance more difficult and that the crews objected to.

In Desert Shield, a quick-and-dirty air conditioning system was devised for the FV-432 Mk 1. Before they could be installed, the ground phase of Desert Storm started, and the rapid end of that conflict meant that they were never installed. Air conditioners did not become a part of the FV-432 until Op Telic.

The FV-432 Mk 3 Bulldog

The British Army decided to deploy the FV-432 Iraq as a part of Operation Telic (the British name for Operation Iraqi Freedom). However, it was quickly discovered that the FV-432 needed several updates, particularly in the area of armor protection, and a new engine to tote around the additional armor. Some 124 FV-432 APC versions were so updated to the Mk 3 configuration under the Force Protection Initiative, and the resulting vehicles christened "Bulldog." Initially, only FV-432s and FV-434s were updated, though other FV-430 versions may be added in the future; eventually, somewhere between 500 and 1000 FV-430-series vehicles will be so upgraded, to varying degrees.

The Bulldog is a rather dramatic upgrade from the base FV-432 configuration, and even from the Mk 2. Externally, the upgrade is rather stunning, with appliqué aluminum armor applied to basically every surface of the FV-432, especially the hull floor; on the glacis and hull sides, this appliqué is armor spaced by stand-off bars. The FV-432 upgrade also includes lugs for ERA on the glacis and hull sides. Ahead of the driver and commander's station is a short, wire-cutting mast to keep low-hanging wires from taking the driver's and/or commander's heads off. Alternatively, a conventional GPMG pintle may be mounted, probably surrounded with gun shields. Other improvements include a beefed-up suspension for the crew and troops seats. An increasing number of Bulldogs are equipped with GPS systems as well as extra radio.

The commander's position is sometimes unarmed; this is because the FV-432 Mk 3 may be equipped with a CROWS-type station called the RCWS-30 armed with a light autocannon, a coaxial machinegun, and a pair of ATGM. (This station is designed by Rafael of Israel.) This station is operated by a dedicated gunner, but may also be operated by the squad leader of the infantry squad in the vehicle; the sensors of the station include a telescopic sight, a thermal imager, and an image intensifier. The gunner's station itself is inside the body of the vehicle, connected to the RCWS-30 turret by an LCD panel downlink. A RCWS-30-equipped FV-432 Mk 3 typically has its smoke grenade clusters increased to four each. The Bulldog, when equipped with ERA and the RCWS-30 station, presents an appearance almost unrecognizable as an FV-432.

The engine used in the upgrade is a 260-horsepower diesel engine (though initially the Bulldog retained its 240-horsepower multifuel engine), along with a fully automatic transmission. The former driver's laterals for control of the FV-432 are gone, replaced by a steering yoke and a standard gas pedal and brake pedal. The Bulldog has an air conditioning unit, though it is modular and may be removed if it is deemed unnecessary, such as if a war occurs in cold climates. In the lower hull, the British have taken a page out of the Russian T-90s tech manual and installed a mine/IED electrical jammer; when the jammer encounters a magnetic mine or one with an electrical fuze within 10 meters, the jammer will disable the fuze from operating on a roll 14 or better on a d20. Note that the mine must be in a 20-degree radius of the front of the Bulldog. The jammer device is also not a mine *detector* – if the device does not detonate the mine and the mine does not actually go off, the Bulldog's crew will not know that the mine is there.

An Unusual Variant: The FV-432/30

The FV-432/30 was originally designed as a vehicle to beef up the fighting power of British troops manning the Berlin Brigade during the Cold War. The FV-432/30 was an FV-432 Mk 2 that was modified by mounting the turret of the Fox armored car, a vehicle

that at the time was slowly being withdrawn from service. Inside the Fox turret, a laser rangefinder was added. The Fox turret essentially replaces the passenger compartment overhead hatch, and the normal commander's position is deleted. As stated, the FV-432/30 was originally used only by the British component of the Berlin Brigade, but was later used by other components of the BAOR. In the late 1980s, the FV-432/30 was retired from active service; they then became surrogate BMP-2s, complete with faux ATGM launchers on the turret, with some based in NATO training bases in Canada and some retained in Britain as OPFOR vehicles. They are maintained, however, as fully functioning vehicles, though there are no plans to put them back into service. Only 13 of these conversions were done.

Other APC Variants

Several APC-type variants of the FV-432 were built; most of these are simply carriers for heavy weapons, but there are also armored ambulance and command post-type versions, as well as a sort of "armored truck" logistics carrier and a communications vehicle. Most of these are now out of service, especially the weapons carriers, as the weapons they carried have been supplanted by more modern weapons. The FV-432 has proven to be quite adaptable, and many of the weapon carrier variants can be converted to one another or back to the APC configuration by the use of simple installation kits.

One of the first of these weapons carriers was equipped with a 120mm Wombat recoilless rifle. In this role, the passenger compartment overhead hatch could not be closed without removal of the Wombat from its mount. In the passenger compartment, bins for ammunition were installed, and the vehicle carried only a gun crew and the vehicle driver and commander. Tools and maintenance equipment for the Wombat were also carried, and racks for the gun crew's personal weapons were also provided. This weapons carrier was later replaced by the Milan carrier detailed in a paragraph below.

Another recoilless rifle carrier used the M-2 Carl Gustav 84mm recoilless rifle. It was essentially the same as the Wombat carrier above, except for the armament and the ammunition storage. It too was replaced by the Milan team carrier.

That Milan team carrier is designed to carry a pair of Milan ATGM teams, their ground mount equipment, maintenance and testing equipment, and as many missiles as possible. It's actually rather cramped inside the passenger compartment due to the amount of missiles it carries. Though one could set up a Milan ground mount atop the FV-432, it would be a slippery mount, as there are no actual external mounts for the Milan launcher; the teams are meant to leave the FV-432 to deploy their missiles, and the FV-432 is basically a truck to carry around reloads. The commander's position is retained, and the interior is modified to carry the missile racks, but it's otherwise an FV-432.

The FV-432 was also used as a logistics carrier – an armored truck. This version is simply a standard FV-432 Mk 1 or Mk 2 (I haven't been able to determine whether Mk 3s are being used this way), but the seats are folded up and secured, and some tie-downs and locking points installed for boxes, containers, pallets, etc. These are identical to standard Mk 1s and Mk 2s for game purposes, except that they generally carry supplies instead of troops. In fact, such an FV-432 may simply be a standard FV-432 APC that the logistics personnel packed a bunch of supplies into for transport to more forward areas.

The FV-432 ambulance (Mk 1, Mk 2, and Mk 3 versions were made) is a standard FV-432 APC, but modified to carry medical supplies, personnel, and casualties. The FV-432 ambulance may carry up to four stretcher-borne patients, two stretcher-borne patients and five seated patients, or one stretcher-borne patient, five seated patients, and boxes or lockers with extra medical supplies. Normally, the driver and commander are also the medics, but sometimes a third medic is carried, and the figures below reflect that. The vehicle has heating (and later air conditioning) for casualty comfort, a small refrigerator for perishable medical supplies, a small heater for blankets to treat hypothermic patients or to heat medical supplies (some sources on the Web also say it makes a decent bread toaster), and two sets of oxygen treatment units. Later, defibrillator units were added. These vehicles are normally unarmed except for the crew's personal weapons.

A command version of the FV-432 was developed. The basic form of the FV-432 was not modified for this role, but a superstructure a little over a meter tall was attached to the top of vehicle around the area of the large overhead hatch (though the superstructure is square and somewhat larger than the hatch). Lockdown points inside the superstructure were provided to allow the overhead hatches to be locked open. This superstructure, commonly called a "penthouse" by British troops, allowed passengers to stand upright in the hatch and still be protected, and also to stop light leaks but still be able to keep the interior lights on. It also provided a small amount of extra storage space around the edges of the superstructure interior. The command post variant was also used (in a different interior configuration) as an FDC. Like most such vehicles, it has a map board and various supplies for making notations, writing messages, and plotting battlefield locations; the price below also includes a hand-held image intensifier, thermal imager, and four sets of binoculars. A hand-held laser rangefinder is also included in the price, as is a rugged laptop computer and one short-range, two medium-range, and two long-range radios with data receipt/transmission capability for one of the medium-range radios. (The computer and data radio are not included with the Mk 1 version, nor is a thermal imager; the Mk 1 version includes two image intensifiers.)

Some interesting notes include that an FV-432, modified to look like a Sturmgeschütz III, was used in the HBO miniseries *Band of Brothers*. In Game Workshop's game Warhammer 40,000, a model of an FV-432 was modified into the model of the Rhino Tank. In the last scenes of *V for Vendetta*, FV-432s appear amongst the security vehicles defending Parliament.

Twilight 2000 Notes: In the Twilight 2000 timeline, the Mk 3 does not exist (in any form). The FV-432/30 was modified in larger numbers; some of them had new-built turrets, and a total of 38 were so modified for use in Europe, with another 22 used in the Persian Gulf. FV-432s that were formerly used for training purposes in Canada were "impounded" for use by the Canadians. The

Indians never received any FV-432s in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-432 Mk 1	\$48,925	G, A	1.54 tons	15.3 tons	2+10	8	Passive IR (D)	Enclosed
FV-432 Mk 2	\$50,925	D, G, A	1.54 tons	15.3 tons	2+10	8	Passive IR (D)	Shielded
FV-432 Mk 2 (Turreted)	\$51,435	D, G, A	1.34 tons	15.5 tons	3+10	8	Passive IR (D)	Shielded
FV-432 Mk 3	\$43,633	D, A	1.2 tons	16.8 tons	2+10	8	Passive IR (D)	Shielded
FV-432 Mk 3 w/RCWS-30	\$159,135	D, A	1.1 tons	17.2 tons	3+8	10	Passive IR (D, G), Thermal Imaging (G), Image Intensification (G)	Shielded
FV-432/30	\$179,532	D, G, A	1 ton	18 tons	3+6	11	Passive IR (D, G, C)	Shielded
FV-432 Mk 2 Wombat Carrier	\$66,625	D, G, A	400 kg	15.2 tons	5	8	Passive IR (D)	Shielded
FV-432 Mk 2 M-2 Carrier	\$63,713	D, G, A	400 kg	15.2 tons	5	8	Passive IR (D)	Shielded
FV-432 Milan Carrier	\$183,640	D, G, A	400 kg	15.5 tons	2+4	8	Passive IR (D)	Shielded
FV-432 Mk 1 Ambulance	\$56,264	G, A	1.54 tons	15.3 tons	***	9	Passive IR (D)	Shielded
FV-432 Mk 2 Ambulance	\$58,264	D, G, A	1.54 tons	15.3 tons	***	9	Passive IR (D)	Shielded
FV-432 Mk 3 Ambulance	\$50,178	D, A	1.2 tons	16.8 tons	***	9	Passive IR (D)	Shielded
FV-432 Mk 1 CPV	\$146,755	G, A	1 ton	16.2 tons	2+5	10	Passive IR (D)	Enclosed
FV-432 Mk 2 CPV	\$267,800	D, G, A	1 ton	16.2 tons	2+5	10	Passive IR (D)	Shielded
FV-432 Mk 3 CPV	\$289,013	D, A	1 ton	17.8 tons	2+5	9	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV-432 Mk 1/Ambulance	113/79	28/17/2	454	134	Std	T2	HF6 HS4 HR3
FV-432 Mk 2/Wombat Carrier/M-2 Carrier/Ambulance	113/79	28/17/2	454	100	Std	T2	HF6 HS4 HR3
FV-432 (Turreted)/Milan Carrier	113/79	28/17/2	454	100	Std	T2	TF2 TS2 TR2 HF6 HS4 HR3
FV-432 Mk 3/Ambulance	107/75	26/16	454	128	Std	T3	HF8Sp HS6Sp HR4*
FV-432 Mk 3 w/RCWS-30	105/74	25/16	454	131	Std	T3	TF2 TS2 TR2 HF8Sp HS6Sp HR4*
FV-432 Mk 2/30	97/68	24/14	454	118	Std	T2	TF5 TS3 TR2 HF6 HS4 HR3
FV-432 Mk 1 CPV	106/74	26/16/2	454	142	Std	T2	HF6 HS4 HR3
FV-432 Mk 2 CPV	106/74	26/16/2	454	106	Std	T2	HF6 HS4 HR3
FV-432 Mk 3 CPV	101/71	24/15	454	136	Std	T3	HF8Sp HS6Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV-432/CPV	None	None	L7A2 (C) or Bren L4**	1600x7.62mm (belted) or 1500x7.62mm (in 50x30-round Bren magazines)
FV-432	+1	None	L37A1	1600x7.62mm

(Turreted)				
FV-432 Mk 3 w/RCWS-30	+3	Fair	30mm ATK Mk 44, L7A2, 2xJavelin ATGM Launchers	300x30mm, 1000x7.62mm, 2xJavelin ATGM
FV-432/30	+3	Basic	30mm Rarden, EX-34	200x30mm, 3000x7.62mm
FV-432 Mk 2 Wombat Carrier	None	None	120mm Wombat Recoilless Rifle, L7A2 (C)	20x120mm, 100x.50 Spotting Rounds, 1600x7.62mm
FV-432 Mk 2 M- 2 Carrier	None	None	84mm M-2 Recoilless Rifle, L7A2 (C)	32x84mm, 1600x7.62mm
FV-432 Milan Carrier	None	None	2xMilan ATGMs, L7A2 (C)	24xMilan ATGM, 1600x7.62mm

*Hull floor AV is 4.

**Brens are not found on FV-432s after 2000.

***See notes in description.

Alvis/BAE FV-510 Warrior

Notes: The Warrior ICV was the result of General Staff Requirement 3533, which called for the general modernization of British Army vehicles, and as much consolidation of designs as possible. The initial contract for the MCV-80, which later became the FV-510 Warrior, was awarded to GKN Sankey in the early 1970s (Sankey was soon thereafter bought out by Alvis, which was later bought by BAE). Primarily to a tight budget, development was slow; the final contract and flow of money did not start until 1980s, and first deliveries of the Warrior did not begin until 1986. Another reason for the lengthy development was the British Army itself, who seemed not be able to decide what it wanted from the MCV-80 project – originally, the MCV-80 was to be much heavier and equipped with Chobham armor on its glacis, then they wanted an ATGM launcher to be added, some wanted light SAM launchers as well, then decided that all that would be too expensive and heavy. The British Army then did a 180-degree turn and wanted something light in weight and armament (and cost), then finally settled on a compromise of sorts. The Warrior was exclusively a British-used vehicle until after Desert Storm; Kuwait bought 254 of the version known as the Desert Warrior (see below). The Warrior was planned from the start as a family of vehicles, though not all of the potential variants have been manufactured or gotten off the drawing board.

The FV-510 Warrior – The Original Version

In most ways, the Warrior is a standard sort of ICV (strictly speaking, the Warrior is not an IFV, as it lacks ATGMs or other means to engage heavy armor or strongpoints). The driver is on the left side of the vehicle, with the engine to his right. The turret has hatches for the commander and gunner, with the commander to the left. Fuel tanks are found in the walls of the passenger compartment, with stowage boxes in the rear and a large bustle rack in the rear of the turret. The passenger compartment is in the rear, and is rather cramped.

Power for the Warrior is provided by Perkins/Rolls-Royce Condor CV8 TCA diesel engine developing 550 horsepower; this is coupled to an Allison X300-4B automatic transmission. (This engine is essentially a smaller version of those used on the Challenger 1 and 2; some parts are actually interchangeable between the Warrior and Challenger engines.) This gives the Warrior the necessary speed to keep up with the Challenger 1 and 2 tanks, a requirement of the original specifications. The suspension can give a bit of a rough ride, but is quite capable over rough terrain. The ride of the Warrior can be a muddy, dusty, dirty one; the design of the suspension unfortunately throws up lots of terrain; and these days most Warriors have extra rubber skirts attached to the fenders, side skirts, and the lower front hull. The powerpack, suspension, electrical system, and armament systems are regarded as very reliable (and not just by the British Army. The fuel tank is made of translucent polyethylene, located in the turret floor, and visible to the turret crew and some of the passengers. It was discovered during Desert Storm that seeing the sloshing of the fuel in the tank actually contributed to motion sickness and most of them have been painted.

The driver is on the left side of the front hull, with a overhead hatch that can be locked open enough for him to see out almost 270 degrees around, but not block the traverse of the turret; it can also be opened straight up to allow the driver to enter and exit through the hatch (but it will block the traverse of the turret. The driver uses a steering yoke and a conventional brake and gas pedal. A little-used design feature is a windshield that can be fitted to the hatch opening when the hatch is open for driving; this seals the hatchway opening but still allows the driver to see out through the partially-opened hatch, and even includes a windshield wiper! Originally, the driver had one wide angle vision block which could be replaced with a night vision block; later, another vision block was added on either side of the front vision block to give the driver a better view when buttoned up. The driver has a seat adjustable for height as well as being able to recline almost totally; though the driver's compartment is cramped, it is conceivable that one could sleep in there.

The passenger compartment had troop seats along the walls of the vehicle. There are no firing ports, keeping with the British doctrine that troops leave the vehicle to fight with the ICV providing fire support. The lack of firing ports also allows for appliqué armor to be readily fitted without worrying about blocking any firing ports or vision blocks, and allows the sides of the passenger compartment to be slightly sloped to increase armor protection. The commander and gunner have a decent view around the vehicle through vision ports. On the rear deck is a large double hatch; the passengers enter and exit through a large power-assisted door on the rear face. The troops in the passenger compartment have use of a pair of rotating periscopes with a magnification of x8. A nice-to-have extra feature in the passenger compartment are a pair of hot plates/water boilers for crew rations and beverages.

Hull armor is of al-welded aluminum, often with appliqué armor plates on the sides and sometimes on the glacis (especially during and after Desert Storm, during deployments to the former Yugoslavia, and during the recent fighting in Iraq). Floor armor is

notoriously thin, something that is being addressed by current upgrades. The turret, on the other hand, is armored in welded steel, and compared to most vehicles of its class, is relatively well armored. (Even compared to the Warrior's hull, the turret is well armored.) On the other hand, it does make the vehicle heavier than it might have been if an aluminum armor turret had been used.

The main armament of the Warrior is the tried-and-true L21 Rarden autocannon, with a coaxial L94A1 (the US EX-34, built by Boeing) machinegun. (Something that seems to have been overlooked is stabilization for the Rarden.) The turret is in the center of the vehicle, somewhat offset to the left to accommodate some equipment stowage (especially a bin for seven LAW-80 rockets and small arms ammunition for the passengers). The commander and gunner have night vision equipment, as well as magnified scopes with magnification channels of x2 and x6. On each side of the turret are a cluster of four smoke grenade launchers. The vehicle has a collective NBC system for the crew and passengers, and this system also shields the airflow to the radios and some other electronic equipment. The Warrior has automatic fire detection and suppression systems, with separate systems for the turret and passenger compartments, the driver's compartment, the engine compartment, and the fuel tanks. In addition, there are a pair of manual handles to actuate the fire extinguishing system. The ammunition is protected by armored bins. On each side of the turret is a cluster of four smoke grenade launchers, normally loaded with visual and IR screening smoke grenades.

Warrior Upgrades

Though the design of the Warrior remained relatively static for a long time, Operations Telic and Herrick (the British parts of the operations in Iraq and Afghanistan) as well as earlier operations as part of IFOR and KFOR in the Former Yugoslavia showed a need for upgrades, and several were proposed, from the incremental to the radical. Upgrades already fitted to the Warrior include the improved Bowman communications system and a Thales thermal imaging system for the gunner. GPS with an inertial navigation backup has also been fitted, along with a laser rangefinder for the armament; these upgrades were a part of the BGTI upgrade program.

Until all of the Warriors had been retrofitted with applique armor, many Warriors were equipped with bar/slat-type armor in the interim. The cage covered the front, sides, and the rear of the vehicle, with the cage covering the door opening with the door. The turret sides and rear were also covered, though the cage for the hull and turret did not rise above the vehicle. The design of the cage did not allow for its use as an equipment-carrying option. The cage was eventually totally replaced by applique, called "Wrap Two."

The current upgrades that have been applied to the have started with the Warrior Capability Sustainment Program (WSCP). Some 643 Warriors are projected to be upgraded by WSCP; 194 will receive additional protection (the Warrior Modular Protection System, or WMPS) and the Warrior Enhanced Electronic Architecture (WEAA). 449 others will also be fitted with a new turret under the Warrior Fightability Lethality Improvement Program (WFLIP). The remainder of the Warrior fleet will receive more incremental improvements such as enhanced communications, improved suspensions, and better electrical systems and night vision equipment.

The basic WSCP upgrades include a modular armor protection system (the WMPS), similar in concept to the different levels of armor protection devised for vehicles such as the now-defunct M-8 Buford Airborne Combat Vehicle and the Stingray 2 light tank. At the lowest levels, the additional protection includes add-on appliqué armor similar to that already used by the Warrior, but with superior protection, and also protection for the turret; an additional layer of titanium plate can be added to the turret roof and hull floor. Lugs for ERA can be attached to the hull sides, glacis, and turret sides for additional protection. At the maximum level of protection, a layer of ceramic composite armor (not as good as Chobham, but better than simple spaced armor) can be added to the hull sides and glacis, and the lugs for ERA moved to the outside of this additional protection layer.

The WEAA adds the absent stabilization to the Rarden autocannon, in both planes of movement. The standard Rarden autocannon is fed by 3-round clips (feasible, as the Rarden's ROF is a very low 90 rpm); this discourages wasteful ammunition use, but is not ideal when volume of fire is necessary. The WEAA converts the Rarden to dual belt feed. The WEAA also adds an up-to-date ballistic computer and an upgraded day/night vision system that gives the Warrior a true hunter/killer capability. Electronic IFF and IR suppression for the engine and exhaust are also added. The WEAA also gives the Warrior a capability that more and more modern combat vehicles have – a battlefield management system that allows the crew to receive digital updates, plot enemy and friendly positions, transmit collected data to higher and lower-echelon units, and monitor the total condition of the vehicle.

The WFLIP will replace the standard Warrior turret with one that, while based on the standard turret to reduce costs and simplify upgrade difficulties, will bring heavier firepower to the Warrior. The increase in firepower is based around the CT-40 CTWS (Case-Telescoped Weapon System). This is a 40mm autocannon developed as a joint venture between France and Britain to equip their next generation of IFVs and reconnaissance vehicles, and is ideal for the WFLIP system as the case-telescoped ammunition takes up less space than the L21A1's ammunition. A single Milan ATGM launcher will also probably be mounted, fired by the commander; it is becoming increasingly possible that the new turret will also give the commander a machinegun on a pintle mount.

As the new armor levels increase the Warrior's weight, the brakes have had to be improved, as has the transmission. A 750-horsepower engine is being considered, but is still just a thought to the British Army; extensive tests have been done, however, so I have included it below.

Nexter has been testing a new BAE/Nexter turret, with twin Javelin launchers. This may eventually filter back to the Warrior, but who knows...

These upgrades were originally to have all been done on all ICV-type Warriors. Later, the MoD decided to go the piecemeal route, to the outrage of the Army and many soldiers.

The Desert Warrior

Desert Warrior, or Fahrīs as it is called in the Kuwaiti Army, is a special version of the FV-510 Warrior, designed for Kuwait. The Desert Warrior is a highly-modified Warrior, with a hull that includes seven firing ports (three on each side, and one in the rear door). Sand shields have been amply provided to keep down the dust signature of the Desert Warrior, and the Desert Warrior has a high-performance air conditioning system. Appliqué armor has been added to the hull sides and glacis, and the hull floor is also more heavily armored. Other refinements include a ration cooker, a small APU (0.07 kw), and personal cleanup supplies. A GPS and mapping system is also provided.

However, the most noticeable difference in the Desert Warrior is the turret – it has been replaced with one based on the LAV-25, but more heavily armored. The primary armament is an M-242 25mm ChainGun, along with a MAG as a coaxial machinegun; the armament has a laser rangefinder and ballistic computer. The commander also has a pintle-mounted weapon. On each side of the turret is a launcher for a TOW II missile, with reloads being carried in the hull. The interior is more cramped, and the Desert Warrior is heavier, but the Desert Warrior has a marked firepower increase and protection factor over the base Warrior.

Recently, the Kuwaitis have indicated that they would be interested in most of the same upgrades that the Warrior is receiving, but retaining their basic turret and using a different autocannon.

The Warrior – The Other APC-Type Variants

The British Army uses three command versions of the Warrior. These versions are externally identical to the FV-510 and have the same weapons fit. However, they are internally quite different; the communications fit is very different and the interior arrangements are also quite different. For game purposes, all three versions are the same. These versions carry one short-range, two medium-range, and two long-range radios, map boards, extra stowage for supplies for plotting friendly and enemy movements, a ruggedized laptop computer, extra lighting, and a set of hand-held vision devices including a thermal imager, an image intensifier, four sets of binoculars, and a laser rangefinder. They typically also have a separate GPS unit installed aboard instead of being built-in. (These are included in the price below, but not otherwise listed.) The electrical system is also a bit more robust, and extra electrical connections are provided for equipment in use. There is a 5kW APU provided for off-engine functioning. An artillery battery command vehicle is of similar concept, but different in its outfitting; for game purposes, it is otherwise the same. The command versions also have double doors at the rear instead of the standard single large door.

Twilight 2000 Notes: The lack of firing points proved to not be critical, as did the lack of amphibious capability, but the lack of heavy weapons was to lead to many tragic losses during the Twilight War, and by 1997, production of the baseline Warrior stopped in favor of the Desert Warrior version, until the production facilities were destroyed in mid-1998 by a nuclear strike. None of the upgraded Warriors made it to the party, but a few (less than 10) operate in England herself. Early versions of Warrior 2000 were drawing board concepts and not even prototypes had been built before the factories were nuked.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Warrior	\$243,097	D, A	1 ton	28 tons	3+7	17	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior w/Cage Armor	\$247,099	D, A	986 kg	28.4 tons	3+7	18	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior w/Appliqué	\$249,659	D, A	966 kg	29 tons	3+7	18	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior w/Appliqué 750 hp Engine	\$250,669	D, A	1.4 tons	29.3 tons	3+7	18	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior (BGTI)	\$373,591	D, A	966 kg	29 tons	3+7	18	Thermal Imaging (G), Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior (WSCP, Basic Armor)	\$445,716	D, A	963 kg	29.1 tons	3+7	18	Thermal Imaging (G, C), Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior (WSCP, LV 1 Appliqué)	\$440,007	D, A	947 kg	29.6 tons	3+7	18	Thermal Imaging (G, C), Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior (WSCP, LV 2 Appliqué)	\$455,836	D, A	901 kg	31.1 tons	3+7	18	Thermal Imaging (G, C), Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior (WFLIP, Basic Armor)	\$592,695	D, A	960 kg	29.2 tons	3+7	20	Thermal Imaging (G, C), Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Warrior (WFLIP, LV 1 Appliqué)	\$703,261	D, A	944 kg	29.7 tons	3+7	21	Thermal Imaging (G, C), Passive IR (D, G, C), Image Intensification (G, C)	Shielded

Warrior (WFLIP, LV 2 Appliqué)	\$705,646	D, A	901 kg	31.2 tons	3+7	21	Thermal Imaging (G, C), Passive IR (D, G, C), Image Intensification (G, C)	Shielded
Desert Warrior	\$312,509	D, A	986 kg	28.5 tons	3+7	20	Thermal Imaging (G), Passive IR (D, G, C)	Shielded
Desert Warrior (Late)	\$503,990	D, A	974 kg	28.84 tons	3+7	21	Thermal Imaging (G), Passive IR (D, G, C)	Shielded
Warrior CPV	\$700,018	D, A	498 kg	28 tons	3+4	18	Thermal Imaging (C), Passive IR (D, G, C), Image Intensification (G, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Warrior/CPV	132/92	33/20	770	282	Trtd	T4	TF12 TS8 TR5 HF11 HS7 HR5*
Warrior w/Cage Armor	130/91	32/19	770	286	Trtd	T4	TF12 TS10Sp TR7Sp HF13Sp HS9Sp HR7Sp*
Warrior w/Appliqué/BGTI/WSCP/WFLIP Basic Armor/CPV	128/89	32/19	770	293	Trtd	T4	TF12 TS8 TR5 HF17Sp HS10Sp HR5*
Warrior w/Appliqué (750 hp Engine)	166/116	46/32	770	262	Trtd	T4	TF12 TS8 TR5 HF17Sp HS10Sp HR5*
Warrior (WSCP/WFLIP, LV 1 Appliqué)	125/87	31/19	770	299	Trtd	T4	TF12 TS9Sp TR6Sp HF19Sp HS11Sp HR6**
Warrior (WSCP/WFLIP, LV 2 Appliqué)	119/83	29/18	770	314	Trtd	T4	TF13Sp TS10Sp TR7Sp HF24Sp HS16Sp HR6***
Desert Warrior	129/31	32/20	770	288	Trtd	T4	TF7 TS7Sp TR5 HF16Sp HF10Sp HR5**
Desert Warrior (Late)	197/137	55/38	770	310	Trtd	T4	TF7 TS7Sp TR5 HF16Sp HF10Sp HR5**
Warrior 2000 (650 hp)	136/114	34/21	770	290	Trtd	T4	TF12Sp TS8Sp TR5Sp HF17Sp HS10Sp HR5****

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Warrior/CPV	+1	Basic	30mm L21A1 Rarden autocannon, L94A1	250x30mm, 2000x7.62mm
Warrior (BGTI)	+2	Basic	30mm L21A1 Rarden autocannon, L94A1	250x30mm, 2000x7.62mm
Warrior (WSCP)	+3	Good	30mm L21A2 Rarden autocannon, L94A1	250x30mm, 2000x7.62mm
Warrior (WFLIP)	+4	Good	40mm CT-40 autocannon, L94A1, L7A2 (C), Milan ATGM launcher	500x40mm CTA, 3000x7.62mm, 4xMilan ATGM
Desert Warrior	+2	Fair	25mm M-242 Chaingun, MAG, 2xTOW II launchers	630x25mm, 1920x7.62mm, 7xTOW II ATGM
Desert Warrior (Late)	+3	Good	30mm Mk 44 Bushmaster II, MAG, MAG (C), 2xTOW II Launchers	525x30mm, 1920x7.62mm, 7xTOW II ATGM

*Hull floor armor for this version is 5.

**Hull floor armor for this version is 6; turret roof armor is 5.

***Hull floor armor for this version is 7; turret roof armor is 5. The spaced armor of the hull sides and hull front is of a special composition and stops 4D6 instead of 2D6 from HE-type rounds; from AP and KE-type rounds, it stops 2D6.

Alvis/BAE FV-4333 Stormer

Notes: The Stormer series is an outgrowth of the CVR(T) series of vehicles, and of the FV-103 Spartan in particular. Development began in the mid-1970s, with the first prototype appearing in 1978, and series production beginning in 1981. The Stormer was designed to supplement the Warrior, and to be a family of vehicles (over 20 variants were planned, and a great deal have been implemented). The Stormer is longer and wider than the Spartan, and a little higher as well. Stormers and their variants are used by Indonesia, Malaysia, and Oman in addition to Britain; in addition, the US Army and Marines both tested them (the Marines under its LAV requirement; the Army as an Airborne/Light Infantry vehicle, particularly in its guise as the Stormer 90; three of differing sorts were actually sold to the US DoD). The Stormer is no longer being sold by BAE, but modifications are still carried out upon request, and the most commonly-needed spare parts are still being made.

The Basic Stormer

The basic version, the FV-4333, is a “basic box” sort of APC equipped with a No. 16 turret that allows the gunner’s machinegun to be aimed and fired from under armor. (In its basic form, not many were actually seen in British service, as they preferred a number of specialist and upgraded forms.) Layout is basically the same as the Spartan, but the commander’s position has a cupola and the squad leader for the passengers has his own hatch along with four wide-angle vision blocks. The driver’s position is at the top left of the glacis, with the commander’s position behind him on the deck and the squad leader’s hatch to the right. The passenger’s compartment is to the rear; despite the larger dimensions of the Stormer, the interior of the Stormer is actually a bit smaller than that of the Spartan. Part of this is due to an increase in armor, part due to larger fuel tanks, and part due to equipment storage and things like the vehicle’s NBC filtration pack being mounted inside the walls of the vehicle instead of on the exterior.

The Spartan is powered by a 250-horsepower Perkins T6.3544 diesel, positioned to the right of the driver, coupled to an Allison T300 automatic transmission that is known for its ease and agility in shifting gears. The engine and transmission as well as some other automotive components are designed as a single integrated powerpack. The driver has one wide-angle vision block, which may be replaced by a night vision block; his hatch opens forward and downward on the glacis, clearing his forward vision block. The driver steers with a yoke and has a conventional brake and gas pedal. Six aluminum, rubber-tired roadwheels are found on each side, with torsion-bar suspension and with hydropneumatic shock absorbers at the first, second, and sixth set of roadwheels, granting a fairly smooth ride. Originally, the Stormer had no return rollers, but later two per side were added. The Stormer is amphibious with preparation (similar to the Spartan, with a floatation screen requiring erection, a trim vane extended, and a bilge pump turned on; time required is 15 minutes). A propeller kit can be retrofitted to the Stormer for amphibious operations, doubling the Stormer’s swimming speed. The tension of the tracks can be set by the driver from his compartment using a hand pump, which connects to a hydraulic ram-type tension adjuster (doing this while the vehicle is in motion is definitely discouraged, as it can easily lead to a thrown track).

Behind the driver, the commander has a cupola surrounded by vision blocks and with a machinegun that can be aimed and fired from under armor. (It’s the same No. 16 cupola that is fitted to most versions of the Spartan.) The vision blocks have no magnification, but the machinegun mount has a dual-channel x1/x10 periscope with an aiming reticule. The commander’s hatch opens to the left; it is large enough and positioned such that it would block the rear deck hatches if the hatch opened to the rear. An optional night vision device can be included in the cupola; it is common enough that I have included it in the stats below. At the top of the glacis on each side of the vehicle are found four-barreled smoke grenade launchers. The squad leader has a simple deck hatch (with the aforementioned vision blocks); this does open to the rear, but only to a point where it is locked in a straight-up position, so as to not block the rear deck hatches. The standard passenger compartment has folding bench seats for four troops down either side of the compartment; they normally enter and exit the vehicle through a large rear hatch which has a single vision block in it. Small equipment lockers are found under the bench seats, and large stowage boxes are found on the sides and at the rear on either side of the door. In keeping with British Army doctrine, there are no firing ports. Over the passenger compartment are a pair of large rectangular hatches; when both are open, all eight troops in the passenger compartment can stand upright in the hatchway. The crew and passengers have a collective NBC system and a heater. Armor is of steel, and an appliqué armor kit is available.

Further options (found mostly on export versions or never bought by any country) include an air conditioner, NBC overpressure system, firing ports (from 2-4 in each side, and up to two in the rear), an automatic fire detection and suppression system, a fully automatic transmission, an inertial navigation system and/or GPS, and various communication system fits.

A minor variant of the Stormer uses a No. 27 cupola for the commander. This cupola is similar to the No. 16, but is fitted with an M-2HB heavy machinegun. On such vehicles, the squad leader’s position usually has a pintle weapon mount. Though not official designations, I have referred to these two versions as the No. 16 and No. 27 versions below.

Variants and mods and changes, oh my! (And these are just the APC-type variants.)

The amount of modifications, variants, prototypes, and other odd ideas for the Stormer approaches those of those M-113; some 25 versions were either produced or proposed. (Mostly proposed, but never achieved any sales; I think that Alvis and BAE tried to come with everything but a lawn-mowing version.) Lots of countries use or used the Stormer, or at least tested them, and it seems that everyone wanted something different. BAE was only too happy to oblige, and come up with some of their own ideas as well to attempt to attract more of the international market.

When the US Marines were looking for a LAV, one of the vehicles they looked at was the Stormer. The Army was also looking at a light airborne combat vehicle, similar in idea to the BMD-2 (in addition to the Scorpion-90 for airborne fire support). This USMC/Army LAV mounted (naturally) the same turret as the LAV-25; the BAE designation was the FVT-800, and that is how I refer to it in the stats below. The smoke grenade launchers are still in clusters of four, but are moved to the sides of the turret. The rear face has a smaller door, but the door has a firing port in it; in addition, the rear face has a drop ramp instead of merely the door. The overhead hatch is eliminated (the turret leaves no room for it), as is the standard cupola and the squad leader’s hatch. Each side of the FVT-800 has three more firing ports; the vehicle was tested both with seats down the center and seats on sides of the passenger compartment. As the engine was the same as that of the standard Stormer, some cited a lack of power; more likely was a “not invented here” attitude that heavily pervaded the US military at the time. A similar idea was then marketed by BAE for international consumption; this version’s houses a 30mm L21A1 Rarden autocannon. The turret has a coaxial machinegun, but is otherwise similar in concept to the FVT-800; it was referred to as the Stormer MICV. The ramp is deleted, with the former large rear door replaced. It appears to have not ever found any customers.

The FVT-900 Stormer IFV was also marketed, but had no known sales other than 12 sold to Malaysia. This version has a Helio

FVT-900 turret (hence the designation) originally mounting a 20mm autocannon and coaxial machinegun. The autocannon was later upgraded to a 25mm model. Each side of the turret has a cluster of five smoke grenade launchers. The overhead hatches on the rear deck are less than half the size of those on the standard Stormer, with four troops able to stand in them while bumping elbows and shoulders. The rear face is the same as that of the original Stormer, with one large door and no ramp, though the rear door has a firing port and each side has three firing ports. The new turret has better night vision than most versions of the Stormer, along with high-magnification day sights. Gun stabilization is better than most Stormers, and a laser rangefinder also helps the situation in later versions of the FVT-900.

The other 13 of the Stormer APCs bought by Malaysia are Stormer TH-1s, which have the commander's cupola replaced by a somewhat larger Rheinmetall TH-1 turret. This turret has a pair of MG-3 machineguns.

The FV-900 was an interesting variant, another that never sold. It was similar to the FVT-800 and FVT-900, but the turret used was a turret like that of the M-2 Bradley, though with less armor protection. An interesting idea, in my mind, and one that may have proven a better concept than the Warrior if it had more power and a mite better armor. Oh well...

In addition, many of the specialized variants of the Spartan had their counterparts in the Spartan. Stormer counterparts to the Samaritan, Sultan, the Sultan EW vehicle were built. A fully enclosed logistics carrier, and the Stormer counterpart to the Streaker – the HMLC (High-Mobility Logistics Carrier) were all built, with only the Stormer command vehicle and the HMLC achieving any measure of success. (The HMLC, in fact, spawned several specialized variants itself.) Most conform to the Spartan variants above, though with updated electronics and equipment, but we'll go into the logistics carrier and HMLC a little more. The logistics carrier is essentially the same as the basic Stormer with a No. 16 turret, but the flooring has rollers, lockdown points, and tie-down points to allow it to carry large bulk cargoes. The seats remain, but are normally folded up. Any number of smaller lockers and bins can be added to the interior.

The HMLC can be mistaken for the Streaker at first glance, but is a bit larger and has more cargo capacity. The commander's position has a pintle mount, but no cupola. Like the Streaker, the rear cargo area has drop sides and a tailgate, and these are low, with no overhead cover. The sides are essentially sheet steel, with the front of the cargo area being the rear of the cab. Both the HMLC and the logistics carrier are equipped with a small crane with a capacity of 1.5 tons to assist with offloading and loading cargo. Indonesia, in particular, fields a decent number of HMLCs (in addition to No. 16 and No. 27 APCs), but Britain's HMLCs are generally further modified into more specialist vehicles.

Twilight 2000 Notes: Perhaps the most common of the variant vehicles used by the British in the Twilight 2000 timeline was the FVT-900, but the other variants were also encountered with regularity by Pact forces. The British basically fielded as many Stormer variants as possible. The US Marines did not pick up the FVT-800, but the US 82nd Airborne Division did field it in small numbers, as did the Belgian Army.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-4333 No. 16	\$50,794	D, A	1.05 tons	12.7 tons	2+9	6	Passive IR (D, C)	Shielded
FV-4333 No. 16 w/Appliqué	\$51,331	D, A	1.02 tons	13.3 tons	2+9	6	Passive IR (D, C)	Shielded
FV-4333 No. 27	\$58,613	D, A	1.05 tons	12.7 tons	2+9	6	Passive IR (D, C)	Shielded
FV-4333 No. 27 w/Appliqué	\$59,150	D, A	1.02 tons	13.3 tons	2+9	6	Passive IR (D, C)	Shielded
FVT-800	\$81,588	D, A	1 ton	13.7 tons	3+6	7	Passive IR (D, G, C)	Shielded
Stormer MICV	\$81,060	D, A	1 ton	13.7 tons	3+6	7	Passive IR (D, G, C)	Shielded
FVT-900	\$100,965	D, A	1 ton	13.4 tons	3+8	7	Image Intensification (G, C), Passive IR (D, G, C)	Shielded
FVT-900 (Modified)	\$204,216	D, A	1 ton	13.4 tons	3+8	7	Image Intensification (G, C), Passive IR (D, G, C)	Shielded
Stormer TH-1	\$56,972	D, A	1.02 tons	12.9 tons	2+8	6	Passive IR (G, C)	Shielded
FV-900	\$251,716	D, A	900 kg	14 tons	3+6	8	Passive IR (D), Thermal Imaging (G, C)	Shielded
Stormer AMV	\$58,413	D, A	1.05 tons	13.5 tons	**	7	Passive IR (D, C)	Shielded
Stormer CPV	\$234,619	D, A	700 kg	13.5 tons	2+5	10	Passive IR (D,	Shielded

Stormer EW	\$431,269	D, A	600 kg	13.5 tons	3+3	13	C) Passive IR (D,	Shielded
HMLC	\$35,095	D, A	4 tons	9.2 tons	2	4	C) Passive IR (D)	Shielded (Cab Only)

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV-4333 No. 16/27	133/93	33/20/2	405	130	Std	T3	HF8 HS4 HR4
FV-4333 No. 16/27	129/90	32/19/2	405	134	Std	T3	HF10 HS6 HR4*
w/Appliqué FVT-800/MICV	125/88	31/18/2	405	138	Trtd	T3	TF6 TS4 TR4 HF8 HS4 HR4
FVT-900	127/89	32/18/2	405	135	Trtd	T3	TF5 TS3 TR3 HF8 HS4 HR4
Stormer TH-1	132/92	33/20/2	405	130	CiH	T3	TF3 TS2 TR2 HF8 HS4 HR4
FV-900			405		Trtd	T3	TF4 TS3 TR3 HF8 HS4 HR4
Stormer AMV/CPV/EW	125/87	31/19/2	405	138	Std	T3	HF8 HS4 HR4
HMLC	184/128	46/28/3	320	94	Std	T3	HF8 HS4 HR4***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV-4333 No. 16/CPV/EW/Logistics	+1	None	L7A2 (C)	3000x7.62mm
FV-4333 No. 27	+1	None	M-2HB (C), L7A2	600x.50, 2000x7.62mm
FVT-800	+1	Basic	25mm M-242 ChainGun, M-240D	630x25mm, 1620x25mm
Stormer MICV	+1	Basic	30mm L21A1 Rarden, L94A1	165x30mm, 1620x7.62mm
FVT-900	+1	Fair	20mm Oerlikon KAA, MG-3	600x20mm, 1600x7.62mm
FVT-900 (Modified)	+2	Fair	25mm Oerlikon KBA, MG-3	500x25mm, 1600x7.62mm
Stormer TH-1	+1	Basic	2xMG-3	3000x7.62mm
FV-900	+1	Fair	25mm M-242 ChainGun, M-240D, 2xTOW II ATGM Launchers	600x25mm, 2000x7.62mm, 7xTOW II ATGM
HMLC	None	None	L7A2 (C)	1500x7.62mm

*Belly armor for this variant is 3.

**Three crew, plus four stretchers, 2 stretchers and 3 seated patients, or 6 seated patients.

***The AV of the load-carrying area is 2 on all sides except the front (which is the rear wall of the cab).

BMP-23/30

Notes: Though the Bulgarians used the BMP-1 IFV for the 1970s and most of the 1980s, they opted to go a different route instead of converting to the BMP-2. Instead of simply buying or license-producing BMP-2s, they opted to produce a new IFV based on the MT-LB chassis instead of the BMP-2. This allowed for armor sloping on the sides as well as the front, and give the crew and passengers a bit more room and amenities, as well as benefitting from the MT-LB's better cross-country performance and suspension. The Bulgarians also mixed in components of the 2S1 Gvodzdika, such as the more powerful engine, and this made up for the generally heavier weight of the BMP-23. The BMP-23 series appears to be used only by Bulgaria; recent deployments include IFOR, KFOR, and a deployment to Iraq. The BMP-23 was first seen in a parade in 1980.

The BMP-23

Though armor is still considered poor, it is much better than its MT-LB base. Armor is simple cast steel, with moderately-sloped sides and belly reinforcement. An automatic fire detection and suppression system is fitted, for the engine, fuel tanks, and ammunition storage as well as for the crew compartments, and these have manual pull-handle backups. On each side of the vehicle are three firing ports, and both of the rear doors also has a firing port. The forward firing port on each side will accept a PK machinegun as well as an AK-type assault rifle; this is also true of the rear firing ports. The engine is mounted well forward in the front of the hull, which helps protect the crewmembers and passengers. 6 smoke grenade launchers are located on the turret roof in a single cluster.

The turret is large for a vehicle of its class, as it is based more on the 2S1 than the BMP-2, and mounts a 23mm autocannon with a coaxial machinegun. Originally, the BMP-23 was also armed with an AT-3 ATGM launcher, but later an AT-4 and even later an AT-5 launcher was mounted instead. (Technically, these later vehicles are designated BMP-23A, and they also have their smoke grenade launchers split into clusters of three on either side of the turret.) The ATGM is aimed and guided by the commander, who must have his head, shoulders, and chest outside the hatch to accomplish this, as the ATGM launcher is mounted beside the commander's hatch. The turret is mounted fairly well back on the hull, and it a two-man turret; the driver is well forward in the hull on the right side. Behind him and to the left is a rectangular hatch which primarily for loading ammunition for the vehicle. The gunner and has magnified day and night vision devices, and the driver can replace his forward vision block with a night vision block. The commander has no night vision devices, except for an IR searchlight which he can use in conjunction with night vision goggles. The passengers have seats down the middle of the compartment, with a separate seat facing to the rear. Two small roof hatches are found in the passenger compartment. The fuel tank is found in the floor of the interior of the passenger compartment, something that would not give me the warm fuzzies. The large size of the passenger compartment allow the troops to carry a lot of ammunition and weapons, basically everything an infantry squad might possibly need, as well as rations, water, and boiling pots and plates.

The engine is a 315-horsepower (some sources say 302 horsepower) YaMZ-238N diesel engine, with a semiautomatic transmission. The BMP-23 is amphibious with little preparation, propelled in the water by its tracks, though a bilge pump must be turned on (requiring only a flip of a switch) and a trim vane must be extended at the front. The trim vane keeps the driver from seeing through his vision blocks, so the driver must be head out of the vehicle or must install an extended-height vision block. Other devices carried by the BMP-23 include a heater, an inertial navigation system, a collective NBC system, a chemical sniffer, a radiation meter, and the ability to lay a smoke screen by injecting diesel into its exhaust.

The BRM-23

The BRM-23 is an armored reconnaissance variant of the standard BMP-23. As such, it mostly conforms to the same specifications as the BMP-23, but is equipped with a number of specialist devices to suit its role. Like most such vehicles, the crew of the BRM-23 may find themselves as much as 100 kilometers in front of the main body of vehicles, acting as their eyes and ears and conducting route reconnaissance. Though not strictly an IFV or APC, it is included here for completeness.

The crew of the BRM-23 consists of the commander, gunner, and driver, plus a dedicated communications specialist and navigator. Up to two other scouts may be carried as the mission and space inside permit. Additional equipment include a hand-held laser rangefinder that can also function as a designator and can be removed from the vehicle and mounted on a tripod, an extra hand-held passive IR device which can also be removed from the vehicle and placed on a tripod, an inertial navigation system which includes mapping computers and a radio modem to allow the BRM-23 to transmit its findings back to higher headquarters at a range of up to 120 km, numerous pivoting periscopes with magnification (one at each regular crew station), and artillery aiming circle mounted as part of the commander's cupola. The BRM-23 has two additional medium-range, two additional long-range radios (one of which has the radio modem), and one additional short-range radio, which is used primarily to communicate with the short-range hand radios carried by the crewmembers. Mine detectors are mounted in the front hull, and one which is hand-held is also carried. More capable chemical and radiation detectors are carried, as well as a detector which has a rudimentary ability to detect biological agents. The BRM-23 has an NBC overpressure system. The number of firing ports are reduced; two are found on the right side and one on the left side, with one in the right rear door. Both the commander and the gunner have night vision devices. At the rear of the BRM-23 is a large folding aerial that provides short-range ground surveillance radar as well as radar and radio detection. Recently, a GPS system has begun to be fitted to the BRM-23 fleet, but large-scale deployment has been beset by budgetary problems.

The BMP-30

Hull-wise, the BMP-30 is virtually identical to the BMP-23; however, the turret is a slightly-enlarged version of the BMP-2's turret, armed with a 30mm autocannon. The BMP-30 version was first observed by the West in 1982, and apparently supplements rather

than replaces the BMP-23. The new autocannon is much-better stabilized and has better fire control equipment than the BMP-23, as well as firing a more effective round. Both the commander and gunner have night vision devices, but range is limited to 400 meters. The ATGM used on the BMP-30 is either an AT-4 or AT-5; the AT-3 is not used with the BMP-30. The smoke grenade launchers are moved to either side of the turret, with three on each side. The roadwheels are lighter models, and the entire suspension, though offering a smoother ride, is likewise lighter than the BMP-23s suspension. Otherwise, the specifications of the BMP-23 apply to the BMP-30.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BMP-23	\$103,993	D, A	2 tons	15.2 tons	3+7	9	Passive IR (D, G), Image Intensification (G)	Shielded
BRM-23	\$423,993	D, A	600 kg	15.7 tons	5+2	12	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
BMP-30	\$135,704	D, A	2 tons	15 tons	3+7	9	Passive IR (D, G, C), Image Intensification (G, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
BMP-23	135/95	33/20/2	560	158	Trtd	T3	TF6 TS6 TR4 HF8 HS5 HR3*
BRM-23	131/92	32/19/2	560	163	Trtd	T3	TF6 TS6 TR4 HF8 HS5 HR3*
BMP-30	136/95	33/20/2	560	156	Trtd	T3	TF10 TS6 TR6 HF8 HS5 HR3*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BMP-23/BRM-23	+1	Fair	23mm 2A14 Autocannon, PKT, AT-3, AT-4, or AT-5 Launcher	600x23mm, 2000x7.62mm, 4xAT-3, AT-4, or AT-5 ATGM
BMP-30	+1	Fair	30mm 2A46 Autocannon, PKT, AT-4 or AT-5 Launcher	1000x30mm, 2000x7.62mm, 4xAT-4 or AT-5 ATGM

*Floor and deck (turret and hull) armor is 3.

Norinco Type 63

Notes: The Type 63 is the first Chinese armored vehicle that was built without any Soviet assistance. The Chinese ended up with a vehicle that, while it does not resemble them, has about the same capabilities of contemporaries such as the US M-113 and the British FV-432. Some 3000 were produced by the Chinese for the Chinese, and several countries also had licenses to build them; all in all, some 15 countries use or used them, and they can be found almost everywhere except the Western hemisphere (though they can also be found operationally in small numbers at the NTC in California and the JRTC in Arkansas and Louisiana). Like many Chinese vehicles, the Type 63 was planned as a family of related armored vehicles, with over 10 versions planned or built. The Type 63 is also called the A-531, YW-531 (its Norinco designation), the ZSD-63 (the PLA designation), the A-63 (the Vietnamese designation), and the VTT-323 (the North Korean designation, though this also has a few differences from the standard Type 63). Other designations include the earlier NATO reporting designations of M-1967, or M-1970 for later versions.

The Type 63 APC

The standard Type 63 is a "basic box" type of APC, essentially a battlefield taxi, designed to get troops to the battlefield in reasonable safety instead of being a fighting platform. Armor is notably thin, and it is critically susceptible to mines and overhead hits. Initial operational prototypes appeared in 1963, and series production began in 1964; however, service use revealed numerous deficiencies, particularly in the area of reliability, and widespread issue did not begin until 1970. Construction is of welded steel. With a sharply-sloped glacis and moderately-sloped sides, armor protection is improved despite the lack of thickness of the plating itself. Initial versions were not amphibious, though this was added in later with the advent of the Type 63C. The driver is on the front left, with a commander's hatch on the right front and a gunner's position in the center of the passenger compartment. The driver has three vision blocks ahead of him; initially, no night vision capability was provided, though toward the end of its production run, provision was made to remove and replace the front vision block with a night vision block. The gunner may be a dedicated crewmember, or the squad leader of the infantry in the rear; up to 15 troops are meant to be jammed into the Type 63, though it seems to me that some may be sitting in each others' laps. The commander and gunner's positions have cupolas which hand-rotate and have all-around vision blocks with no provision for night vision. The gunner's position has a pintle-mounted machinegun and almost never is found with gun shields (they would take up too much room). The commander's position also has a pintle mount for a light weapon. Behind the driver is another hatch, more for observation by passengers than anything else. At the rear are a pair of long, narrow hatches for use by standing passengers. Suspension is by simple torsion bars and is said to be rather rough. The engine of the initial versions is a Type 6150L 260-horsepower diesel, making the Type 63 a bit underpowered, and the transmission is manual and difficult to change gears. Four rubber-tired roadwheels are found on each side; they are large, and no return rollers are used.

The initial version, produced only in small numbers, had a Type 56 (PKM) as a gunner's weapon. The Type 63A was then requested by the PLA, which had the change of having a heavier machinegun as a gunner's weapon. (Thai versions use an M-2HB instead of a DShK.) The North Korean VTT-323 is based on the Type 63A. Initial operational use revealed the poor suspension, and this was considerably beefed-up and the ride smoothed out somewhat. This version, the Type 63-I, also had a pair of small circular roof hatches on either side of the gunner's position and two firing ports on each side as well as one in the rear door, and also adds a heater for the crew compartment. This version is also called the B-531, and less commonly, the Type 63B. The Type 63C is identical, but with the addition of a trim vane and bilge pump for amphibious operations. Water propulsion is by motion of the tracks.

Later, the Type 81 version was produced. This model has the commander's position moved to the left of the vehicle and the left-side position deleted, to make room for a 320-horsepower turbocharged KHD BF8L engine and a matching transmission. The new commander's position has no pintle mount for a weapon, but does have a rotating cupola. The Type 81 version was designed for export and is not used by the PLA; Thailand is known to use some of them, and other export sales have also probably been made. A Type 89D version was also produced; this is identical, but only has one firing port per side (though it still has two vision blocks per side). The Type 89E is also the same as the Type 81, but is equipped with an additional radio. Export versions of the Type 81 were built as ACVs and armored ambulances as well. The commander's machinegun of the ACV version is typically lighter than the corresponding Type 63 variant.

The VTT-323

The North Korean Sinhung VTT-323, known to the West as the M-1973, is a based license-built copy of the Type 63A. The VTT-323 is a bit more than a meter longer than the Type 63; this allows for the mounting of a Susong-Po ATGM (North Korean copy of the AT-3 Sagger), along with some reload missiles, and a mounted SA-7 or SA-16 SAM launcher, along with some reload missiles for that launcher. These launchers are on either side of the gunner's position. A full infantry squad can also be carried, though things do get a bit cramped inside. Though standard Type 63As are used by the PRK, the standard North Korean APC is the VTT-323.

Other APC-Type Type 63s

Other than these standard APC-types, the Type 63 had a number of versions built for more specialized roles. The Type 63 Armored Command Vehicle, ACV, or WZ-701, or the Norinco designation, the YW-701A, is similar to other such vehicles in that it has a raised roofline. This version is generally fitted with at least one short-range, two medium-range, and two-long-range radios; later, when radios were being built smaller, some were also fitted with a teletype machine. These vehicles also had the usual equipment for a command vehicle: a map board, various office and plotting supplies, less bench seats and suchlike. Several variations of this basic idea were produced, such as the WZ-721 communications relay vehicle and the ZZM-88 cryptographic communications vehicle, equipped with various radios and computers for the dissemination of codes for other radios in the net. The ACV version typically

carries a pair of hand-held passive IR viewers, an image intensifier, and a laser rangefinder for the command staff to use. The commander's cupola also has an artillery plotting circle inscribed on it. These versions typically carry a 5kW generator on the roof to power the electronics and the heater when the vehicle is switched off. The commander's machinegun is typically lighter than on an APC version of the Type 63.

An armored ambulance version was built, able to carry four stretcher cases, two stretcher cases and four sitting casualties, or eight sitting casualties. This version has a small refrigerator for perishable medical supplies, two hot plates, and the equivalent of four doctor's medical bags and 20 personal medical kits as medical supplies. It is unarmed. This version also has a raised roofline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 63	\$21,000	D, A	1.1 tons	12.6 tons	3+12	9	Headlights	Enclosed
Type 63A/Type 63-I	\$23,792	D, A	1.1 tons	12.6 tons	3+12	9	Headlights	Enclosed
Type 63C	\$34,792	D, A	1.1 tons	12.6 tons	3+12	9	Passive IR (D)	Enclosed
Type 81	\$35,392	D, A	1.1 tons	12.8 tons	3+12	9	Passive IR (D)	Enclosed
WZ-701	\$170,932	D, A	600 kg	14 tons	2+6	11	Passive IR (D)	Enclosed
Type 81 ACV	\$52,740	D, A	600 kg	14.2 tons	2+6	11	Passive IR (D)	Enclosed
Type 63 Ambulance	\$43,966	D, A	835 kg	12.8 tons	*	10	Passive IR (D)	Enclosed
Type 81 Ambulance	\$44,724	D, A	835 kg	13 tons	*	10	Passive IR (D)	Enclosed
VTT-323	\$63,527	D, A	900 kg	12.9 tons	3+10	10	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 63/Type 63A/Type 63-I	131/92	32/20	450	109	Std	T3	HF6 HS3 HR2
Type 63C	131/92	32/20/3	450	109	Std	T3	HF6 HS3 HR2
Type 81	154/108	38/24/4	450	170	Std	T3	HF6 HS3 HR2
WZ-701	119/84	29/18/3	450	120	Std	T3	HF6 HS3 HR2
Type 81 ACV	140/98	35/22/4	450	187	Std	T3	HF6 HS3 HR2
Type 63 Ambulance	128/90	31/20/3	450	111	Std	T3	HF6 HS3 HR2
Type 81 Ambulance	151/106	37/24/4	450	173	Std	T3	HF6 HS3 HR2
VTT-323	129/90	31/20	450	111	Std	T3	HF6 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 63	None	None	PK (C)	2000x7.62mm
Type 63/Type 63-I/Type 63C/WZ-701	None	None	DShK (C)	1120x12.7mm
Type 81 ACV	None	None	PK (C)	2000x7.62mm
VTT-323	None	None	DShK (C), AT-3 ATGM Launcher, SA-7 or SA-16 SAM Launcher	1000x12.7mm, 4xAT-3 ATGM, 2xSA-7 or SA-16

*See Notes above.

Norinco Type 77

Notes: The Type 77 was originally to be a Chinese copy of the Russian BTR-50PK, but China made various improvements, modifications, and alterations not only to make it better suited to Chinese manufacture methods and service, but to give it capabilities the BTR-50PK did not have. Other than China, Albania is the only known user; both countries are in the process or replacing the Type 77, but both still have them in service. Design work began around 1978, and it was produced during the first half of the 1980s.

For the most part, details of the Type 77 conform to the BTR-50PK. Differences include the all-welded steel hull, with almost no rivets to fly around the interior upon a hit. The Type 77 supposedly has a smoother ride (though sources differ on this, most say it does have a better ride). I tend to doubt this, as the Type 77 has a conventional torsion bar suspension with no special provisions for shock absorption; it can't be all that different from that of the BTR-50PK. There are no return rollers; the large roadwheels are rubber-tired. The commander has a cupola on the right side of the vehicle; he has vision blocks that allow him to see to the front and to a limited extent, to the sides; the vision blocks are quite small and he cannot see much when buttoned up. He has a pintle mount for a weapon, normally a Type 56 Heavy Machinegun (the Chinese copy of the DShK). His position projects forward of the main hull. The commander's position is often found with gun shields that may extend completely around the cupola, but this is not a standard installation. The driver is on the left side of the hull with forward vision blocks. In the sides of the hull, in the raised part of hull in the

forward half of the rear compartment, on the right side, is a hatch which is primarily for loading and unloading of equipment and supplies, but are also large enough to allow crew and passenger access. The lower rear part of the passenger compartment has a pair of large hatches, though they cover only a little over half of this rear section. In the rear face is a large door for ingress and egress. In the raised part of the passenger compartment are three firing ports, one on the right side and two on the left. The rear door has a vision block, but no firing port. Atop the raised portion of the passenger compartment, at the front left, is a white-light searchlight which is steerable from under armor by either the crew or the commander. The Type 77 is amphibious with a minimum of preparation (turning on a bilge pump and erection of a trim vane, and is propelled in the water by waterjets. The engine, a Type 12150L-2A 400-horsepower diesel, is more powerful to that fitted to the BTR-50PK, giving it an increase in speed and agility; this is also aided by wider tracks. Nonetheless, the Type 77 is still The Type 77 also has a fairly low center of gravity, giving it added stability in rough terrain.

There are two primary and several minor variants of the Type 77; only the second of the primary variant will be tackled here in detail. The first version is a field gun or howitzer carrier; I say carrier because when the guns are being transported, they are carried atop the Type 77 and locked down. The guns which may be carried are an 85mm antitank gun or a 122mm field howitzer, as well as ramps for the gun. The gun is removed from the vehicle and emplaced before firing. In this case, the version is the Type 77-1, and the interior is stocked with racks for ammunition, seats for the gun crew, and their equipment for the gun and items.

The Type 77-2 is the APC variant. This version has room for an astounding 16 passengers as well as the two-man crew. The sit on fold-up seats, and the rear door, while it can cause a bottleneck, allows for rather fast egress. A weak point of the Type 77-2 is armor protection, though at least you don't have to hump it all the time. There is no overpressure or even a collective NBC system. Fire extinguishing requires pulling manual handles, and the fuel tanks are in the walls of the lower part of the passenger compartment. The overhead hatches allow for eight of the troops to stand and fight in them if you're being nice, or twelve if you want to be more cramped. It's a "basic box" type of APC.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$241,581	D, A	1.2 tons	15.5 tons	2+16	6	WL/IR Searchlight	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
180/126	44/27/4	416	169	Std	T3	HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	DShK(C)	500x12.7mm

Norinco Type 85

Notes: The Type 85 was developed from the old Type 63, and itself was later developed into the Type 89. It is also called by its Chinese Army designation, the ZSD-85, and its Norinco designation, the YW-531H. Though developed from the Type 63, the Type 85 is in appearance and performance much different than the Type 63. The Type 85 was developed in tandem with the Type 89; the Type 85 was meant for export, while the Type 89 was designed primarily for PLA service. The primary user of the Type 85 is, in fact, the Thai Army and not the Chinese. The Thai Army began use of the Type 85 in 1987; production continued until 1990, when it was superseded, even in export use, by the Type 89 and later, the Type 90.

In layout, the Type 85 is virtually identical to the Type 89, with the driver on the front left and having three vision blocks to the front. The center block can be removed and replaced with a night vision block. The hull is of welded steel, with a sharply-sloped glacis and mildly-sloped sides. To the right of the driver is the engine. Behind the driver is the commander's cupola; this cupola is unarmed, but has all-around vision blocks. To the rear and right of the commander is a gunner's cupola with a pintle-mounted weapon. The rear passenger compartment has fold-up bench seats and can literally be crammed full of troops; up to 13 passengers can be accommodated, though most countries use a 10-man infantry squad. The troops enter and exit through a large door in the rear face.

Type 85 and 89 APC

The Type 85 and Type 89 look much like a larger, stretched version of the Type 63 APC. The Type 89 can also be easily mistaken for the Type 85, and is essentially a slightly larger version of the Type 85. The front armor is sharply-sloped, and the side armor is moderately-sloped, providing good armor protection in relation to the thickness of the armor. The engine is at the front left, with the driver to the right of it; his hatch opens to the left, and he has three vision blocks to the front. The center block can be removed and replaced with a night vision block. The commander is to the rear of the driver. He has a cupola that gives him all-around vision, but no night vision. The Type 89's weapon is pintle-mounted and on a third hatch opening, usually manned by the commander of the troops in the rear or a dedicated gunner. This gunner of the Type 89 also has a rotating cupola and protection is almost always seen around the gunner's cupola in the form of thick (AV2) gun shields, but no overhead protection. The Type 85's gunner's station normally does not have these gun shields, though some vehicles have been seen with them. On either side of the hull front, about halfway down the glacis and to the sides, are a cluster of four smoke grenade launchers. The passenger's compartment is roomy compared to most APCs, but that seems to mean that the Chinese simply cram more troops into it. (Most other armies do not shove so many troops into their Type 85s and Type 89s; for example, the Type 85s of the Thai Army normally carry 10-man squads.) The passengers enter and exit through a large door in the rear, which has a firing port; there is also a hatch atop the rear of the passenger compartment which opens to the rear. In addition, two small circular hatches are found near the front of the passenger compartment (though these have no vision blocks; they are just simple hatches). The passenger compartment has four vision blocks on the right

side and three to the left, but the each side has only three firing ports. (Some Type 89s have been seen with this situation reversed – four vision blocks on the left and three on the right. The reason for this is unknown.) The Type 85 and 89 have a collective NBC system for the crew and passengers, as well as an automatic fire detection and suppression system for the crew compartment, passenger compartment, engine compartment, and fuel tanks. Vision blocks for the Type 89 are fitted with defoggers for use in cold conditions, a rarity on military vehicles.

The Type 85 and 89's engine is German-designed and license-built, a BF8L413F 320-horsepower turbocharged diesel. Both can be equipped with external fuel tanks for long-range operations in addition to its internal fuel; these are mounted at the rear. The Type 85 and 89 are amphibious with a minimum of preparation – a trim vane must be erected at the front of the vehicle. The roadwheels of the Type 89 have an uneven distribution, with a gap between the third and fourth roadwheels (of the five roadwheels present); the roadwheel distribution of the Type 85 is even. The Type 85 has a bit less armor protection and is a bit smaller in size – but this makes it an overall lighter vehicle, giving it better speed and agility than the Type 89. Thai Type 85s use the M-2HB heavy machinegun instead of the W-85 as main armament, but are otherwise identical to the standard Type 85 (other than the ammunition they use, .50 BMG instead of 12.7mm).

The ZSD-85 IFV

The ZSD-85 (also Type 85 IFV or YW-309) is the Type 85 with the turret and commander's position replaced with the complete turret of the WZ-501 IFV (a Chinese near-copy of the BMP-1). This gives the ZSD-85 enormous firepower and though is much heavier than the Type 85 APC, still has decent performance and agility. The WZ-501 turret not only gives the ZSD-85 a 73mm cannon, but a coaxial machinegun and a launcher above the main gun's barrel for HJ-73 (Red Arrow-73) ATGMs. (One prototype is armed with an HJ-8 launcher to the side of the commander's station instead, but was not proceeded further with.) The inclusion of the turret does considerably reduce the number of troops that can be carried in the rear, however, as much room is taken up by the turret and ammunition. Each side of the turret has a pair of smoke grenade launchers. The Chinese did not bite, as they already had the WZ-501 in service, and so far, no known other countries have bitten either, though it is rumored that both North Korea and Iran may have some in service.

The ZSD-90 IFV

The ZSD-90, also called the YW-307 or Type 307, is a variant of the Type 89 shopped around by Norinco. This version replaces the gunner's position with a small turret with an externally-mounted 25mm KBA autocannon. This greatly increased firepower, but also drastically increased the weight of the vehicle. The Chinese felt that the increase in firepower was unnecessary and the increase in weight unacceptable, and chose not to accept the ZSD-90 into service. The design is otherwise the same as the Type 89, though passenger capacity is greatly reduced by the turret and ammunition stowage for its weapons.

The Type 90 APC

The Type 90 APC (not to be confused with the ZSD-90; it's Norinco designation is YW-535) is a slight upgrade of the Type 89; it has a similar basic hull design to the Type 89, and like the Type 89, was designed as part of a large family of related vehicles. Many of these versions remained unbuilt, as the Type 90 did not have the increase in performance and capabilities that the PLA hoped for, and was seen as unnecessary duplication of effort. The Type 90 was therefore offered up for export. The Type 90 is larger than the Type 89, but not a lot heavier; however, the automotive components and suspension are essentially the same. Likewise, the layout is almost identical to that of the Type 89. Perhaps the biggest difference is the gunner's station – the weapon is housed in a small turret instead of being on a pintle mount. This turret, however, has no provision for night vision. The hull sides are vertical instead of the moderate sloping on the Type 89. The additional vision block on the right side has been eliminated. It is not known for certain how many export sales of the Type 90 were made – the UN says none were made between 1992 and 2005 except to Iran, and it is unknown if or how many have been made since 2005. (Iran calls the Type 90 APC the Boraq, sometimes written as "Boragh," and it differs primarily in the radios that are used and the markings of vehicle components and instruments.)

The Type 91

The Type 91 APC is a minor variant of Type 90, differing primarily in the use of a license-built version of the German BF8L513C 360-horsepower turbocharged diesel engine and a matching transmission which is simply a slight modification of that used in the Type 90 APC (it has a new hydraulic gearbox). It otherwise conforms to the design of the Type 90 APC. So far, the only known exports of the Type 91 APC have been the 55 sold to Myanmar.

There is also a Type 91 IFV; this version has a turret which looks similar to that of the BMP-2 on the outside, though it has no ATGM launcher. In this turret can be mounted a 23mm, 25mm, or 30mm autocannon, and a coaxial machinegun. The Type 91 IFV is longer than the Type 91 APC, with six roadwheels per side; this allows it to carry more troops but also increases its weight considerably. No known sales have been made or the Type 91 IFV.

The Type 97

The Type 97 (PLA designation ZBD-97) may or may not be a part of the extended Type 85 family – the hull certainly looks like a lengthened Type 85 hull (with six roadwheels per side), and the very few interior shots I've seen look quite similar to those of the Type 85. The Chinese, on the other hand, appear to have gotten the idea of the turret from the Russians; it's a bit smaller than a BMP-3 turret (but not much), and carries the same armament. The Type 97 started development in the mid-1990s, but operational examples

were not seen until a parade in Beijing in 2003, and large scale deployment does not appear to have started until 2006.

On the other hand, the addition of what is still a much larger turret than other Type 85 IFV-type vehicles does not make for a cramped interior, and unlike the BMP-3, the engine is at the front of the vehicle instead of at the rear. The rear passenger compartment is like most Type 85s in basic layout, but carries only six troops – the squad leader sits in the front hull to the left of the driver (though he has direct access to the rear passenger compartment, and has his own vision blocks and overhead hatch. There are small overhead hatches atop the passenger compartment. There are three firing ports on each side of the passenger compartment, and one in the rear door. The passengers sit down the middle, facing outwards. The turret has hatches on the deck for the commander and gunner. The crew and passengers are protected by an NBC overpressure system with a collective NBC system backup. The night vision system is comprehensive and includes an image intensifier for the driver, though a day/night vision block; the Type 97 also has a hunter/killer capability, with separate observation heads for the commander and gunner.

The two-man turret is armed with a copy of the same 100mm main gun found on the BMP-3, and it does fire Chinese copies of the ATGMs that the 100mm Russian gun fires, in addition to more conventional rounds. On each side of the main gun is a coaxial weapon; to the right is a 30mm autocannon, while to the left is a machinegun. The main gun has a ballistic computer and laser rangefinder of modern design. At the front of the turret, on either side of the weapons, are three smoke grenade launchers. The Type 97 has a laser warning system as well as a chemical and radiological alarm system. The laser warning system can automatically trigger smoke grenades to obscure the incoming laser beam.

The suspension is similar to the extended-length versions of the Type 85 family, and therefore the ride may be a bit rough. The engine is to the right of the driver and squad leader, the engine is more powerful than that of most members of the Type 85 family, and is possibly a more advanced form of the German BF8L513C. The Type 97 has excellent amphibious capability, powered by strong waterjets and using a power-extended wave fence to the front. The Type 97 is therefore capable of extended-range swims, even in heavy surf, from offshore amphibious assault ships.

Note that it is believed that the Type 97 is believed to be serving alongside license-built copies of actual BMP-3s.

Other APC-Type Versions

The Type 89 ACV (Armored Command Vehicle) starts with a Type 89 chassis, but raises the roofline about a meter and lengthens the vehicle by about a half a meter, including the addition of a sixth roadwheel on each side. The dedicated gunner's station is deleted, and the commander's station has a simple cupola without powered rotation and armed with a pintle-mounted machinegun. Of course, the biggest changes are internal – at least one short-range, two medium-range, and two-long range radios are installed, along with a long-range radio designed for data transmission. A small computer is also installed, along with a teletype machine. The usual map board and storage for office supplies and materials for plotting battlefield information is present. More internal lighting is also provided. A 5kW APU is provided to power the vehicle's electronics while the engine is switched off; this APU can be dismantled (and usually dug in, to dampen the noise), and connected to the vehicle with a cable. A hand-held image intensifier, thermal imager, and laser rangefinder is included in the price below (though not noted in the stats), and the commander's station has an artillery plotting circle inscribed on it. A version of the Type 90 was also designed as a command vehicle, with sales being made only to Iran; this conforms to the Type 89 ACV for game purposes. The Type 91 was also designed with a command version, though no known sales have been made; it differs (for game purposes) only in the engine used and the size of the fuel tanks. The Type 85 ACV is similar in concept to the Type 89 ACV, except for the lesser armor and weight. It is otherwise identical to the Type 89 ACV.

The Type 89 Armored Ambulance, also called the WZ-752, has the same basic chassis as the ACV, but is unarmed. Instead of a lot of command and communications equipment, it carries medical equipment, including the equivalent of four T2K doctor's medical bags, twenty T2K personal medical kits, a portable defibrillator, two oxygen tanks and sets for administering it to casualties, a heater for blankets (for hypothermia victims), and plates for the heating of rations and water (again, supposedly for treating casualties. Also present is a small refrigerator. The Ambulance version has a heater, and an air conditioner is optional. The Ambulance version can carry up to four stretcher-borne patients and two seated patients, two stretcher-borne and six seated patients, or one stretcher-borne and eight seated patients. The crew are normally all medical personnel, and includes a third crewman who tends to the patients full-time. The vehicle has a 5kW APU to power the equipment when the engine is off, similar to that of the ACV. As with the ACV, a version of the Type 91 was designed as an Armored Ambulance, but appears to have had no sales; a Type 90 Armored Ambulance was also designed and some of them bought by Iran, and this mostly conforms to the Type 89 Armored Ambulance for game purposes. The Type 85 also has an Armored Ambulance version; it can carry four stretcher-borne patients and two seated patients, two stretcher-borne and six seated patients, or one stretcher-borne and seven seated patients.

The Type 89 Supply Vehicle, or ZHB-94, is essentially an armored truck on tracks. It has a number of tie-down and lock-down points in the interior, as well as attachment points for lockers and supply boxes that are to be mounted in a more permanent form. The flooring is reversible, with one side having rollers to aid in unloading. On the left side of the roof is a light crane with a capacity of 2 tons, and the roof hatches over the rear compartment are much larger than in the APC version. The gunner's position is removed, and the commander's cupola has a pintle-mounted machinegun. Similar versions were also designed for the Type 90 and Type 91, but none of the three appear to have gone into service anywhere.

Twilight 2000 Notes: No version of the Type 91 exists in the Twilight 2000 timeline. The ZSD-90 is a very rare vehicle in the Twilight 2000 timeline, and normally used by the PLA as a scout vehicle. A decent amount of Type 90-based vehicles were taken into PLA service. One Chinese warlord north of Beijing is known to have a Type 97; where he got it is unknown.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
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Type 85	\$33,862	D, A	1.7 tons	13.6 tons	3+12	6	Passive IR (D)	Shielded
Type 89	\$34,708	D, A	1.8 tons	14.3 tons	3+12	6	Passive IR (D)	Shielded
ZSD-85	\$220,858	D, A	1.5 tons	15.3 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G)	Shielded
ZSD-90	\$111,996	D, A	1.2 tons	15.4 tons	3+7	8	Passive IR (D, G)	Shielded
Type 90	\$37,737	D, A	2 tons	14.5 tons	3+12	7	Passive IR (D)	Shielded
Type 91 APC	\$37,787	D, A	2 tons	14.5 tons	3+12	7	Passive IR (D)	Shielded
Type 91 IFV (23mm)	\$116,347	D, A	1.4 tons	15 tons	3+9	8	Passive IR (D, G)	Shielded
Type 91 IFV (25mm)	\$115,169	D, A	1.4 tons	15 tons	3+9	8	Passive IR (D, G)	Shielded
Type 91 IFV (30mm)	\$118,242	D, A	1.4 tons	15 tons	3+9	8	Passive IR (D, G)	Shielded
Type 97	\$330,973	D, A	1.3 tons	20 tons	3+7	9	Thermal Imaging (C, G), Image Intensification (C, G, D)	Shielded
Type 85 ACV	\$258,289	D, A	900 kg	14.5 tons	2+6	10	Passive IR (D)	Shielded
Type 89/90 ACV	\$264,456	D, A	1 ton	15.2 tons	2+6	10	Passive IR (D)	Shielded
Type 91 ACV	\$264,506	D, A	1 ton	15.4 tons	2+6	10	Passive IR (D)	Shielded
Type 85 Ambulance	\$43,036	D, A	1.3 tons	13.8 tons	*	9	Passive IR (D)	Shielded
Type 89 Ambulance	\$44,106	D, A	1.4 tons	14.5 tons	*	9	Passive IR (D)	Shielded
Type 91 Ambulance	\$44,156	D, A	1.4 tons	14.5 tons	*	9	Passive IR (D)	Shielded
ZHD-94/Type 90 Supply Vehicle	\$51,700	D, A	2 tons	14.3 tons	2	7	Passive IR (D)	Shielded
Type 91 Supply Vehicle	\$51,750	D, A	2.2 tons	14.5 tons	2	7	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 85/Type 85/Ambulance	156/109	38/23/4	400+300	160	Std	T4	HF6 HS3 HR2
Type 89/Type 89 Ambulance/ZHD-94	150/105	37/22/3	500+300	170	Std	T4	HF8 HS3 HR2
ZSD-85	130/91	34/20/3	400+300	181	Trtd	T4	TF10 TS4 TR4 HF6 HS3 HR2
ZSD-90	141/99	35/21/3	500+300	180	CiH	T4	TF5 TS3 TR3 HF8 HS3 HR2
Type 90/Type 90 Ambulance/Type 90 Supply Vehicle	148/104	35/21/4	520+300	173	CiH	T4	TF6 TS4 TR4 HF8 HS3 HR2
Type 91 APC/Ambulance/Supply Vehicle	163/114	39/23/4	520+300	190	CiH	T4	TF6 TS4 TR4 HF8 HS3 HR2
Type 97	129/90	31/18/10	520+300	261	Trtd	T4	TF11 TS4 TR4 HF8 HS3 HR2
Type 85 ACV	148/104	35/21/4	400+300	173	Std	T4	HF6 HS3 HR2
Type 89/90 ACV	141/99	35/21/3	500+300	180	Std	T4	HF8 HS3 HR2

Type 91 ACV	163/114	39/23/4	520+300	190	Std	T4	HF8 HS3 HR2
Type 91 IFV	158/110	38/22/4	520+300	196	Trtd	T4	TF10 TS6 TR6 HF8 HS3 HR2
Type 89 ACV	141/99	35/21/3	500+300	180	Std	T4	HF8 HS3 HR2
Type 91 ACV	153/103	37/22/4	520+300	201	Std	T4	HF8 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type	None	None	W-85	1120x12.7mm
85/89/Type 85 BRV				
ZSD-85	+1	Fair	73mm 2A28M gun, PKT, HJ-73 ATGM Launcher	40x73mm, 2000x7.62mm, 4xHJ-73 ATGM
ZSD-90	+2	Fair	25mm KBA Autocannon, PKT	400x25mm, 1000x7.62mm
Type 90/91 APC	+1	None	W-85	1050x12.7mm
Type 91 IFV (23mm)	+2	Fair	23mm ZU-23 Autocannon, PKT	685x23mm, 1000x7.62mm
Type 91 IFV (25mm)	+2	Fair	25mm GIAT or M-242 Chaingun, PKT	630x25mm, 1000x7.62mm
Type 91 IFV (30mm)	+2	Fair	30mm 2A46 or M-230 ChainGun	525x30mm, 1000x7.62mm
Type 97	+3	Good	100mm gun, 30mm 2A46 autocannon, PKT	22x100mm, 8xATGM, 300x30mm, 1200x7.62mm
Type	None	None	W-85 (C)	1000x12.7mm
85/Type 89/Type 90 ACV/Type 91 ACV/ZHB- 94/Type 90 Supply vehicle/Type 91 Supply Vehicle				

*See Notes above.

Norinco Type 86 (WZ-501)

Notes: The Type 86, also called the ZSD-86 (it's PLA designation), is probably more familiar in its Norinco industrial designation, the WZ-501. And you may say, it's just a Chinese BMP-1, right? Well, sort of. It did start out as simply an unlicensed copy of the BMP-1, and has basically the same armament, configuration, and appearance as the BMP-1. However, there are a number of differences, enough for the Type 86 to warrant its own entry. The Chinese began reverse-engineering the Type 86 in the early 1980s, probably from vehicles traded-for from the Middle East (most likely Egypt), and it entered service in 1992, except for a small batch that entered limited service in 1987. The Chinese, in turn, not only use about a thousand of them, but have sold them to several other countries, most notably Iran, Iraq, Myanmar, Bangladesh, and Sri Lanka. (It should be noted that by the time Norinco began reverse-engineering them, they already realized the design was obsolete, despite the fact that eventually 1000 were put into Chinese service. Aren't central government decisions great?) Nonetheless, the PLA considers the Type 86 an important vehicle type, despite the fact that it is beginning to update the design at a breakneck pace, trying several subtypes and modifications. Norinco has also designed several variants and updates of the basic design, some of which are also in Chinese service and available on the export market.

The Type 86

The basic Type 86 is in effect a BMP-1, but with a bit lower weight, a little less engine power (not enough to have effect in game terms), and the ATGM launcher fires the indigenously-designed HJ-73 missile. Most changes were made to suit local production methods and use local electronics, but the hull, especially the hull front, is a bit longer and better-suited for amphibious operations than the BMP-1, and the turret is lower in profile than the BMP-1. There are a number of small difference details, such as the shape of the headlights. And the damn thing is just as cramped inside as the BMP-1, but the smaller stature in general of Chinese troops makes this less of a problem. (It does beg the question, though, of how this is going to hold up as the Chinese become more well-to-do, and start getting taller and bigger in stature. The South Koreans, after all, have had the same problem.) The turret has a top hatch for the commander, with the HJ-73 ATGM launcher above of the 73mm main gun (identical in design to the BMP-1's gun). Unlike the BMP-1, space is provided for a Red Tassel SAM, (a Chinese copy of the SA-7) and a reload missile, for use by the infantry squad in the rear (the gunner and commander would have to be world-class gymnasts to reach them from their positions). The glacis

is sharply-sloped, but the sides and rear are straight, with shallow side skirts which have more to do with flotation than protection. The troops seats for the eight passengers go down the middle of the passenger compartment, with four firing ports down the sides and one in the right rear door. The pair of rear doors, as with the BMP-1, are the primary means of entry and exit for the passengers and have the same vulnerability in that they contain most of the fuel. A pair of rectangular roof hatches are found on the roof of the passenger compartment. The driver is on the front left, with a right-opening pivoting hatch, and the gunner has a hatch to the left of the turret (though not on the turret itself). The low turret silhouette and the resulting almost nonexistent capability to depress the main gun make hull-down firing positions almost impossible. Like the BMP-1, the Type 86 has an NBC overpressure system, but reloading the HJ-73 launcher completely breaks this sealing and requires the crew to don MOPP gear if this is necessary in NBC conditions, as the Type 86 has no collective NBC system. The Type 86 has a fire detection and suppression system. It can lay a smoke screen by injecting diesel fuel into its exhaust, but unlike most Chinese vehicles, has no smoke grenade launchers. The gunner, driver, and commander all have night vision devices; these are better than their BMP-1 counterparts, and recently they have been seen retrofitted with thermal cameras. Atop the turret is also a smallish, wide-angle IR/white light searchlight.

The engine of the Type 86 is a CV150 292-horsepower diesel, which is possibly also a design that the Chinese got through Egypt and may be a derivative of a US Cummins design (again, unlicensed). Suspension is by conventional torsion bar with very little thought to shock absorption, which can lead to motion-sickness among its passengers and crew, especially when buttoned up. The Type 86 is amphibious with almost no preparation (a trim vane must be erected and bilge pumps turned on), though freeboard is very low. Propulsion in the water is by its tracks.

The WZ-505 and NFV-1

These two vehicles currently have only Norinco industrial designations; the PLA appears to be ready to accept production of the WZ-505 on a limited basis, while the NVH-1 appears to have been an export-only version that has died on the vine and is no longer being offered for sale. The WZ-505 is topped with the larger turret used by the Type 92 wheeled IFV; this turret is armed with a 25mm autocannon and a coaxial machinegun. Gun control includes a computer and a laser rangefinder. Both are externally-mounted (though internally-fed and controlled), and the gunner is seated primarily under armor protection. The WZ-505 has one cluster of four smoke grenade launchers mounted on the right side of turret; a second cluster of grenade launchers is mounted on the left side of right side of the hull. The gunner has a small hatch just forward of the externally-mounted main gun (a tight squeeze), while the commander has a hatch behind the driver on the left of the hull behind the driver. The turret does take up a bit more room, reducing internal capacity. The commander has all-around vision blocks and night vision heads, but does not have access to the weapons. The driver has an automatic transmission instead of the manual transmission of the Type 86. Improved shock absorbers are present at the first and last roadwheels on each side, improving the ride. The internal arrangements of the passenger compartment are basically identical to those of the Type 86.

The NVH-1, produced as prototypes only and shown as some arms shows, is a Type 86 with a new turret (larger than the Type 86's turret) with a 300-horsepower turbocharged diesel engine, and a few more improvements to the electrical system and transmission. Armament is a 25mm M-242 ChainGun and a coaxial machinegun; the NVH-1 has a hunter/killer capability (as both the commander and gunner have independent vision heads) as well as a comprehensive night vision and enhanced vision block set. On the turret front, on either side of the main gun, is a cluster of four smoke grenade launchers. The commander and gunner both have turret roof hatches. Installation of a pair of Red Arrow 8 launchers (one on each side of the turret) were an option, but again NBC seals would have to be broken to reload the launchers; therefore, a collective NBC system was installed. Only one such prototype was built, and when showed at an arms show, these tubes and the reloading hatches were probably dummies. The tubes themselves are reloaded from small hatches to the rear and on either side of the turret, which like the US Bradley, open just enough to reload the Red Arrow 8 tubes. The PLA regarded it as a great improvement, but too expensive both in money and technology transfer restrictions; other countries may have felt the same.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 86	\$226,726	D, A	1.5 tons	13.3 tons	3+8	8	Passive IR (D, C, G), Image Intensification (G, C), Thermal Imaging (G)*, White Light/IR Searchlight	Shielded
WZ-505	\$160,902	D, A	1.4 tons	13.1 tons	3+8	6	Passive IR (D, C, G), Image Intensification (G, C), Thermal Imaging (G)	Shielded
NVH-1	\$162,267	D, A	1.4 tons	13.2 tons	3+8	8	Passive IR (D, C, G), Image Intensification (G, C), Thermal Imaging (G)	Shielded

NVH-1 (w/ATGM)	\$176,966	D, A	1.4 tons	13.3 tons	3+8	9	Passive IR (D, C, G), Image Intensification (G, C), Thermal Imaging (G,C)	Shielded
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 86	135/94	33/20/4	460	116	Trtd	T3	TF10 TS4 TR4 HF8 HS4 HR4
WZ-505	138/96	34/30/4	460	114	Trtd	T3	HF8 TS5 TR3 HF8 HS4 HR4
NVH-1	136/95	33/20/4	460	115	Trtd	T3	HF8 TS4 TR4 HF8 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 86	+1	Fair	73mm 2A28 Gun, PKT, HJ-73 ATGM Launcher	40x73mm, 2000x7.62mm, 4xHJ-73 ATGM
WZ-505	+2	Fair	25mm GIAT autocannon, PKT	400x25mm, 2000x7.62mm
NVH-1	+2	Fair	M-242 ChainGun, PKT (or MAG)	500x25mm, 2500x7.62mm

*Before 1993, thermal imagers were absent; subtract \$20,000 for these earlier vehicles.

Norinco Type 05

Notes: The Type 05 is also known as the ZBD-2000, Type 03, ZTL-05, and (in export sales) the VN16. (Very confusing!) It is designed to replace various navalized versions of Chinese APCs and IFVs. The Type 05 is so far only used by the PLAMC, but is up for export in its standard form. The Type 05 was introduced in a parade in 2006, but was in development for several years before that.

The Type 06 is typically launched from LST-type ships about 10 kilometers off the coast. It seemingly borrows many features from the cancelled US Marine EFV, but does not have as high a swimming speed, nor can it handle as heavy a sea state as the EFV. It also does not ride as high above the water as the EFV, nor is it as large as the EFV. The Type 05 shares a common chassis and hull with the Type 05 light tank, which has a similar role as the Type 05 IFV. The Type 05 has a planning hull for riding in the water, along with high-output waterjets. It has hydraulically-deployed bow and side flaps, giving it more buoyancy than most amphibious vehicles, and reducing drag in water. However, the tracks do not retract like those of the EFV, giving the Type 05 some drag that the EFV does not have. The hull is otherwise flat and boat-like. The suspension has six roadwheels on each side, with the drive sprockets in front and roller in the rear. Armor is of all-welded steel. The 590-horsepower is in the front, to the right of the driver's position. With the waterjets and engine, the ZBD-05 can generate 1580 horsepower on water. The suspension is composed of simple torsion bars, which can lead to a rough off-road ride.

The 30mm autocannon is a new design, believed not to be based on any earlier 30mm autocannon, though it may in fact be a Ukrainian design. It has a very long barrel and an increased rate of fire. On the roof of the turret at the commander's position is a launcher for an HJ-73C ATGM, and coaxial to the autocannon is a 7.62mm machinegun. The gun is fully stabilized, to the point of being able to accurately fire while crossing ship-to-shore, and has a laser rangefinder as well as a laser designator. It has an advanced fire control computer, able to control the vehicle, point for gun at the selected targets automatically (including slewing the turret). The Type 05 has a full night vision and amplified day vision suite, as well as a full NBC Overpressure suite. As is standard with almost all fighting vehicles these days, the Type 05 has a cluster of 4 smoke grenade launchers on either side of the turret.

The crew compartment is surprisingly roomy for an IFV, and the troops in the rear are not as cramped as most such vehicles. The turret is low and horseshoe-shaped, and has a power-operated cupola which also has the ATGM launcher attached so it rotates with the cupola. The gunner is below and to the right of the commander, though he too has a hatch in the turret roof. The crew has a large ramp with a door in it in the rear for ingress and egress, and the door has a wide-angle vision block in it. The passengers also have a screen and are able to access the vision suite as well as dedicated LLTV cameras in the rear and to the sides. The Type 05 has a vehicle state computer, GPS, and a mapping system, as well as extra radios.

It is rumored that the hull and turret have some measure of composite armor, though officially the armor is of all-welded steel. What is known is that the Type 05 weighs more than a vehicle of its size and design should weigh, if only by a little. This also may be from the added electronics, the heavier autocannon, though the steel armor base of the Type 05 is rather limited. I will present the Type 05 with the possible composite armor in the stats below for now, (sounds logical to me). There are rumored photos of Type 05-series vehicles fitted with APSs, but I have no hard information on this or any Chinese APSs, so I have not included it here.

Variants include the aforementioned light tank, an ARV, and a command and control vehicle (which will be found below). There is also a rare AFV variant, which has a turret with a pair of heavy machineguns and a lighter machinegun, and is otherwise the same as the Type 05 IFV. The AFV variant may carry more passengers than the IFV. An armored ambulance is also rumored, though stats on this are to great extent a guess based on other armored ambulance vehicles.

Type 05 AFV

The AFV version of the Type 05 has a smaller turret with a plethora of machineguns of varying calibers, and carries more troops due to the smaller turret. It appears to be more of a "battle taxi" than a vehicle meant to get into possibly heavy combat like the Type 05 IFV. It essentially otherwise has the same features as the Type 05 IFV, but is much lighter due to the much smaller turret, and more

agile and speedier due to the same. It is not meant to get into heavy combat, but instead simply to deliver troops and sometimes materiel inland and into the rear areas of the battle. It occurs to me, however, that a vehicle with good mobility which can carry decent amounts of cargo will find itself pressed into deliveries into the FEBA, and delivering reinforcements to battle. Just a thought...

Type 05 CCV

The CCV (Command and Control Vehicle) has a raised roofline instead of any sort of turret, though it is equipped with a commander's cupola with a weapon mount and a gun shield in front of the cupola. In its role as the command post, it is equipped with a command post, it is equipped with a BMS, extra radios (all data-capable and encrypted, and including one SATCOM radio), several (at least three) computers, including one which is connected to a military intranet of sorts, and the CCV is able to contact and coordinate naval, helicopter gunship, aircraft, and UAV support. It is equipped with an advanced visual suite, including long range laser rangefinders and designators. There are different versions of the CCV, depending upon the level or function they will serve; most such vehicles differ primarily in radios setup and computer setup. The CCV has a vehicle state computer, and GPS with inertial navigation backup, along with a mapping system. Other systems are like the Type 05 IFV. The vehicle's superior speed allows it to keep up with the developing battle. For when the CCV is stopped for an extended period, the CCV has a tent which can be erected at the rear, though this section is not NBC Sealed and has a Radiological rating of only Enclosed. The CCV has a 12kW APU to run the CP during halts.

Type 05 Ambulance

This uses the same chassis and hull as the CCV; however, the interior is stocked with stretchers, padded seats, moving stools, and medical equipment. There is enough room for four stretcher cases, two stretcher cases and four seated patients, or eight seated patients. The Ambulance is staffed by two medics, or a medic and a PA. There are enough oxygen sets to administer oxygen to all four stretcher cases, with oxygen lasting a maximum of two hours per patient; with less patients, oxygen may last longer. Two auxiliary oxygen bottles are also available, with enough O2 for one-half hour. There is a medium sized refrigerator, stocked with four units of Type O blood and four bags of plasma, as well as two bags of Ringer's Lactate and four bags of saline solution for use as a blood expander. Various drugs and supplies are also available in the refrigerator and cabinets and drawers, including the equivalent of five doctor's medical bags, two emergency surgery kits, and a large variety of minor drugs such as minor pain relievers or antihistamines or anti-diarrheals, etc. There is a large selection of bandages, pressure dressings, items like QuickClot, etc. There is a medical computer the medics and PAs can consult is they have any questions, or to maintain records on their casualties. As with most medical vehicles, the Type 05 Ambulance is not armed, though it retains the cupola, without the gun shield. In addition, it can be protected by the small arms and whatever weapons the crew or casualties have. Note that the Ambulance has neither a laser rangefinder nor a laser designator.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 05 IFV	\$921,639	D, A	1.45 kg	17 tons	3+8	14	2 nd Gen Thermal Imaging (G), Thermal Imaging (D, C), 5x 2nd Gen LLTV (F, L, Rt, R, Backup), 2 nd Gen Image Intensification (G, C)	Shielded
Type 05 AFV	\$821,007	D, A	1.5 tons	16.11 tons	3+10	12	Thermal Imaging (D, G, C), 5x 2nd Gen LLTV (F, L, Rt, R, Backup), 2 nd Gen Image Intensification (G, C)	Shielded
Type 05 CCV	\$1,308,911	D, A	833 kg	11.62 tons	2+5	19	Thermal Imaging (D), FLIR (C). 5x 2nd Gen LLTV (F, L, Rt, R, Backup), 2 nd Gen Image Intensification (C)	Shielded
Type 05 Ambulance	\$713,256	D, A	726 kg	13.36 tons	2+4 Stretcher or up to 8 Seated	15	Thermal Imaging (D), 2 nd Gen Image Intensification (C), 5x 2nd Gen LLTV	Shielded

(F, L, Rt, R,
Backup),

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 05 IFV	224/157/113	62/44/6	880	218	Trtd	T3	TF12Cp TS7Sp TR3 HF15Cp HS7Sp HR4
Type 05 AFV	227/169/115	63/44/6	880	207	Trtd	T3	TF12Cp TS7Sp TR3 HF15Cp HS7Cp HR4
Type 05 CCV	314/220/159	87/61/9	880	150	Stnd	T3	HF15Cp HS7Cp HR4
Type 05 Ambulance	272/191/138	76/53/8	880	173	Stnd	T3	HF15Cp HS7Cp HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 05 IFV	+4	Good	30mm Type 05 Autocannon, 7.62mm Type 59, HJ-73C Missile Launcher	500x30mm, 2000x7.62mm, 4xHJ- 73C ATGM
Type 05 AFV	+4	Good	14.5mm Type 70-I, 12.7mm QJC-88, 7.62mm Type 59	1000x14.5mm, 2000x12.7mm, 4000x7.62mm
Type 05 CCV	+2	None	12.7mm Type 90-II (C)	2000x12.7mm
Type 05 Ambulance	None	None	None	None

Danish M-113 APC-Type Modifications and Variants

Notes: Denmark has been using the M-113 since the early 1970s, in large numbers (compared to their relatively small military forces) and in over a dozen versions. APC-type variants range from simple variants with add-on armor (including some 50 with Israeli-type ERA) or appliqué, to the M-92 Wildcat (also called the M-113A2 DK I), which is similar in concept and appearance to the Twilight 2000 M-115 variant of the M-113A2. Denmark plans to modify all of their APC-type M-113 versions to the M-113 G3 DK and some M-92 Wildcat versions, as they plan to acquire heavier IFVs (most likely, the Swedish CV-9040 or its Norwegian counterpart, the CV-9030). Though some “plain vanilla” M-113s and M-113A1s are still in service, most of their fleet has been upgraded in some way or another.

Versions with Appliqué Armor and other Minor Upgrades

The primary version of the M-113 that has appliqué armor uses Israeli-designed appliqué armor which has a ribbed appearance on the sides and flat appliqué shielding on the front, as well as a slight thickening of the belly armor (the Urdan package). The commander’s cupola borrows from the US ACAV-type designs from Vietnam, with all-around gun shields of AV2. The headlights have been given more protection, and a folding rear-view mirror is attached in front of the driver’s position to allow him to back the vehicle without a ground guide. Some also have bars to cut low-hanging wires that might otherwise take a driver’s or commander’s head off as the vehicle speeds along. In another trick borrowed from the US, most Danish M-113s have comms wire strung along the front and sides of their vehicles (in a triangular pattern) to allow quick addition of camouflage. Unlike the US, most Danish M-113s normally have their swimming side skirts attached, and some of them have the rubber skirts replaced with aluminum skirts which are tougher than their rubber counterparts. Most of the M-113s and M-113A1s are also upgraded to M-113A2 automotive standards; some have had their fuel tanks moved to the rear of the vehicle, like those of the M-113A3. Much of these vehicles are slated for further upgrade to the M-113 G3 DK standard (below).

M-92 “Wildcat”

The M-92 is a version of the M-113A2 similar in concept to the M-115, but with a smaller turret and some other modifications. The nickname “Wildcat” was adopted early in the testing phases of the M-92, but officially dropped later in testing; however, troops sometimes still call it the Wildcat (or rather, it’s Danish equivalent). A more common nickname among the troops is the *maskinkanin* (machine rabbit), due to its similarity to the word *mashinkanon* (machine cannon, or autocannon; soldiers are experts at puns). The M-92 is the only version of the M-113 that has been completely built and modified in Denmark; the Danes have a license to build the M-113A2 because of the heavy modifications they intended to carry out to produce the M-92. E. Falck Schmidt A/S, which produced Denmark’s version of the M-41 light tank (the M-41DK I) is the company that produced the M-92. The first versions, the M-92A1, were produced in the early 1980s; the modifications to the M-92A1 that produced the M-92A2 began in the early 1990s.

The M-92A1 is more based on the M-113A2, but other than the turret, the most readily-identifiable feature is the rear-mounted fuel tanks. The trim vane is a bit thicker, to help stabilize the now top-heavy vehicle during amphibious operations. The M-92 still carries a small squad of troops, but the hatch on the rear deck is much smaller due to the turret. The rear face hatch and door remain the same, as does the driver’s station. Three troops sit on each side, with the seventh (normally the squad leader) being to the rear of the turret and facing to the rear. They have access to a collective NBC system. The turret is a two-man model (just barely – it is a bit on the small side). The turret ring is reinforced to help protect against the unavoidable shot trap. It has a commander’s hatch, but the gunner uses the commander’s hatch or the rear hatch for entry and exit. Ammunition is primarily stored in the large turret bustle. The turret of the M-92A1 has a good day/night vision suite. (The turret is, in fact, the Italian Otobreda T-25 turret.) Armament consists of a 25mm autocannon and a coaxial machinegun; no provision is made for a commander’s machinegun. On each side of the turret are four smoke grenade launchers.

The M-92A2 began as a temporary upgrade to the M-92A1 for use in the former Yugoslavia during Denmark’s IFOR and SFOR commitments. The engine is an improved turbocharged 300-horsepower MTU diesel engine; this gave the M-92A1 the power necessary for the other planned modifications to be carried out. The primary modification in mind was Urdan-type appliqué armor, but the night vision suite was also modified to give the commander and gunner thermal imagers. The suspension was also beefed up considerably, and an improved heater as well as an air conditioner was added. A laser rangefinder was added to the fire control computer. The controls are similar to the US M-113A3, with a conventional steering yoke, a brake pedal, and a gas pedal.

The M-113 G3 DK

As the M-113-based APC fleet passes into less and less use with the acquisition of more advanced APCs and IFVs, the M-113-based APC is no longer required to perform a semi-IFV role like the M-92. However, the M-113-based APC will still perform a role in Danish armed forces, and most of them will eventually be a version called the M-113 G3 DK. This is essentially Denmark’s version of the M-113A3; it is equipped with rear-mounted fuel tanks and a 300-horsepower engine and matching drive train. The driver’s station are also modified with a fully automatic transmission, steering yoke, brake pedal, and gas pedal. The suspension itself is improved to smooth out the ride, and the steering, accelerator, and braking system are much more responsive, primarily for driving in the tight quarters of many European towns and traffic. Likewise, noise and exhaust systems are modified to conform to EURO 2 standards. The M-113 G3 DK is also up-armored with the Urdan appliqué armor kit mentioned above. The vehicle has a collective NBC system. The commander’s station has a turret with night vision. This version will, with small amounts of the M-92A2, form most of the Danish M-113 APC fleet in the coming years; most M-113s will in fact be specialist vehicles rather than APCs.

Twilight 2000 Notes: Some 50 M-92s were ready for the Twilight War; only 5 of these were M-92A2s. Few others were made after the beginning of the Twilight War, though there were several modifications of M-92A1s into M-92A2s. Likewise, most "plain vanilla" M-113s were converted into M-113 DKs. The M-113 G3 DK does not exist in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-113 DK	\$143,863	D, A	1 ton	11.9 tons	2+11	6	Passive IR (D)	Shielded
M-92A1	\$253,596	D, A	700 kg	13.2 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
M-92A2	\$303,798	D, A	500 kg	13.9 tons	3+7	8	Passive IR (D, G, C), Thermal Imaging (G, C)	Shielded
M-113 G3 DK	\$218,936	D, A	1 ton	11.9 tons	2+9	5	Passive IR (D, C), Image Intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-113 DK	141/99	34/21/3	360	117	Std	T2	HF8 HS6Sp HR4*
M-92A1	127/89	31/19/3	360	130	Trtd	T2	TF7 TS5 TR5 HF6 HS4 HR4
M-92A2	133/93	33/20/3	360	145	Trtd	T2	TF7 TS5 TR5 HF8 HS6Sp HR4*
M-113 G3 DK	155/108	37/23/4	360	147	Trtd	T2	TF3 TS3 TR3 HF8 HS6Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-113 DK	None	None	M-2HB (C)	2000x12.7mm
M-92A1	+1	Fair	25mm KBA Autocannon, MG-3	600x25mm, 1500x7.62mm
M-92A2	+2	Good	25mm KBA Autocannon, MG-3	600x25mm, 1500x7.62mm
M-113 G3 DK	+1	None	M-2HB (C)	1500x12.7mm

*Belly and top armor are 3.

EIFV

Notes: The Egyptian Infantry Fighting Vehicle (EIFV; also known by its BAE developmental name, Infantry Fighting Vehicle - Light, or IFV-L) is a virtually unique vehicle designed by BAE for the Egyptian Army to solve a specific problem; so far, BAE Systems has not attempted to shop the design around elsewhere. The Egyptian Army's use of the M-113 series and other M-113-based vehicles has been growing since peace between Israel and Egypt became a reality in the late 1970s, and the Egyptians began turning away from their former Soviet masters and towards the West for military hardware and trade in other areas. One of the problems posed by this new Western alliance was the Egyptian's procurement and eventually production of the M-1A1 Abrams tank, a fast, maneuverable vehicle even in the sands of the Egyptian deserts.

The primary IFVs and APCs the Egyptians had at the time, the BMP-1, BMP-2, Fahd, and M-113, could not keep up with an M-1A1 unit with a full head of steam. The BMP-2s had armament comparable to modern IFVs, but the rest, including the BMP-1s, were outclassed on the modern battlefield. Unfortunately, the Egyptians' recent military acquisitions, especially the M-1A1 (which they went into in a big way), meant that they didn't have the funds for something like a Bradley or Warrior, the cheap Russian hardware that would become available in the future wasn't there yet, and the Egyptians didn't want to jeopardize their new relationship with the US by going to the Chinese. So they contacted BAE systems and asked them how they could modify their M-113A2s to fit the bill. BAE responded with a hybrid vehicle – a lengthened M-113A2 with the turret of an M-2A2 Bradley. In real-world cost, the new vehicle would cost about a fifth the price of an M-2A2 Bradley, but provide a significant increase in firepower and mobility. In addition, it could be built in Egypt by the ETF (Egyptian Tank Factory), at the same facilities that were being built to produce the M-1A1. This was just the thing the Egyptians were looking for. By 2010, they have built or modified some 1200 EIFVs; production had begun in 1997, and development had started in late 1994.

The Original Specs

The original specifications of the EIFV called for the lengthening of the M-113A2 to six roadwheels on each side and moving the fuel tanks to the rear of the vehicle in the same manner as on the M-113A3, making the EIFV's hull over a meter longer than the M-113A2, and even a half a meter longer than an M-113A3. Much of the hull layout is retained, with the driver to the front left and a large hatch on the rear deck opening to the rear for the passengers to stand. (The driver's hatch is a bit different – it rotates open slightly up and laterally opens to the right instead of opening upwards.) Though the Egyptians don't make use of it, amphibious capability could be easily retrofitted by simply re-mounting the trim vane and enabling the bilge pumps (which are still present, but deactivated, in the EIFV). The hull shape is unmistakably an M-113-series vehicle, and the roadwheels, drive sprockets, and idler wheels are identical to those of an M-113A2. The suspension is beefed up, but is still based on torsion bars with hydraulic shock absorbers at the front and rear roadwheels. The side and frontal armor is improved with appliqué armor, including armored side skirts, but the rear ramp with a door in it are still present.

On the other hand, the engine, drive train, transmission, and driver's station were greatly-modified, with the engine being replaced with a 350-horsepower turbocharged diesel, the transmission fully automatic, and the driver's station having a steering yoke instead of the M-113A2's steering laterals, as well as a conventional brake and gas pedal. The fuel tanks were also greatly enlarged.

Of course, the biggest change was the addition of the Bradley turret. This provided a great increase in firepower, and also allowed part of the EIFV force to be used as scout vehicles if desired. This turret gave the EIFV a 25mm M-242 ChainGun, a coaxial machinegun, and twin TOW launchers. It also gave the Egyptians a vehicle that could match the Abrams in the day/night vision department. (The commander does not have his own thermal imager, but can see through the gunner's thermal imager.) At the front sides of the turret are a cluster of four smoke grenade launchers on each side.

The Egyptians were happy with this original version of the EIFV – but not totally. The engine had to work hard to keep up with the M-1A1 as it was, and the Egyptians were considering a further appliqué armor package that could be added to increase protection for the EIFV. The resulting weight of the package they envisioned would definitely have the EIFV straining to keep up, not to mention the added wear and tear operating the powerpack and drive train at high strain for long periods would seriously increase the maintenance factor. They told BAE what improvements they wanted, and out of this came the production version of the EIFV.

The Production EIFV

The first thing BAE did was to address the power problem, replacing the engine with a compatible 400-horsepower 6V53TIA turbocharged diesel. The suspension also had to be further strengthened, as did the shock absorbers. This fix was almost magical, as it addressed pretty much every deficiency the Egyptians had identified. The standard armor package remained the same, but AOI (Arab Organization for Industrialization) devised an appliqué armor package that greatly increases armor protection to the sides and also improves frontal armor protection. Lugs for ERA have been added to progressively more EIFVs (and other Egyptian armored vehicles). An air conditioner was fitted, as well as a collective NBC system.

AOI (the parent agency of the ETF) has identified some possible future modifications for EIFV, including an NBC overpressure system, firing ports in the sides and rear of the vehicle, and a hunter/killer-type observation system. The firing ports would be fitted either two (more probable) or three per side, with one in the rear door. Another possibility is revised passenger seating, with the seats going down the center of the vehicle. A further enlargement of fuel tankage is also possible, with some fuel being housed in the walls of the crew compartment.

Twilight 2000 Notes: Though most EIFVs in the Twilight 2000 timeline were of the Production type mentioned above, a few later

examples were of the Original specifications. Extra appliqué armor is relatively rare.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
EIFV (Original)	\$204,275	D, A	1 ton	17.7 tons	3+6	10	Passive IR (D, C, G), Image Intensifier (G, C), Thermal Imager (G)	Shielded
EIFV (Production)	\$204,475	D, A	1 ton	17.7 tons	3+6	10	Passive IR (D, C, G), Image Intensifier (G, C), Thermal Imager (G)	Shielded
EIFV (Production w/Appliqué)	\$205,467	D, A	1 ton	18.1 tons	3+6	10	Passive IR (D, C, G), Image Intensifier (G, C), Thermal Imager (G)	Shielded
EIFV (Future)	\$234,475	D, A	1 ton	17.8 tons	3+6	10	Passive IR (D, C, G), Image Intensifier (G, C), Thermal Imager (G, C)	Shielded
EIFV (Future w/Appliqué)	\$235,467	D, A	1 ton	18.2 tons	3+6	10	Passive IR (D, C, G), Image Intensifier (G, C), Thermal Imager (G, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor					
EIFV (Original)	125/87	27/21	454	166	Trtd	T3	TF11	TS8	TR6Sp	HF8	HS6	HR4*
EIFV (Production)	140/98	30/24	454	193	Trtd	T3	TF11	TS8	TR6Sp	HF8	HS6	HR4*
EIFV (Production w/Appliqué)	138/97	30/24	454	196	Trtd	T3	TF11	TS8	TR6Sp	HF10Sp	HS9Sp	HR5
EIFV (Future)	139/47	30/24	492	195	Trtd	T3	TF11	TS8	TR6Sp	HF8	HS6	HR4*
EIFV (Future w/Appliqué)	137/96	29/24	492	198	Trtd	T3	TF11	TS8	TR6Sp	HF10Sp	HS9Sp	HR5

Vehicle	Fire Control	Stabilization	Armament	Ammunition
EIFV (Original/Production)	+2	Fair	M-242 25mm ChainGun, M-240C, 2xTOW II ATGM Launchers	600x25mm, 3600x7.62mm, 6xTOW II ATGM
EIFV (Future)	+3	Fair	M-242 25mm ChainGun, M-240C, 2xTOW II ATGM Launchers	600x25mm, 3600x7.62mm, 6xTOW II ATGM

*Roof and belly armor is 3.

Sisu NA-110 Nasu

Notes: Finland's Arctic troops used horses for transport well into the 1960's, but eventually, the Finnish military decided it was time to replace them with vehicles. To this end, they license-produced the Swedish BV-202s and Bv-206s, but the Finns weren't weren't happy with the BV-206 as it was; they wanted a vehicle that was not only a rough-terrain vehicle (and remember, Finland abounds with swamps as well as snow), but a light-armored vehicle as well, and they felt that the Bv-206 did not have the muscle they wanted in the power department. With heavy modifications, the Finns turned them into the NA-110. The word "Nasu" is an acronym of *Nahua-Sisu*, or "Tracked Sisu vehicle," but the word *Nasu* is also the Finnish word for "piglet." The Na-110 has found employment in small number around the world, (particularly in use by arctic or mountain troops) ranging from the Chinese Woodlands Fire Service, Indian Army special police units, the Mexican Army's mountain troops, and even in Antarctica (the armor makes them warmer inside than normal over-the-snow vehicles, as well as hardier).

The first modification the Finns made was to the engine and drive train. The engine was replaced with a more powerful 115-horsepower engine that was a bit more economical than the Bv-206s stock engine. This meant that the cab portion (like the Bv-206, the Nasu has a front section with the engine and most of the drive train, driver, commander, and some of the crewmembers, and a rear cargo section) grew by about a meter and became taller. The rear section was also lengthened a bit, primarily to increase its utility when not being used as a general APC. A general beefing-up of the suspension also raised the profile of the Nasu a bit. Some light Kevlar armor was also added; the Nasu can generally stave off most small arms rounds and shell fragments. The Nasu also has the capability to tow a special tracked trailer behind it to carry more cargo; this trailer is partially motorized, and can carry 2.5 tons, but cuts the Nasu's speed in half. The tracks of the Nasu were widened to 620 millimeters. The Nasu is also fully amphibious without preparation other than switching on a bilge pump. Though the Nasu has more engine power, it is also much heavier than a Bv-206, and this negates most of the Nasu's power advantage in the speed and agility departments; nonetheless, the Nasu has an almost unmatched power ratio among tracked armored vehicles. The commander has a hatch in the roof over his seat that has a pintle weapon mount; a special mount can be fitted that allows the mounting of an ATGM (usually a TOW launcher).

An appliqué armor kit was developed for the Nasu that effectively doubles the armor protection to most faces of the vehicle. Command, signals, and ambulance version also exist, as well as a version used as a carrier for a 120mm mortar.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
NA-110	\$15,610	D, A	1.95 tons	5.25 tons	2+15*	4	Headlights	Shielded
NA-110 (w/Appliqué)	\$17,686	D, A	1.65 tons	5.85 tons	2+15*	4	Headlights	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
NA-110	192/134	42/31/4	280	90	Std	T3	HF2 HS2 HR2
NA-110	176/123	39/28/4	280	98	Std	T3	HF4 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
NA-110	None	None	NSVT (C)	500x12.7mm

*Six in the front section, 9 in the rear.

**top and belly armor are 2.

GIAT AMX-10P

Notes: The AMX-10P was designed to replace the older AMX-VCI series in the APC role, and also to serve as the basis for some other vehicles. Development began in 1965, prototypes appeared in 1968, and first issue began to the French Army in 1973. By the time of first issue, the AMX-10P was already regarded as obsolete, and continual attempts were made to address its shortcomings. The AMX-10P still serves today, both in the French Army and others, though the French are in the process of replacing it with the VBCI. The AMX-10P is a little heavier than similar vehicles, and has better armor protection, particularly at the sharply-sloped glacis. It also does have a light autocannon available; it is a little more than a simple APC, but nowhere near an IFV. Despite the designation, the AMX-10P is not related to the wheeled AMX-10RC, though many of the same automotive components are used. About 10 countries used or still use the AMX-10P and its variants.

The AMX-10P

Layout is basically conventional, with a driver's hatch on the front right that has three vision blocks to the front, the center of which can be replaced by a night vision block. The engine is to the left of the driver, and the engine and transmission form a complete power pack. At the center and slightly to the left of the vehicle is a two-man Toucan II turret, and on the rear deck is a pair of hatches. Main entrance to the passenger compartment is by a power-operated ramp, which also has a pair of doors in it. The doors each have a firing port in them. The sides have no firing ports, but two vision blocks are found on each side and a rotating periscope at the front right. Locking points are found by both overhead hatches in the passenger compartment for the mounting of a Milan ATGM launcher, and the AMX-10P is sometimes used as an ad hoc ATGM carrier vehicle by the addition of racks for ten Milan missiles (plus two in the launchers) in lieu of troops. The troops have a collective NBC system to protect them, as well as a heater and an NBC alarm.

The Toucan II turret has a small hatch on the top for the commander; the gunner sits in the vehicle to the left of the commander and has no direct access to the outside. The AMX 10P has a minimum of night vision equipment, and the field of view is quite small with the night vision (7 degrees wide). Later, better day/night sights were added, with a much better field of view, though magnification was limited in day and night to x6. The 20mm autocannon is effective against light vehicles, personnel, and some light armor, but is generally regarded as inadequate in modern combat, and was so even at the time of its inception.

Power is provided by a Hispano-Suiza HS-115 supercharged diesel engine providing 280 horsepower, coupled to a semiautomatic transmission. The suspension is of the torsion-bar type, with three track return rollers and five roadwheels. The first and last roadwheel on each side have shock absorbers. The steel tracks have replaceable rubber tracks. The AMX-10P is amphibious with little preparation; a trim vane must be erected at the front, a bilge pump switched on, and waterjets for propulsion turned on.

GIAT has proposed an upgrade kit for the AMX-10P. This primarily consists of a more powerful 300-horsepower engine, a fully-automatic transmission, appliqué armor, and the Dragar turret, as installed on the AMX-10P25.

The AMX-10P25 ICV

The AMX-10P25 variant is primarily used by Singapore, and in very small amounts by some Indonesia, France and Mexico (though Singapore's are largely retired and have been sold to other countries or cannibalized). It first was shown at an international arms exposition in 1983. The AMX-10P25 is for the most part the same as the AMX-10P, but the turret is replaced by a new Dragar turret which is armed with a heavier autocannon. The new turret is a one-man turret, where the commander is also the gunner; he has a hatch on the turret deck. On either side of the turret is a pair of smoke grenade launchers. The amphibious system is beefed up and modified to handle the additional weight.

The AMX-10P Marines

Designed for the Indonesian Army, the AMX-10P Marines differs primarily in more powerful waterjets for amphibious operations and the installation of a remote, overhead-mounted M-2HB instead of the standard weapons mount. It makes for a lighter vehicle than the standard AMX-10P, granting a mobility increase both off and on land.

Other APC Variants

The AMX-10P Ambulance uses the hull of the AMX-10P, but the weapon station is replaced with a simple rotating unarmed commander's cupola. The standard crew is three (with the commander also being a medic). Three stretcher cases or one stretcher case and four seated patients can be accommodated. Additional equipment includes an air conditioner, a small refrigerator, a searchlight, a sink with a 50-liter water tank, an oxygen system, a defibrillator, a blood transfusion machine, the equivalent of four doctor's medical bags and 20 personal medical kits.

The AMX-10PC is typical of command variants of vehicles – it does not have the weapon turret, simply a commander's cupola with a pintle-mounted weapon. The rear section has the typical map boards, office and plotting supplies, and a variety of communications gear, such as one short, two medium, and two long-range radios. A ruggedized laptop is also included, and one of the long-range radios is data-capable. A hand-held image intensifier, thermal imager, four pairs of binoculars, and a laser rangefinder are included in the vehicle equipment. The rear of the vehicle has a short canopy that can be erected if two AMX-10PCs are back-to-back to form one work space; an awning can also be erected on one side. The hull does not have a raised rear section, but the rear roof of the vehicle carries a bolted-down frame for a 5kW generator. Similar vehicles are built as FIST or signals vehicles, differing only in details of the interior equipment.

Twilight 2000 Notes: As the Twilight War wore on, the AMX-10P25 Marines and AMX-10P Marines were adopted by the Philippines, and by French, Belgian, and Spanish Marines and the French Foreign Legion for use in the Middle East.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AMX-10P	\$85,335	D, A	1 ton	14.5 tons	3+8	10	Passive IR (D, C, G), Image Intensification (G)	Shielded
AMX-10P (Upgraded)	\$155,339	D, A	750 kg	15.5 tons	2+9	8	Passive IR (D, C), Image Intensification (C)	Shielded
AMX-10P25	\$117,126	D, A	625 kg	15.3 tons	2+9	10	Passive IR (D, C), Image Intensification (C)	Shielded
AMX-10P Marines	\$83,225	D, A	725 kg	15.2 tons	2+9		Passive IR (D, C)	Shielded
AMX-10P Ambulance	\$97,633	D, A	1.25 tons	14.5 tons	**	11	Passive IR (D)	Shielded
AMX-10PC	\$181,178	D, A	650 kg	15.3 tons	2+4	12	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AMX-10P	124/87	27/20/3	528	135	Trtd	T2	TF3 TS3 TR2 HF8 HS3 HR3
AMX-10P (Upgraded)	133/93	28/21/3	528	158	Trtd	T2	TF4 TS4 TR3 HF14 HS5 HS4*
AMX-10P25	110/77	23/17/3	518	142	Trtd	T2	TF4 TS4 TR3 HF8 HS3 HR3
AMX-10P Marines	110/77	23/17/6	518	142	CiH	T2	TF2 TS2 TR2 HF8 HS3 HR3
AMX-10P Ambulance	124/87	27/20/3	528	135	Std	T2	HF8 HS3 HR3
AMX-10PC	110/77	23/17/3	528	142	Std	T2	HF8 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AMX-10P	+1	Basic	20mm M-693 Autocannon, AAT-F1	760x20mm, 2000x7.62mm
AMX-10P (Upgraded)	+2	Good	25mm M-811 Autocannon, AAT-F1	600x25mm, 3000x7.62mm
AMX-10P25	+2	Good	25mm M-811 Autocannon, AAT-F1	600x25mm, 3000x7.62mm
AMX-10P Marines	+1	Basic	M-2HB	1800x.50
AMX-10PC	None	None	M-2HB (C)	1500x.50

*Belly armor is 3.

**See text above.

GIAT AMX VCI

Notes: Designed around the same time as the US M-113, the AMX VCI is the same sort of vehicle: a “basic box” sort of APC with minimal armor, designed as a battlefield taxi and not a true fighting vehicle. The AMX VCI is part of a larger family of armored vehicles; the first of these was the AMX-13 light tank, and as a result, the AMX VCI was, at first, designated the AMX-13 VTT – the AMX VCI itself generated over a dozen variants. Frontal armor is excellent for an APC of its period, but the side and rear armor is average. By 2003, the AMX VCI had completely left French service, and was out of service among many of its export customers. Most modern armies no longer use them except in certain specialist roles or for spare parts, but some Third World countries still have them in service, most notably in Africa and Mexico.

The AMX VCI APC

The AMX VCI has a steeply-sloped glacis with a flat front deck for the driver and the engine; behind the driver is a pulpit-type gunner's position that is at the front of the rear superstructure that is the passenger compartment. The driver has three vision blocks to the front and the middle block can be removed and replaced by a night vision block. The glacis has a splashboard to help protect the driver when fording deep water or from mud, and like many APCs of the time, mounts a spare set of three treads and a roadwheel. The gunner has no night vision, but does have a manually-rotating cupola with all-around vision blocks. This cupola originally mounted a pair of AAT-52 machineguns, but this was quickly replaced with a single M-2HB (the AMX VCI 1987), or a true turret armed with a single AAT-52 or AAT-F1 machinegun. The commander is to the right and rear of the gunner and has his own hatch with vision blocks to the front and right, but no weapon mount. Another variant (the M-56) has the small Toucan turret armed with a 20mm autocannon and a coaxial machinegun. The troop compartment at the rear has room for 10 soldiers; they are 33seated down the center, back-to-back. There are four firing ports on each side of the passenger compartment contained on the lower parts of the overhead hatch, and one each in the two large rear doors. These are single slide-open firing ports instead of being the ball-and-socket sort of firing ports that are typically found on newer APCs. Overhead, on each side of the passenger compartment roof, is a

pair of hatches which open out to the sides. The crew and passengers originally relied on their personal NBC masks and suits, but later the AMX VCI was fitted with a collective NBC system.

The original engine of the AMX VCI was a SOFAM 8Gxb 250-horsepower gasoline engine, with a manual transmission. In the 1980s, this was replaced by 280-horsepower Baudouin 6F11SRY turbocharged engine and a semiautomatic transmission. Some export versions had their engine and transmission replaced with one based on the Detroit Diesel 6V-53T 280-horsepower turbocharged engine and an automatic transmission to form a unitary powerpack that is easier to maintain. (These diesel-powered versions are sometimes referred to as AMX VCI 1987s.) The suspension is unusual in that it the line of the tracks is not level; it is noticeably lower at the rear of the vehicle. It is based on conventional torsion bars with shock absorbers at the front and rear of the five roadwheels. Early examples have four return rollers, but later production reduced this to three return rollers. Most tracks for the AMX VCI are steel, but rubber track pads can be retrofitted. The AMX VCI is not amphibious, though fording of up to 1 meter is possible.

The Other APC-Type Variants

Perhaps the simplest of the AMX VCI Variants is the AMX Cargo. It is an armored logistics carrier; the side and rear armor is lightened somewhat, lightening the vehicle in general and enabling it to carry more cargo. Other than this, the primary alternations are the absence of seats for passengers and rollers and lock/tie-down points inside to facilitate loading and unloading of cargo. The rear are has an open-topped roof, and there vehicle has a materiel-handling crane able to lift 3 tons. The front driver, gunner, and commander's position are retained, with the commander having the controls for the crane. The collective NBC system applies only to the crew within the cab area. The commander's weapon is on a simple pintle mount.

The AMX PC is a command post variant of the AMX VCI, and has the usual sort of items that such a vehicle carries: a map board, interior lighting, office and plotting supplies, one short, two medium, and two long-range radios (with one of the long-range radios being data-capable), and a ruggedized laptop radio. Price also includes a hand-held image intensifier, thermal imager, and laser rangefinder. They also carry a lighter weapon on their gunner's mount, and the commander's position is deleted (though the vision blocks are retained).

The AMX TB is an armored ambulance version, which has a crew of four medics and can carry 4 sitting wounded and 3 stretcher cases. It has the equivalent of four doctor's medical bags, 20 personal medical kits, a defibrillator, 2 sets of oxygen kits, a small refrigerator, and a warmer for blankets and fluids.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AMX VCI	\$22,187	G, A	1.15 tons	15 tons	3+10	11	Passive IR (D)	Enclosed
AMX VCI 1987	\$22,567	D, A	1.15 tons	15 tons	3+10	10	Passive IR (D)	Enclosed
AMX VCI 12.7	\$22,969	G, A	1.05 tons	15.3 tons	3+10	11	Passive IR (D)	Enclosed
AMX VCI 12.7 1987	\$23,349	D, A	1.05 tons	15.3 tons	3+10	10	Passive IR (D)	Enclosed
AMX VCI M-56	\$32,557	G, A	800 kg	15.7 tons	3+10	12	Passive IR (D)	Enclosed
AMX VCI M-56 1987	\$32,937	D, A	800 kg	15.7 tons	3+10	11	Passive IR (D)	Enclosed
AMX Cargo	\$20,472	G, A	2.15 tons	14 tons	3	11	Passive IR (D)	Enclosed (Cab Only)
AMX Cargo 1987	\$20,852	D, A	2.15 tons	14 tons	3	10	Passive IR (D)	Enclosed (Cab Only)
AMX PC	\$160,072	G, A	900 kg	15.5 tons	2+6	13	Passive IR (D)	Enclosed
AMX PC 1987	\$160,452	D, A	900 kg	15.5 tons	2+6	12	Passive IR (D)	Enclosed
AMX TB	\$37,115	G, A	1.44 tons	15 tons	*	12	Passive IR (D)	Enclosed
AMX TB 1987	\$37,495	D, A	1.44 tons	15 tons	*	11	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AMX VCI/TB	118/83	26/19	410	139	Std	T3	HF8 HS4 HR4
AMX VCI 1987/TB	129/91	28/21	410	148	Std	T3	HF8 HS4 HR4
AMX VCI 12.7	116/81	25/19	410	142	CIH	T3	TF 2 TS2 TR2 HF8 HS4 HR4

French Tracked APCs

AMX VCI 12.7 1987	126/89	27/21	410	151	CIH	T3	TF 2	TS2	TR2	HF8	HS4
										HR4	
AMX VCI M-56	114/80	25/19	410	145	Trtd	T3	TF 3	TS3	TR3	HF8	HS4
										HR4	
AMX VCI M-56 1987	123/87	26/21	410	154	Trtd	T3	TF 3	TS3	TR3	HF8	HS4
										HR4	
AMX Cargo	126/89	28/20	410	130	Stnd	T3			HF8	HS3	HR2
AMX Cargo 1987	138/97	30/22	410	138	Stnd	T3			HF8	HS3	HR2
AMX PC	114/81	25/19	410	143	Stnd	T3			HF8	HS4	HR4
AMX PC 1987	125/88	27/20	410	152	Stnd	T3			HF8	HS4	HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AMX VCI/1987	None	None	2xAAT-52/F1 or 1xM-2HB or 1xAAT-52/F1 in turret	3350x7.5/7.62mm or 2000x.50
AMX VCI 12.7/1987	None	None	M-2HB	2000x.50
AMX VCI M-56	+1	Basic	20mm GIAT 76T2 autocannon, AAT-F1	700x20mm, 2000x7.62mm
AMX Cargo/PC	None	None	AAT-52 or AAT-F1	2000x7.5mm/7.62mm

Rheinmetall Marder 1

Notes: Development of the Marder began in the late 1950s as a chassis that could be used for a number of vehicles, but resulted only in the Marder and Jagdpanzer Kanone/Rakete as production vehicles. Several companies were invited to provide competing vehicles, and along with budget delays, this meant that the final prototypes were not finished until 1967 and fielding did not begin until 1971. The Marder became at that point NATO's only true IFV at that time. The Marder also provided the base chassis for a number of specialist vehicles and several vehicles that did not proceed beyond prototypes.

The Marder 1

The Marder is one of the best-protected IFVs in existence, a fact made more remarkable by the date it began service. The Marder 1 has all-welded steel armor. The driver is in the front hull behind a well-sloped glacis, and has three vision blocks to the front, the center of which can be removed and replaced with a night vision block. The driver has a conventional station with a steering yoke, brake pedal, and gas pedal. The commander and gunner are in a turret in the center front of the hull, which is armed with an externally-mounted light autocannon. The turret has all-around vision blocks and night vision for the gunner; the gunner is responsible for the autocannon and the coaxial machinegun, though both the commander and gunner have controls for them. The commander has no dedicated night vision gear, but can access the gunner's night sight. To the left side of the autocannon are a cluster of six smoke grenade launchers. Though the Rh-202 autocannon allows for dual feed, the Marder 1's turret has no room to allow this, and the Rh-202 on the Marder 1 can have only one belt loaded into the autocannon at a time. At the rear are bench seats for six infantrymen; the seats are near the outside of the vehicle, but face outwards to allow the troops to use their firing ports. Two ports are found on each side, and primary entry and exit are by a powered ramp at the rear. The seating pattern can be adjusted so that four troops can lie down and sleep while the other two remain seated and manning firing ports. One of the troops in the rear is seated behind the driver and has a periscope that can rotate 360 degrees. The rear deck has a pair of circular overhead hatches, as well as a remote overhead weapon station with a machinegun be traversed 135 degrees either way of center and normally faces to the rear.

The Marder 1 is powered by an MTU MB-833 Ea-500 600-horsepower diesel engine along with an automatic transmission. This gives the Marder 1 reasonable speed and agility despite its rather high weight. The Marder 1 is not amphibious; an amphibious operations kit was devised for the Marder series, but never adopted by the German Army. However, a kit does exist that increases the normal 1-meter fording capability to 2.5 meters. This kit takes 6 minutes to deploy, provided it is already attached to the vehicle.

The First Upgrades

The first upgrades were the Marder 1A1 upgrades; there were three of these, most of which differ only in minor details. The complete Marder 1A1 upgrade package, the Marder 1A1(+), changes the layout of the turret enough to allow for dual feed for the Rh-202 autocannon. The night vision suite for the gunner and commander are improved, and the fire control system uses a thermal pointer, a sort of low-tech laser rangefinder. Perhaps the biggest change in the Marder 1A1(+) is the addition of an overhead mount for a Milan ATGM. The turret has a hatch to allow the commander to look out and to reload the Milan launcher. The commander must have his head and chest outside of the turret to aim and fire the Milan launcher; the gunner is responsible for the autocannon and coaxial machinegun. As an added touch, the Milan launcher has a holder so that the commander can grab his protective mask quickly if necessary. Inside the vehicle, new racks for water cans have been installed, as well as rearranged stowage for the equipment and weapons of the infantry squad inside. However, the changes inside have reduced the room for the infantry squad to the point that only a five-man squad can be carried.

The Marder 1A1(-) is almost identical, but does not have the thermal pointer. The mount is still there, however, and installation of the thermal pointer will turn it into a Marder 1A1(+). The Marder 1A1A is also similar, but does not have the upgraded night vision gear or the thermal pointer. Again, installation of the equipment will turn it into a Marder 1A1(+); the Marder 1A1(-) and Marder 1A1A were devised primarily as cost-saving measures.

By 1983, all the Marders in German service had been converted to the new Marder 1A2 standard. This upgrade replaces the gunner's image intensifier with a thermal imager, which the commander can also access. The searchlight is removed, the fuel tanks are made self-sealing, the cooling system is improved, and the suspension modified to give a better ride. The Marder 1A2's Milan launcher is also upgraded to Milan 2 standards.

A Major Upgrade – The Marder 1A3

Conversions to the Marder 1A3 standard began in 1989; though reunification slowed things down due to economics, virtually every Marder was converted to the 1A3 standard by 1999. The most marked difference in the 1A3 is the huge increase in armor protection – most autocannons are not going to penetrate the glacis, and many will not be able to penetrate the sides. Side armor was increased to the point that the firing ports were blocked off. Turret armor was also increased, and even the floor and hull deck armor have been increased. The hatch pattern on top of the passenger compartment has been rearranged; there are now three hatches in a triangular pattern; two towards the front of the compartment and one towards the rear. The rear remote machinegun has been moved to be over the extreme left rear of the compartment. As the weight of the Marder 1A3 is significantly increased, the suspension has been considerably beefed up. New internal stowage arrangements have been made, and the sixth infantryman has been added back into the squad. The new stowage also improves the feed chutes to the autocannon (they could jam sometimes), and ends a persistent problem with the commander banging his knees painfully on equipment boxes inside the turret. It also gives the commander and

especially the gunner more room to operate in general. The Milan launcher includes a thermal imager.

The Marder that Almost Was – The Marder 1A3/40

The Marder 1A3/40mm is a Marder 1A3 with a new turret mounting a Bofors 40mm autocannon, and a few other improvements, particularly in fire control and night vision. The turret is of a completely different shape, similar to that of the CV-9040, but smaller. Germany gained the autocannons in a reciprocal agreement (Germany traded Sweden some MT-LBs, T-55s, and BMP-1s in exchange for some autocannons and cash). The vehicle is otherwise similar to the standard Marder 1A3. However, the Marder 1A3/40mm will almost certainly never be adopted by the Germans, as they do not feel the increase in firepower or the cost are warranted.

Twilight 2000 Notes: The Marder 1A3/40mm was adopted in small numbers in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Marder 1	\$227,244	D, A	1 ton	29.2 tons	3+6	16	Active IR (D, G), WL/IR Searchlight	Shielded
Marder 1A1(+)	\$432,594	D, A	1 ton	30 tons	3+5	16	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight	Shielded
Marder 1A1 (-)	\$332,594	D, A	1 ton	30 tons	3+5	16	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight	Shielded
Marder 1A1A	\$236,594	D, A	1 ton	30 tons	3+5	15	Passive IR (D, G), WL/IR Searchlight	Shielded
Marder 1A2	\$296,594	D, A	1 ton	30 tons	3+5	16	Passive IR (D, G, C), Image Intensification (C), Thermal Imager (G)	Shielded
Marder 1A3	\$202,929	D, A	1 ton	35 tons	3+6	20	Passive IR (D, G, C), Image Intensification (C), Thermal Imager (G)	Shielded
Marder 1A3/40	\$246,244	D, A	1 ton	34.8 tons	3+6	20	Passive IR (D, G, C), Image Intensification (C), Thermal Imager (G, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Marder 1	154/107	35/26	652	258	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A1(+)	150/105	34/25	652	266	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A1 (-)	150/105	34/25	652	266	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A1A	150/105	34/25	652	266	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A2	150/105	34/25	652	266	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A3	130/91	30/22	652	306	Trtd	T4	TF12 TS7 TR7 HF27Sp HS12Sp HS8*
Marder 1A3/40	130/91	30/22	652	306	Trtd	T4	TF12 TS7 TR7 HF27Sp HS12Sp HS8*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Marder 1	+1	Basic	20mm Rh-202, MG-3, MG-3 (Rear)	1250x20mm, 5000x7.62mm
Marder 1A1(+)	+2	Basic	20mm Rh-202, MG-3, Milan I Launcher, MG-3 (Rear)	1250x20mm, 5000x7.62mm, 4xMilan I ATGM
Marder 1A1 (-)	+1	Basic	20mm Rh-202, MG-3, Milan II Launcher, MG-3 (Rear)	1250x20mm, 5000x7.62mm, 4xMilan II ATGM
Marder 1A1A	+1	Basic	20mm Rh-202, MG-3, Milan II Launcher, MG-3 (Rear)	1250x20mm, 5000x7.62mm, 4xMilan II ATGM
Marder 1A2	+2	Fair	20mm Rh-202, MG-3, Milan II Launcher, MG-3 (Rear)	1250x20mm, 5000x7.62mm, 4xMilan II ATGM
Marder 1A3	+2	Good	20mm Rh-202, MG-3, Milan II Launcher, MG-3 (Rear)	1250x20mm, 5000x7.62mm, 4xMilan II ATGM
Marder 1A3/40mm	+2	Good	40mm Bofors L/70, MG-3, Milan II Launcher, MG-3 (Rear)	700x40mm, 5000x7.62mm, 5xMilan II

*Floor armor is 5Sp; hull deck armor is 4Sp.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Marder 1	\$207,691	D, A	1.01 tons	29.21 tons	3+6	15	Active/Passive IR, WL/IR Searchlight	Shielded
Marder 1A1(+)	\$228,847	D, A	1.01 tons	29.4 tons	3+5	16	Passive IR, WL/IR Searchlight	Shielded
Marder 1A2	\$294,447	D, A	1.01 tons	29.5 tons	3+5	16	Passive IR, Thermal Imaging	Shielded
Marder 1A3	\$335,209	D, A	1.01 tons	35 tons	3+5	17	Passive IR, Thermal Imaging	Shielded
Marder 1A3/40mm	\$424,010	D, A	800 kg	34.8 tons	3+5	17	Thermal Imaging, Image Intensification	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Marder 1	105/74	25/15	652	185	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A1(+)	112/79	25/15	652	178	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A2	114/80	25/25	652	176	Trtd	T4	TF12 TS7 TR7 HF15 HS6 HR6
Marder 1A3	103/72	20/15	652	176	Trtd	T4	TF12 TS7 TR7 HF27 HS12 HS8
Marder 1A3/40mm	104/73	30/20	652	176	Trtd	T4	TF12 TS7 TR7 HF27 HS12 HS8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Marder 1	+1	Basic	20mm Rh-202, MG-3, MG-3 (Rear)	1250x20mm, 5000x7.62mm
Marder 1A1(+)	+2	Basic	20mm Rh-202, MG-3, Milan I Launcher, MG-3 (Rear)	1250x20mm, 5000x7.62mm, 4xMilan I ATGM
Marder 1A2	+2	Fair	20mm Rh-202, MG-3, Milan II Launcher, MG-3 (Rear)	1250x20mm, 5000x7.62mm, 4xMilan II ATGM
Marder 1A3	+2	Good	25mm Mauser Mk 25, MG-3, Milan II Launcher, MG-3 (Rear)	1000x25mm, 5000x7.62mm, 4xMilan II ATGM
Marder 1A3/40mm	+2	Fair	40mm Bofors L/70, MG-3, Milan II Launcher, MG-3 (Rear)	700x40mm, 5000x7.62mm, 5xMilan II

Henschel Wehrtechnik TH-439 Breitkettenfahrzeug

Notes: This vehicle is the German counterpart to the Swedish Bv-206s, being optimized for difficult terrain such as ice, deep snow, and swamps. It is, however, a single-unit vehicle rather than a twin-unit vehicle like the Bv-206. It uses extra-wide tracks and an engine with additional low gears to accomplish this sort of mobility. The TH-439 is used in a variety of roles, including troop carrier, command post, ambulance, and mortar towing vehicle.

The commander and driver are seated at the front, with bullet resistant windows to their front and sides. Smaller windows are on the sides of the passenger compartment. The commander and driver have doors on either side of their positions and there is a large door in the rear of the vehicle that also has a window. These windows have armored shutters which can be raised and lowered from within vehicle. The vehicle has heating and air conditioning; optionally, it can be NBC sealed. Night vision is also optional, but more commonly, night vision consists of a pair of NODs worn by the commander and driver. Many of these vehicles have 3 firing ports in each side and one in the rear, a hatch above the commander's position with a machinegun mount, and hatches above the passenger compartment.

The engine and transmission are under the cab; this is a Mercedes-Benz OM-352A 150-horsepower engine coupled to an automatic transmission with pivot steer capability. The standard engine is water-cooled, but an option is an air-cooled KHD 152-horsepower turbocharged engine. The double-wide tracks are protected by armored side skirts. The TH-439 is fairly tall, including a tall suspension; this helps mobility in rough terrain or deep snow or mud, but increases its profile as well.

Twilight 2000 Notes: Some 100 of these vehicles made it into the Twilight War, usually with mountain troops.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$10,064	D, A	1.05 tons	6.5 tons	2+8	4	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
159/111	35/26	116	75	Std	T2	HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
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None

None

MG-3 (C)

1000x7.62mm

Rheinmetall Wiesel 2 APC

Notes: This is a larger development of the Wiesel 1 multipurpose vehicle, used as a personnel carrier in light infantry formations; it's sort of a "jeep version" of an APC. The Wiesel 2 has one more roadwheel (for a total of five small roadwheels) on each side and is taller, and has over twice the interior space. The engine was changed to a 1.91 Volkswagen 109-horsepower turbocharged diesel, coupled to an automatic transmission, giving it outstanding agility, especially when considering its small size and low weight. Armor protection is likewise improved, and the Wiesel 2 even has heating, air conditioning, and an NBC overpressure system. Basic APC versions of the Wiesel 2 can carry half a standard German infantry squad and their equipment. The troops enter through a large door in the hull rear face. There is a hatch on the front left deck for the driver with an excellent array of vision clocks, and a cupola on the front right deck for the commander. The cupola has a remote MG-3 machinegun that can be aimed and fired from under armor, and has all-around vision blocks with a night vision periscope/gunsight. New treads complete the redesign.

The Wiesel 2 is not, however, normally used as a simple APC. Several specialist versions are made, over a dozen in all. The Wiesel 2 Ambulance is a medical evacuation version of the Wiesel 2 APC. In this role, the Wiesel can carry a stretcher or 3 seated patients (or one stretcher and one seated patient), and has medical supplies. The Wiesel 2 Ambulance carries an oxygen tank, a selection of medical supplies, a doctor's medical bag, and refills for one squad's worth of personal medical kits. It is normally unarmed. A command post carrier version is built, with 1 short, one 1 medium, and 1 long-range radio as well as a ruggedized laptop computer and other command supplies; a hand-held thermal imager, image intensifier, and laser rangefinder are also included in the cost.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
APC	\$22,096	D, A	700 kg	4.1 tons	2+4	2	Passive IR (D, C)	Shielded
Ambulance	\$25,189	D, A	500 kg	4.1 tons	*	4	Passive IR (D)	Shielded
CPV	\$67,046	D, A	300 kg	4.2 tons	2+3	4	Passive IR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
APC/Ambulance	158/111	35/26/3	117	52	Std	T2	HF8 HS3 HR2
CPV	131/92	29/22/3	117	62	Std	T2	HF8 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
APC/CPV	None	None	MG-3 (C)	750x7.62mm

*See Notes above.

BMP-1A1

Notes: When Germany reunified, she inherited some 764 BMP-1s from former East German stocks. These vehicles were declared surplus and not needed by the German Army, and they were sold on the European Market at cut-rate prices. Some of these were acquired by Sweden and modified, but most of them (some 500) were bought by Greece after extensive modifications by the German KM-3 factory, shortly before the Twilight War. The AT-3 launcher was removed and replaced by either an AT-4 or AT-5 launcher. As the system for injecting diesel into the exhaust to produce a smoke screen never really worked well on the BMP-1, it was removed and in its place 6 smoke grenade launchers were mounted on the rear of the turret. As the autoloader on the 73mm gun was prone to accidents (often attempting to load the gunner's arm into the breech), it was removed. Though this adds 1 phase to reloading times, it was felt the removal of danger to the gunner made up for the lack of the autoloader. The fuel tanks inside the rear hatches have been removed, as they were vulnerable to heavy machinegun fire and often caught fire, trapping the passengers inside. A new light set has been installed, including headlights, signal lights, blackout lights, convoy lights, and position lights; these have been replaced with ones identical to those on the Marder. An anti-slip coating has been applied to the hull deck. The steel tracks have had rubber pads added to them to reduce wear to paved roads. A mount for an M-2HB has been added in front of the commander's hatch. The engine has been overhauled and improved, and electrical wiring has been replaced. Finally, a heater has been installed in the vehicle.

Twilight 2000 Story: This vehicle does not exist in the Twilight 2000 timeline.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$205,991	D, A	1 ton	13.5 tons	3+8	8	Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor		
157/110	35/25/3	400	116	Trtd	T2	TF10	TS6	TR6 HF8 HS4 HR4

Fire Control	Stabilization	Armament		Ammunition
+2	Fair	73mm gun, PKT, AT-4 or AT-5 Launcher, M-2HB (C)		40x73mm, 2000x7.62mm, 5xAT-4 or AT-5 ATGM, 500x.50

FMC AIFV

Notes: The AIFV was originally developed by FMC as an improved version of the M-113, to replace the M-113 in the US Army. The US Army did not accept the AIFV, and FMC went on to develop what became the Bradley, but several of NATO's countries were quite interested in the AIFV, as it could be a low-cost upgrade for their M-113 fleets or a lower-cost IFV than those available at the time. The primary mover behind this movement was the Netherlands, who went on to develop the design as the YPR-765; soon other countries were interested, especially Belgium, and other countries such as the Philippines, Pakistan and Egypt also bought into the design; in all, more than 10 countries use the AIFV or some version of it. Several other countries, most notably Turkey and South Korea, went on to develop their own versions of the AIFV.

The AIFV – the YPR-765

The initial version of the AIFV was the Dutch version, the YPR-765. This was a greatly-improved version of a rejected design for the US Army, the XM-765. FMC continued to develop the XM-765 concept, hoping for foreign sales, and the Dutch eventually decided to equip their army with the vehicle – but not after obtaining a building license and a making even more adjustments and modifications. They eventually bought or built 880; 815 were actually built in the Netherlands. There are 23 variants of the basic vehicle.

Like the M-113A1, the basic infantry version, YPR-765 PRI, has a hull with aluminum armor, but incorporates a large amount of spaced armor appliqué, with extra aluminum panels filled by polyurethane foam. This not only provides extra protection, but allows the AIFV to retain its amphibious characteristics. The engine is the same as the M-113A1, but power is increased to 267 horsepower by use of a turbocharger, the radiator is larger, and the heavy-duty transmission of the M-548 carrier is used. The driver is in his customary place on the front left deck, but has a steering yoke and conventional brake and gas pedals. He has four vision blocks, allowing frontal and left side vision; the center of the frontal vision blocks can be replaced by a night vision block. Directly behind the driver is a commander's position; the commander has all-around vision blocks and a 1-6x rotating periscope, but no weapon mount. The commander has a searchlight for his use.

On the right of the front hull, behind the engine, is the one-man turret, armed with a 25mm autocannon and a coaxial machinegun. Two smoke grenade launchers are found on either side of the turret. The gunner also has night vision, and a hatch atop the turret. The troops are at the rear of the AIFV, and enter and exit primarily through a large powered ramp at the rear with a door in it. The troops sit with six of them sitting back to back and facing outwards, towards two firing ports in each side. There is another firing port in the rear door. The squad leader sits between the turret and the passengers and faces to the rear.

The YPR-765A1, also called the YPR-2000, is essentially a YPR-765 with additional appliqué armor and an updated 300-horsepower engine. It saw its first combat use in Afghanistan.

The Belgians also use several variants of the AIFV. The basic AIFV is almost identical to the YPR-765. The AIFV-B-C25 has improvements similar to those of the YPR-765A1, has a suspension similar to that of the M-113A2, an NBC overpressure system, and an automatic fire detection and extinguishing system. The AIFV-B-50 has a smaller turret with a heavy machinegun and a mount on the rear deck for a Milan ATGM. (The Milan launcher is also dismountable.) The AIFV-B-50 also has a pair of 71mm Lyran smoke mortars which are reloadable from the turret. As the Filipinos bought their AIFVs from Belgium, their AIFVs are similar, but their counterpart to the AIFC-B-50 has no Milan firing post. (They were initially to have been all armed with 25mm autocannons, but the Filipinos balked at the cost.)

Other APC-Type AIFVs

Of course, there are several specialist versions of the AIFV, including several APC-type versions. Chief among these are command and FIST-type vehicles. The Dutch use one that is essentially identical externally to the YPR-765, but internally has one long, one short, and one medium-range radio, with the medium-range radio able to receive data as well as voice communications. The vehicle also has a ruggedized laptop computer and a hand-held image intensifier, thermal imager, and laser rangefinder, as well as maps, plotting supplies, and other such supplies. This vehicle is called the YPR-765 PCRO-B.

Several other command versions are based on the same chassis, but do not have a turret. Most are similar except for the internal equipment. Examples of these vehicles are the Dutch YPR-765 PCRO-C and the Belgian AIFV-B-CP; these have two long-range, two medium-range, and one short-range radios, with one of the long-range radios able to receive data as well as fax and voice transmissions. They come with a long-range antenna which may be erected when the vehicle is at a halt, and a tent-like extension at the rear which also may be erected when the vehicle is halted to extend working area. They also have ruggedized laptops and various mapping, plotting, and other such supplies, as well as a hand-held image intensifier, thermal imager, and laser rangefinder. Unlike most such command vehicles, the roofline is not raised on these vehicles. These versions do not have turrets, but instead, the commander's position has a rotating cupola with a pintle-mounted machinegun; the smoke grenade launchers are shifted to the hull front. These vehicles have NBC overpressure systems, and carry a 5kW APU.

The Dutch also operate an ambulance version, the YPR-765 PRGWT. This version is unarmed, and can carry two stretcher and two seated patients, or five seated patients. It carries a small refrigerator for perishable medical supplies, a small heater for blankets, a small water heater, the equivalent of 20 personnel medical kits, and the equivalent of four doctor's medical bags. It also has a defibrillator and two sets of oxygen-administering equipment. It has an NBC overpressure system.

Twilight 2000 Notes: The YPR-765A1 does not exist in the Twilight 2000 timeline.

Vehicle	Price	Fuel	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
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Type								
YPR-765 PRI	\$59,384	D, A	1.14 tons	13.7 tons	3+7	8	Passive IR (D, G), WL/IR Searchlight	Shielded
YPR-765A1	\$66,840	D, A	890 kg	14.2 tons	3+7	6	Passive IR (D, G), Image Intensifier (G), WL/IR Searchlight	Shielded
AIFV-B-C25	\$69,184	D, A	1.14 tons	13.7 tons	3+7	8	Passive IR (D, G), Image Intensifier (G), WL/IR Searchlight	Shielded
AIFV-B-50	\$57,738	D, A	1.14 tons	13.4 tons	3+7	8	Passive IR (D, G), WL/IR Searchlight	Shielded
AIFV-B-50 (Filipino)	\$47,238	D, A	1.14 tons	13.3 tons	3+7	7	Passive IR (D, G), WL/IR Searchlight	Shielded
YPR-765 PCRO-B	\$128,253	D, A	1.04 tons	13.9 tons	3+6	10	Passive IR (D, G), WL/IR Searchlight	Shielded
YPR-765 PCRO-C	\$115,816	D, A	800 kg	13.7 tons	2+4	11	Passive IR (D, G), WL/IR Searchlight	Shielded
YPR-765 PRGWT	\$67,155	D, A	1.04 tons	13.7 tons	**	10	Passive IR (D), WL/IR Searchlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
YPR-765 PRI	145/101	31/23/3	416	137	Trtd	T2	TF5 TS4 TR4 HF9Sp HS6Sp HR6
YPR-765A1	155/108	33/24/3	416	158	Trtd	T2	HF6Sp TS4Sp TR4 HF11Sp HS8Sp HR7*
AIFV-B-C25	160/111	34/25/3	416	152	Trtd	T2	TF5 TS4 TR4 HF9Sp HS6Sp HR6
AIFV-B-50	165/114	35/26/4	416	147	CiH	T2	TF3 TS3 TR3 HF9Sp HS6Sp HR6
YPR-765 PCRO-B	144/100	31/23/3	416	139	Trtd	T2	TF5 TS4 TR4 HF9Sp HS6Sp HR6
YPR-765 PCRO-C/PRGWT	145/101	31/23/3	416	137	Std	T2	HF9Sp HS6Sp HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
YPR-765 PRI/YPR-765A1/PCRO-B	+1	Fair	25mm KBA, MG-3	324x25mm, 1840x7.62mm
AIFV-B-C25	+1	Fair	25mm KBA, MAG	324x25mm, 1840x7.62mm
AIFV-B-50	+1	Basic	M-2HB, Milan ATGM Launcher	3700x.50, 5xMilan ATGM
AIFV-B-50 (Filipino)	+1	Basic	M-2HB	3700x.50
YPR-765 PCRO-C	None	None	M-2HB (C)	2000x.50

*Belly armor is 4.

**See Notes above.

ASCOD IFV

Notes: ASCOD (Austrian Spanish Cooperation Development) was an entity put together temporarily from the Austrian Steyr-Daimler-Puch and Spanish Santa Barbara Systemas to develop the AFV family that bears its name. Some half a dozen vehicles are based on this vehicle range, and the ASCOD IFV is one of them. (It should be noted that most of the versions have never been built.) Though later Santa Barbara Systemas would drop out of production after being bought out by General Dynamics Land Systems, the vehicle continues to be produced, developed, and shopped around; currently, the users are Austria, who use 112 (and call them the Ulan; they have plans to buy an upgraded version called the Ulan 2), and Spain (who currently use 144, and have plans to buy more; they call theirs the Pizarro, with later vehicles being the Pizarro 2 version). Greece was initially to have also been a customer, but the Greeks decided to go with less expensive refurbished BMP-1s from Germany. In Austria, they complement the CV-9030 in service. Production began in 1996, and continues today. Austrian Ulans have yet to see combat, but Spanish Pizarros have been deployed to Kosovo and Iraq, where they acquitted themselves well. Ulans and Pizarros differ in some details, most notably the engine.

The ASCOD has a driver's hatch on the front deck behind a well-sloped glacis plate. The driver has three vision blocks to the front, the middle of which can be replaced with a night vision block. The driving station is designed to provide reasonable room and

has a steering yoke with brake and gas pedals. The 2-man turret is in the center of the vehicle offset to the right with the commander on the right and gunner on the left; they have a comprehensive night vision suite, though the commander uses the gunner's thermal imager. Armament is a 30mm autocannon, a coaxial machinegun, and a commander's machinegun, with six smoke grenade launchers on each side of the turret. The main gun and coaxial have an elevation of 50 degrees, which allows it to engage helicopters and slow-moving aircraft as well as ground targets. The rear deck has a round hatch to the right and a rectangular hatch to the left; the round hatch is surrounded by vision blocks. The passenger compartment is accessed by a large door in the rear, and has seats for five down the left side and three down the right side. A passenger seat is under the circular hatch on the deck; this hatch and the seat rotate and it is meant for the squad leader. The ASCOD's silhouette is long and low; the silhouette is low primarily due to the low-profile turret.

The primary difference between the Ulan and the Pizarro is the engine. The Pizarro uses a smaller 600-horsepower MTU 8V-183-TEE22 supercharged diesel, while the Ulan uses a more powerful (but also physically larger) MTU 8V-199-TE22 engine which develops 720 horsepower. This makes the Pizarro slower, but more fuel-efficient; however, the Pizarro 2 version will have the same engine as the Ulan, and for game purposes is identical to the Ulan except for the lugs for ERA. The Spanish generally add lugs for ERA on the front hull, hull sides, turret front, and turret sides of the Pizarro, and both can be fitted with appliqué armor. Both have the same automatic transmissions and advanced torsion bar suspensions. Armored track skirts are standard. Both have an NBC overpressure system with a collective NBC backup.

The Ulan 2 version being developed by Austria uses the same chassis and engine, but has the complete turret of the BMP-3 IFV. The turret has some appliqué armor and a fire control upgrade, as well as Swiss-built missiles identical to those of the BMP-3 and a change of machineguns. Hull appliqué armor is standard on the Ulan 2. The commander has an independent sight head, giving the Ulan 2 a hunter/killer capability. (The Ulan 2 is presumably more cramped than the Ulan.) The high engine power means that speed and agility are not severely impacted, though it does gobble fuel.

Twilight 2000 Notes: The Ulan 2 and Pizarro 2 do not exist in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Pizarro	\$265,426	D, A	1.5 tons	25 tons	3+8	12	Passive IR (D), Image Intensification (G, C), Thermal Imaging (G)	Shielded
Pizarro w/Apliqué	\$267,477	D, A	800 kg	26.8 tons	3+8	12	Passive IR (D), Image Intensification (G, C), Thermal Imaging (G)	Shielded
Ulan	\$265,871	D, A	1.5 tons	25 tons	3+8	12	Passive IR (D), Image Intensification (G, C), Thermal Imaging (G)	Shielded
Ulan w/Apliqué	\$267,922	D, A	800 kg	26.8 tons	3+8	12	Passive IR (D), Image Intensification (G, C), Thermal Imaging (G)	Shielded
Ulan 2	\$389,516	D, A	700 kg	27.9 tons	3+8	12	Passive IR (D), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Pizarro	153/107	33/24	860	305	Trtd	T3	TF14Sp TS7Sp TR6 HF18Sp HS8Sp HR6
Pizarro w/Apliqué	145/101	31/23	860	323	Trtd	T3	TF17Sp TS8Sp TR6 HF22Sp HS10Sp HR6*
Ulan	180/126	36/26	860	372	Trtd	T3	TF14Sp TS7Sp TR6 HF18Sp HS8Sp HR6
Ulan w/Apliqué	171/127	34/25	860	394	Trtd	T3	TF17Sp TS8Sp TR6 HF22Sp HS10Sp HR6*
Ulan 2	164/115	33/24	860	410	Trtd	T3	TF12Sp TS5Sp TR4 HF22Sp HS10Sp HR6*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Pizarro/Pizarro 2/Ulan	+3	Good	30mm Mauser Mk 30 autocannon, MG-3, MG-3 (C)	402x30mm, 2900x7.62mm
Ulan 2	+3	Good	100mm 2A70 Gun, 30mm 2A42 Autocannon, MG-3, MG-3 (C)	40x100mm, 6xAT-10 ATGM, 500x30mm, 4000x7.62mm

*Belly armor is 5Sp.

OT-62

Notes: The OT-62 was originally to be a joint Czech/Polish copy of the Russian BTR-50PK, but it quickly got enough changes, upgrades, and modifications to be considered its own vehicle. The OT-64 entered service with Czechoslovakia in 1964; the Polish did a bit more work on their version, the OT-62C, and it did not enter service until 1966; production ended in 1971. Some 15 other countries use or used the OT-62, but its original users – Czechoslovakia and Poland – have long since sold or given them to other countries, turned into range targets, or in some cases, turned over to civilian police or fire services. As of 2010, Libya and Egypt operate the largest amount of OT-62s; they still have hundreds in service.

The OT-62 looks basically like a BTR-50, but there are several important differences. The OT-62 is a physically somewhat larger vehicle, particularly in length. The OT-64 commander's position has a small turret, barely larger than a cupola, instead of a simple pintle mount for its machinegun. The OT-62 has a more powerful PV-6 Diesel engine developing 300 horsepower in it, and is propelled during amphibious operations by waterjets. The troop compartment is fully enclosed and has an NBC overpressure system, which can be operated by a hand crank if the main system fails. The front half of the vehicle is higher than the rear half, like the BTR-50. The commander's turret is on the front left of the raised section, with the driver to his right. The commander has vision blocks for his turret and two vision blocks in the hull in front of him; the driver has three vision blocks just below his hatch on the front hull. The commander's turret does not have a hatch. The engine compartment is in the rear of the vehicle, along with the transmission, cooling system, and fuel tanks; the passengers leave and enter by overhead hatches or doors in the sides of the passenger compartment as the rear of the raised section of the hull. The automotive compartment and the crew compartment have automatic fire detection and extinguishing systems. The system can also be activated by manual pull handles, and fire extinguishing bottles are also present. The suspension is by conventional torsion bars, with six large roadwheels which are hollow to increase buoyancy. Track tension is variable and can be adjusted by the driver from his compartment. The vehicle is long but has only two pairs of shock absorbers, leading to a rough ride. The OT-62 is amphibious, propelled by waterjets, and requires that a pair of bilge pumps be turned on and a trim vane extended at the front; a special driving vision block that allows the driver to see over the trim vane must also be put in. This procedure takes 10 minutes. The bilge pump can be operated manually if necessary.

The basic Czech version, the OT-62A Topas, is armed with an M-59A recoilless rifle mounted on the rear deck, but has no commander's armament; in addition, the commander has no hatch above him. The OT-62B Topas-2A has the small turret mentioned above; it is armed with one machinegun and is manually-rotated and has manual elevation and some side-to-side movement for the gun. Beside the turret is a T-21 recoilless rifle; it can be aimed and fired from inside the vehicle, but reloaded only by opening the hatch behind it and having someone reload it. To the right of the recoilless rifle is a manually-operated IR searchlight.

The OT-62C Topas-2AP is the Polish version, and it differs much from the Czech versions. In the center of the raised section of the deck is the same turret as fitted to the OT-64, with a KPVT heavy machinegun and a coaxial PKT. The guns can be elevated almost straight up (89.5 degrees), but only to -5 degrees. The turret also has an AT-3 Sagger launch rail on either side of the turret on some models.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
OT-62A	\$56,539	D, A	1 ton	14.8 tons	2+18	8	Headlights	Shielded
OT-62B	\$64,437	D, A	1 ton	15 tons	2+18	8	Headlights	Shielded
OT-62C	\$137,658	D, A	1 ton	16.4 tons	3+12	8	Headlights	Shielded
OT-62C w/ATGM	\$141,858	D, A	1 ton	16.5 tons	3+12	8	Headlights	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
OT-62A	138/97	28/20/5	417	127	Std	T3	HF6 HS3 HR3
OT-62B	137/96	28/20/5	417	128	CiH	T3	TF2 TS2 TR2 HF6 HS3 HR3
OT-62C	125/87	25/18/5	520	140	CiH	T3	TF2 TS2 TR2 HF6 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
OT-62A	None	None	82mm M-59A Recoilless Rifle (Rear Deck)	12x82mm
OT-62B	None	None	PKT, T-21 Recoilless Rifle	1250x7.62mm, 12x82mm
OT-62C	+1	Basic	KPVT, PKT	500x14.5mm, 2000x7.62mm
OT-62C w/ATGM	+1	Basic	KPVT, PKT, 2xAT-3 ATGM Launchers	500x14.5mm, 2000x7.62mm, 4xAT-3 ATGMs

Iraqi BMP-1 Ambulance

Notes: This vehicle has its turret removed, and the rear deck raised to better accommodate walking wounded and stretcher cases. It was not produced in quantity.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$32,659	D, A	1.25 tons	12 tons	3+8 (or 4 stretcher cases)	7	Active/Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
167/117	35/25/4	460	111	Std	T2	HF8 HS4 HR4

Nimda Achzarit Heavy APC (HAPC)

Notes: The Israelis have captured a large number of T-54/T-55 tanks intact over the years, and have turned some of them into heavily-armored APCs. One of these is the Achzarit; this vehicle is designed for assaults on positions where normal APCs would be too vulnerable. The turret is removed, and the hull heavily modified, the engine replaced, armor improved, and other modifications are made. The Achzarit has been in use since 1988.

The Achzarit retains the standard driver's position, though the controls are updated and the transmission is automatic. The turret ring is replaced with a four-part hatch and armor plate; around these hatches are pintle mounts for weapons, and at the front right deck is a Rafael Overhead Weapons Station (OHWS), mounting a third machinegun. (The use of a Rafael OHWS leaves room for the possibility of heavier armament in the future based on the OHWS; some have been seen with 30mm autocannons.) Most of these OHWS's use 7.62mm machineguns, though the Israelis are beginning to replace them with OHWS's mounting M-2HB .50-caliber machineguns. The weapon can be aimed, fired and reloaded from under armor; the Second Intifada also taught the Israelis to mount a bulletproof glass turret over the commander's station (AV5) to allow him to see out of the vehicle with some protection. Most of the interior space is given over to room for troops and their weapons. The engine is replaced with a smaller one that allows a small clamshell door to be added at the rear right, but the engine is still in the rear. The Achzarit Mk 1 has a 650-horsepower engine, while the Mk 2 has an 850-horsepower engine; both are based on the engine of the M-109 SP howitzer.

Some versions of the Achzarit have been refitted for use as armored ambulance, to pluck casualties out of heavy enemy fire; these versions have room for four stretcher casualties, two stretchers and four seated casualties, or eight seated casualties. They have a defibrillator, two sets of oxygen administration equipment, a small refrigerator, a small heater for blankets, an air conditioner and heater, and the equivalent of four doctor's medical bags and 20 personal medical kits.

A command post carrier version is also made; this has 2 long range (one of which can accept data), 2 medium range, and one short range radios, a ruggedized laptop, GPS, and map boards and other supplies for plotting battlefield information. They also have a hand-held thermal imager, image intensifier, and laser rangefinder for use by the passengers. This version has only the OHWS.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Achzarit Mk 1	\$144,455	D, A	2 tons	44 tons	3+7	23	Passive IR (D, G), Image Intensification (G)	Shielded
Achzarit Mk 2	\$146,112	D, A	2 tons	44.2 tons	3+7	17	Passive IR (D, G), Image Intensification (G)	Shielded
Achzarit Mk 1 CPV	\$168,938	D, A	1 ton	44 tons	3+5	25	Passive IR (D, G), Image Intensification (G)	Shielded
Achzarit Mk 2 CPV	\$172,252	D, A	1 ton	44.2 tons	3+5	19	Passive IR (D, G), Image Intensification (G)	Shielded
Achzarit Mk 1 Ambulance	\$164,679	D, A	1.4 tons	44 tons	**	25	Passive IR (D)	Shielded
Achzarit Mk 2 Ambulance	\$166,568	D, A	1.4 tons	44.2 tons	**	19	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Achzarit Mk 1	120/84	30/19	812	339	Std	T6	HF88Sp HS24Sp HR12
Achzarit Mk 2	144/101	36/23	812	447	Std	T6	HF88Sp HS24Sp HR12

Vehicle	Fire Control*	Stabilization*	Armament	Ammunition
Achzarit	+2	Fair	MAG (C), MAG (R, L); MAG, M-2HB, or M-230 30mm (OHWS)	4000x7.62mm or 3000x7.62mm, and 600x.50 or 3000x7.62mm and 250x30mm
Achzarit CPV	+2	Fair	MAG or M-2HB (OHWS)	1500x7.62mm, or 900x.50

*Fire Control and Stabilization are only for the OHWS; the pintle-mounted weapons are None/None.

**See Notes above.

IMI Nagmasho't Heavy APC

Notes: Though the Achzarit was the first Israeli HAPC to gain the large-scale attention of the world, it was preceded by another tank-turned-into an-APC – the Nagmasho't. As the name suggests, the Nagmasho't is a heavily modification of the Israeli model of the Centurion (the Sho't). These HAPCs were born out of lessons learned by the Israelis in the 1982 invasion of Lebanon; the Israelis felt they needed a sort of "mobile pillbox" to crack some enemy strongpoints, and the first was used on the battlefield in 1984. It was, at the time, a revolutionary and controversial development in APC design, and the concept remains so to this day. The Nagmasho't has since been improved upon and superseded by later developments.

The Nagmasho't

The turret of the parent Sho't tank is removed and replaced by a raised armored superstructure. This, in turn, is further raised by the addition of more armor plate, pierced by firing ports, and with the four sides of these plates having open areas allowing for the firing of heavier weapons on pintle mounts. The entire structure is topped by an armored roof. It does, as one might imagine, look sort of thrown together, but the desired effect was achieved (to a point; as seen below, it was improved upon). Inside the superstructure are radio mounts, periscopes, racks for ammunition and radios, and some rudimentary troop seats. To the rear of this raised superstructure are two hatches on each side (on some, they are merely hinged armored panels) that allow troops to stand and fight from them. The driver's section is in the same place as on the Sho't, and there is no real defined commander's position other than the front of the superstructure. The lack of a turret, the raised superstructure, and rearrangement of the power pack gave the room to carry troops. Armor protection is basically the armor of the Sho't except on the superstructure, and the raised superstructure is not as protected as the hull. Nonetheless, the Nagmasho't did the job well enough to warrant further development, though it was essentially an improvised vehicle, and has long since been replaced.

The Nagmachon

The Nagmachon uses the updated Sho't Kal tank as its basis. The Nagmachon has improvements in armor protection and is an altogether refined design, particularly in its central superstructure. Improvements in protection were the central design feature, in fact, especially in mine protection and side protection, as well as fixing the thrown-together nature of the Nagmasho't's superstructure. It was first used to transport combat engineer teams, to assault built-up fortifications, and to destroy minefields (when equipped with anti-mine devices), but is now primarily a troop carrier. The Nagmachon came into use in the mid-1980s. The ugly superstructure of the Nagmachon (and Nakpadon) lead them to be called by many Israelis the Mifletset (Monster).

The superstructure of the Nagmachon looks like a turret, but does not rotate. It is ringed vision ports, and has four firing ports, with vision ports made of bulletproof glass. These are typically, in Israeli practice, occupied with 7.62mm machineguns. On the roof, there are two cupola-type hatches – and these have two pintle mounts by them for more weapons (usually two machineguns, or a 7.62mm machinegun and a 40mm AGL, in Israeli practice). This is mounted above a built-up section that gives the superstructure a high profile. Though this makes the superstructure a target, it also makes the superstructure an effective command and control platform that still affords the occupants good protection – in effect, the sort of mobile pillbox the designers of the Nagmasho't were looking for. (The superstructure is popularly called in Israel the “doghouse.” – though the word does not carry the same connotation as it does in the US.) In addition, the hull itself has been given more protection, and the Nagmachon has ERA lugs on the hull front, sides, and root of the superstructure (all around). The superstructure of the roof has three spaced armor panels. The superstructure also has mounted on it a pair of IS-10 smoke grenade launcher clusters of 10 – though these are capable of launching other types of grenades as well.

Troops sit in the space vacated by the turret as well as in the space vacated by main gun ammo racks, though they must still enter and exit by jumping over the sides through hatches on the roof behind the superstructure.

The Nakpadon

The latest iteration of the Sho't-based HAPC is the Nakapadon (also referred to in some sources as the “Nikpadon”), first used in 1993. This takes the Nagmachon a level further, improving armor and improving the superstructure. The interior is also rearranged, allowing for the carriage of more troops. The lugs for ERA on the Nakapadon can take 1st, 2nd, or 3rd-generation ERA, and the Nakapadon has more appliqué, largely in the form of the same sort of appliqué applied to the USMC AAVP-7. The side skirts are particularly targeted for extra armor, helping to prevent mobility kills. The rear sections of the side skirts can be hinged 180-degrees upwards and locked, further protecting troops fighting from inside the Nakapadon. The belly armor is further reinforced. Further appliqué modules are also added to the glacis, lower front hull, and the superstructure. Though the armor is heavier, the armor sections are more advanced, and therefore the weight of the Nakapadon is not unduly increased over the Nagmachon. Another weapon has been added: a 60mm C-06 mortar, mounted in the rear and firing over the rear of the vehicle. The pintle mounts atop the superstructure can be fitted with an M-2HB in lieu of other weapons. The engine of the Nakapadon is the same 900-horsepower AVDS 1790-9A as that of the Merkava 1 tank; the suspension was at first beefed up, and then later replaced with a Merkava-type suspension and steel roadwheels. Some Nakapadons are in fact updated Nagmachons.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Nagmasho't	\$80,439	G, A	1.5 tons	51 tons	2+8	18	Headlights	Enclosed
Nagmachon	\$120,779	D, A	1.5 tons	53 tons	2+8	17	Passive IR (D)	Enclosed
Nakapadon	\$128,168	D, A	1.5 tons	55 tons	2+10	21	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Nagmasho't	100/70	25/16	1190	376	Std	T6	HF67Sp HS14Sp HR10*
Nagmachon	108/76	27/17	1190	409	Trtd**	T6	TF30Sp TS18Sp TR12Sp HF74Sp HS20Sp HR12**

Nakpadon	121/84	30/19	1190	493	Trtd***	T6	TF36Sp TS22Sp TR15Sp HF81Sp HS24Sp HR14***
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Vehicle	Fire Control	Stabilization	Armament	Ammunition
Nagmasho't	None	None	4xMAG (Superstructure corners)	4000x7.62mm
Nagmachon	None	None	4xMAG (Superstructure corners), 2xMAG or 1xMAG and 1xMk 19 40mm AGL (Roof)	4000x7.62mm or 3500x7.62mm and 150x40mm
Nakpadon	None	None	4xMAG (Superstructure corners); 2 of any mix of the following: MAG, Mk 19, M-2HB; C-06 Mortar	4000x7.62mm; plus up to 800x7.62mm, 475x.50, and/or 150x40mm; 30x60mm mortar shells

*The armor of the superstructure is a little complicated. The superstructure armor is HF20Sp, HS12Sp, HR8Sp. The superstructure roof has an AV of 4. At each corner of the superstructure near the top is an open area which is 1 meter high and has no armor.

**Belly armor for the hull is 9Sp. The superstructure roof has an AV of 8Sp. Though the Nagamachon has no turret, fire against it is resolved as if it did have a turret.

***Belly armor is 10Sp, hull deck armor is 8Sp. The superstructure roof has an AV of 9Sp. Though the Nakpadon has no turret, fire against it is resolved as if it did have a turret.

Oto Melara C-13

Notes: Designed specifically for the export market in the early 1980s, the C-13 was meant for sale to countries who could afford more expensive APCs or IFVs. The C-13 harkens back to the “basic box” sort of APC, the battlefield taxi, and has little in the way of refinements and weapons found in the militaries of more affluent countries. The C-13 was also designed to be light in weight, to avoid undue stresses on the engine, drive train, and suspension, thus lowering maintenance requirements. As with many Italian vehicles of this period, it was sold to “unnamed countries.”

The hull is of all-welded steel, and has a sharply-sloped glacis and moderately-sloped sides to maximize the armor protection of the weight limits imposed on the C-13. Steel appliqué armor was devised to increase this protection if desired, and armored side skirts can also be added. The commander has only a pintle weapon mount surrounded by AV2 gun shields; his vision blocks are below these shields. The cupola rotates and the vision blocks allow vision to the front and sides. The driver is at the front at the left side, and has four vision blocks which extend from the front to the left sides. The front-most vision block can be replaced with a night vision block if desired. The integrated powerpack is to his right. Passengers exit and enter through a ramp in the rear with a door in it (the ramp of an M-113 is used). On the roof are three hatches; two are along the sides, are oblong in shape, and open out, with a third in the center of the rear of the passenger compartment that opens to the front. They have two firing ports in each side and one in the rear. The ride is actually decent, with three shock absorbers per side and a torsion bar suspension, and the vehicle is amphibious, requiring the switching on of twin bilge pumps and the extension of a trim vane. A supercharged 390-horsepower diesel gives the C-13 amazing mobility compared to most APCs (the handicap being relatively high fuel consumption). The crew is protected by an automatic fire extinguishing system, as is the engine compartment.

Twilight 2000 Notes: Many countries in Africa use the C-13 in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
C-13	\$32,832	D, A	1 ton	13.5 tons	2+10	6	Passive IR (D)	Enclosed
C-13 w/Appliqué	\$34,921	D, A	700 kg	14.1 tons	2+10	6	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
C-13	198/139	48/29/5	400	209	Std	T3	HF8 HS3 HR2
C-13 w/Appliqué	192/134	47/28/5	400	215	Std	T3	HF12 HS6 HR2*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
C-13	None	None	M-2HB (C)	2000x.50

*Belly armor for this kit is 3. Access to the firing ports is blocked with the appliqué armor kit.

Oto Melara VCC-1 Camillino

Notes: Italy had used the M-113 since the mid-1060s, and license-produced it since the late-1960s, so it came as no surprise when they also became interested in the XM-765 prototype being developed in the US in the late 1960s. Though the XM-765 program did not directly result in a production vehicle, the Dutch and Belgians ran with the results and developed the YPR-765 (AIFV). The Italians also looked hard at the AIFV, but in the end developed a vehicle that, while it resembled the AIFV's hull, was uniquely Italian, modified and built in Italy. This was the VCC-1, used by Italy and by Saudi Arabia. Production ended in 1982, but improvements and modifications continue.

The VCC-1 addresses a number of problems with the M-113, including armor protection, the lack of firing ports for the passengers, and the lack of protection for the commander when manning his machinegun. Armor protection was improved dramatically on the glacis (and it also has slightly more of a slope), and though appliqué was added on the sides and rear as well, the side protection was also improved by giving the armor a moderate inward slope. Appliqué armor is of steel, bolted onto the VCC-1's base aluminum hull. Two firing ports were added on each side, with another added to the rear. The troop seats go down the middle of the passenger compartment, with the troops facing outwards. The modifications to the passenger compartment have reduced the troop complement. The commander still has a pintle-mounted M-2HB, but the commander is surrounded with AV2 gun shields (AV3 at the front), and his cupola is powered instead of being manually-operated. At the rear, above the passenger compartment, is a pintle mount for a light machinegun. Other than the firing port, the rear ramp with its hatch is the same as the M-113, though appliqué armor has been added.

The suspension has been slightly to improve ride, cross-country performance, and the somewhat-increased weight. The original engines were the same as the M-113A2 – a 6V53 diesel engine – but the engine output is somewhat different at 215 horsepower. The driver's controls are improved, with include a driver's yoke, gas pedal, and brake pedal. Later modifications have had an increase to 275 horsepower along with a new transmission. For operations in Somalia, some VCC-1s were fitted with a further appliqué armor kit; ridged aluminum, developed from that used on the US AAPV-7A1; this was added to sides of the vehicle, while frontal armor was improved by the addition of flat aluminum plates.

A trials modification of the VCC-1 with upgraded engine has a 20mm autocannon and a coaxial machinegun in a one-man turret place of the commander's station. This version is still in on-and-off (and on-and-off) testing, with no final commitment by the Italian Army as of yet; the defense budget may be the primary problem, instead of the modification itself. The rear machinegun mount is

retained. It has no official designation as of yet, but I have referred to it as the VCC-20 below, **unofficially**.

The Italians also designed a minor modification of the M-113, the VCC-2. This version has two firing ports on either side of the vehicle, and one at the rear. It is otherwise identical to the standard M-113A2 for game purposes (see US Tracked APCs).

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
VCC-1	\$46,554	D, A	1.45 tons	11.6 tons	2+8	6	Passive IR (D)	Shielded
VCC-1 (Improved)	\$46,754	D, A	1.45 tons	11.7 tons	2+8	6	Passive IR (D)	Shielded
VCC-1 (w/Appliqué)	\$48,254	D, A	1.3 tons	11.9 tons	2+8	6	Passive IR (D)	Shielded
VCC-1 (Improved, Appliqué)	\$48,454	D, A	1.3 tons	12 tons	2+8	6	Passive IR (D)	Shielded
VCC-20	\$230,024	D, A	1.3 tons	11.9 tons	2+8	6	Passive IR (D, G), Image Intensification (G)	Shielded
VCC-20 w/Appliqué	\$231,724	D, A	1.3 tons	12 tons	2+8	6	Passive IR (D, G), Image Intensification (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
VCC-1	139/97	34/20/3	360	111	Std	T2	HF12 HS8Sp HR6
VCC-1 (Improved)	168/118	41/24/4	360	145	Std	T2	HF12 HS8Sp HR6
VCC-1 (w/Appliqué)	136/95	33/20/3	360	113	Std	T2	HF14Sp HS10Sp HR6
VCC-1 (Improved, Appliqué)	164/115	40/24/4	360	148	Std	T2	HF14Sp HS10Sp HR6
VCC-20	165/116	40/24/4	360	148	Trtd	T2	TF4 TS3 TR3 HF12 HS8Sp HR6
VCC-20 w/Appliqué	163/115	40/24/4	360	149	Trtd	T2	TF4 TS3 TR3 HF14Sp HS10Sp HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
VCC-1	None	None	M-2HB (C), MG-42/59 (Rear)	2000x.50, 1000x7.62mm
VCC-20	+3	Fair	20mm KAA autocannon, MG-42/59, MG-42/59 (Rear)	1250x20mm, 1500x7.62mm

Oto Melara VCC-80 Dardo

Notes: Delayed by budgetary problems, the Dardo did not get into production until 1998, and the first examples did not get to Italian Army units until 2002, with deliveries finishing in 2005. Originally, this production order was to be for 500 vehicles, but budget cuts slashed the order to 200. The Italian 2005 Defense Budget postponed further acquisition of the Dardo for an indefinite period. For now, this means that considerable amounts of VCC-1s must soldier on. The VCC-80 first saw combat in 2004 in Iraq with the Italian contingent to Operation Iraqi Freedom; small amounts of VCC-80s are also in service in Afghanistan, and have been since 2007.

Current Dardos are equipped with the HITFIST turret – armed with a 25mm autocannon, a coaxial machinegun, and a pair of TOW II ATGM launchers, one on each side of the turret. This means that the vehicle is often called the “VCC-80 Dardo HITFIST.” These launchers must be elevated, swinging out from the side of the turret, before firing. They are reloaded through the rear deck hatch. The autocannon mount was designed to be able to take a 30mm M-230 ChainGun or an Israeli 60mm HVMS autocannon as a retrofit (though this has not been considered as of yet). The TOW launchers can also be switched for launchers for Israeli-made Spike-LR ATGMs. The commander’s position also has a pintle mount for a machinegun. The commander also has a power-operated cupola with all-around vision blocks. The gunner has his own hatch with all-around vision blocks, though he has less of them, as they are wide-angle vision blocks. The driver’s thermal imager can be accessed by the commander through an elbow periscope. A ballistic computer and laser rangefinder help out the gunner. The gun is fully stabilized. On the front of the turret on each side of the autocannon is a cluster of four smoke grenade launchers.

The hull and turret of the Dardo are of all-welded aluminum, with a layer of steel armor added to increase armor protection. The

glacis is sharply sloped and the sides moderately sloped. Track skirts protect the suspension. The crew compartment is equipped with five firing ports, two in each side and one in the rear. The primary exit and entrance for the troops is through a power-operated ramp at the rear. Over the passenger compartment is a single-piece hatch that opens to the rear, but this is primarily there to facilitate reloading of the ATGM launchers. Other crew equipment includes an air conditioning system and an automatic fire extinguishing system.

The Dardo has an integrated powerpack, with an Iveco 6V MTCA turbocharged diesel developing 512 horsepower and an automatic transmission. The driver is on the front right and has three vision blocks enabling him to see to the front and right side. The front vision block can be replaced with a night vision block. The driver has a steering yoke with a gas pedal and brake pedal. The Dardo is not amphibious, but can ford to a depth of 1.5 meters. The torsion bar suspension has shock absorbers on each roadwheel arm, giving it a smooth ride. The engine has its own automatic fire extinguishing system.

Dardos in Iraq and Afghanistan have been seen with pieces of aluminum track-way from field roadways attached to their sides. This appears to be a field modification and nothing standard. This would add AV1 to the sides and weigh no more than 100 kg. It would not affect the performance of the vehicle (and the effect is visually rather unattractive and sloppy-looking).

The alternative autocannon installations are provided below as a "what-if."

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
VCC-80 Dardo	\$213,813	D, G, AvG, A	1.1 tons	23 tons	3+6	12	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded
VCC-80 Dardo (30mm Autocannon)	\$216,886	D, G, AvG, A	1.1 tons	23 tons	3+6	12	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded
VCC-80 (60mm Autocannon)	\$235,346	D, G, AvG, A	1.1 tons	23 tons	3+6		Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
VCC-80 Dardo	155/108	39/23	460	256	Trtd	T4	TF13Sp TS7Sp TR4 HF26Sp HS12Sp HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
VCC-80 Dardo	+3	Good	25mm Oerlikon KBA Autocannon, MG-42/59, 2xTOW II ATGM Launchers, MG-42/59 (C)	600x25mm, 1500x7.62mm, 5xTOW II ATGM
VCC-80 Dardo (30mm Autocannon)	+3	Good	30mm M-230 ChainGun, 2xTOW II ATGM Launchers, MG-42/59, MG-42/59 (C)	500x30mm, 1500x7.62mm, 5xTOW II ATGM
VCC-80 Dardo (60mm Autocannon)	+3	Good	60mm HVMS Autocannon, 2xTOW II ATGM Launchers, MG-42/59, MG-42/59 (C)	250x30mm, 1500x7.62mm, 5xTOW II ATGM

Mitsubishi Type 60

Notes: Sometimes referred to as the SU-60, this Japanese vehicle was one of their first post-World War 2 APC designs, taken into service in 1960, and it served the JGSDF for over 40 years. By that time it was retired, it was very old technology and very expensive to keep in running order. The SU-60 was built until 1972, with 755 being built in this time. Some time before the SU-60 was retired, it had already been relegated to reserve and home guard service. Armor is relatively thin, but the design is unusual – it looks sort of like a refrigerator on treads, with a barely-sloped front and square sides and back. Medium and heavy mortar carrier variants exist, and will be found in Japanese Self-Propelled Artillery.

The driver of the Type 60 is on the front right hull, and has three vision blocks to his front. In an unusual design feature, a bow machinegunner sits to his left; he has his own hatch on the left front deck and an integral sighting scope for the machinegun. Between and behind them is the commander's position; he has a cupola with all-around vision blocks and a pintle-mounted weapon. The commander also has a gun shield to the front with an AV of 2. The relatively small troop compartment at the rear is accessed by two large hatches in the rear face, and the rear deck has a large 2-piece hatch opening to the left and right for standing troops. The two parts of these hatch covers are further hinged in the center, allowing standing troops to use them for cover. Power is provided by a Mitsubishi 8 HA 21 WT turbocharged diesel developing 230 horsepower, coupled to a manual transmission. The hull is of all-welded steel. Suspension consists of conventional torsion bars, with three out of the five roadwheels on each side having shock absorbers. The Type 60 is not amphibious.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$24,898	D, A	1.5 tons	11.8 tons	3+6	6	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
145/102	36/23	370	120	Std	T2	HF5 HS3 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	Type 62 (Bow), M-2HB (C)	2200x7.62mm, 435x.50

Mitsubishi Type 73

Notes: The Type 73 is a standard sort of APC that resembles a squatter version of the US M-113 series; in essence, it is basically an updated form of the Type 60 and closely resembles that APC. Design work began in 1967, and competing designs from Komatsu and Mitsubishi were tested all stages of the design process, with Mitsubishi finally winning out. Production continued until the late 1980s, and since production of the Type 89 and Type 96 IFVs has not progressed as fast as originally planned, the Type 73 remains in service. Some 337 Type 73s are still in service with the JGSDF, and will remain in the inventory for the indefinite future. Several variants of the Type 73 are produced, including mortar carriers, an MRL, artillery ammunition carriers, tractors for towed artillery, and even a mobile weather station.

The layout of the Type 73 closely follows that of the Type 60 -- the driver sits on the front right side, and to his left is a position for a bow machinegunner. To the rear of this gunner is the engine; the Type 60 and Type 73 are unusual for military armored vehicles in that the engine is in roughly the center of the vehicle. The commander's position is in the same place as that of the Type 60. All these positions have the same sort of vision arrangement, but the central driver's vision block may be replaced with a night vision block. The commander's weapon can be aimed and fired from under armor, with the hatch closed. The passenger compartment hatch arrangement, both at the rear and on the deck, are the same as on the Type 60. However, the Type 73 adds two firing ports high on each side, as well as one in the rear. The Type 73 is larger than the Type 60 and carries more troops. The Type 73's armor is of aluminum instead of steel, and heavier than that of the Type 60. The Type 73 also adds a cluster of three smoke grenade launchers on either side of the front of the vehicle.

Power for the Type 73 is provided by a Mitsubishi 4ZF turbocharged diesel engine developing 300 horsepower, coupled to a semiautomatic transmission. The Type 73 is considerably heavier than the Type 60, so the power increase is largely soaked up by the increase in weight. The suspension, though beefed up, is basically the same as that of the Type 60. The Type 73 adds amphibious capability, but a lot of preparation is necessary – a trim vane must be extended at the front, rubber skirts must be fitted to the sides (they tend to get torn up under normal use, and are not normally fitted), rubber floatation bags attached to each of the roadwheels (ten in all), and a bilge pump turned on. This all takes nearly a half an hour, or ten minutes less if the side skirts are already attached.

Type 73 CPV is a command post carrier variant of the Type 73, similar in form and function to the US M-577. It has a raised hull to allow standing (or at least crouching) inside. The Type 73 CPV has two long-range, two medium-range, and one short-range radio; one of the long-range radios is data-capable. Other equipment includes a ruggedized laptop computer, map boards, office and plotting supplies (including a folding table and three folding chairs), and a hand-held thermal imager, image intensifier, and laser rangefinder.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 73	\$43,582	D, A	2 tons	13.3 tons	3+9	8	Passive IR (D)	Shielded
Type 73 CPV	\$206,892	D, A	1.15 tons	15 tons	3+5	10	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 73	163/114	40/26/4	450	159	Std	T2	HF6 HS4 HR4
Type 73 CPV	145/101	36/23/4	450	178	Std	T2	HF6 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 73/CPV	None	None	Type 62 (Bow), M-2HB (C)	2700x7.62mm, 525x.50

Mitsubishi Type 89

Notes: The Japanese began design of the Type 89 IFV in 1980, and the first prototypes began testing in 1984, with the testing period continuing until 1986. However, the need for such a vehicle and the cost have been cited as reasons not to produce the Type 89 from the beginning, and it was not type-classified until 1989. The initial requirement for the Type 89 was stated at 300 vehicles, but as of 1999, only 58 had been built, and since then, only 1-3 have been built per year, and the Japanese have less than 80 in service currently. (This had led to large amounts of the Type 73 APC being retained in service.) The numbers of the Type 89 in service will probably never reach the 300 initially requested by the JGDSF.

The Type 89 is of a design that is now common – a welded steel hull, with a highly-sloped glacis plate and moderately-sloped sides, with armored track skirts. The driver is on the right front, with the engine to his right. The driver has three vision blocks to the front, one of which can be replaced with a night vision block; he also has an unusual feature – a periscope in the hatch cover which can be rotated by hand. The passengers are mostly in the rear, but one is just to the rear of the driver, with a hatch of his own and vision blocks that allow him to see to the front of the vehicle. He also has a firing port that allows him to fire his weapon to the right side of the vehicle. The remaining six troops are in the rear and ingress and egress for them (and the soldier behind the driver) are through two large doors in the rear face. Two more firing ports are on the right side, three are in the left side, and one is in the right rear door. There is a medium-sized hatch in the troop compartment's roof, used primarily for reloading of the ATGM launchers. The troops have an NBC overpressure system with a collective NBC backup.

The turret is in the center of the vehicle, offset to the left. The commander is on the right side of the turret, with a cupola that has all-around vision blocks and night vision scopes, as well as a day telescopic scope. The gunner, on the left, has a hatch with two vision blocks that cover the front and left of the turret. The gunner has excellent night vision equipment, and his gunnery is helped by a ballistic computer and laser rangefinder, as well as full stabilization. The main gun in most Type 89s is an Oerlikon KDE autocannon, but late-production vehicles have a license-built version of that weapon, the L-90. A coaxial machinegun is provided and on each side of the turret is a launcher for a Type 89 Jyu-MAT ATGM. Under the front of each missile launcher is a cluster of three smoke grenade launchers.

The Type 89 has a 600-horsepower 6 SY 31 WA turbocharged diesel engine that gives the vehicle excellent range and agility, but not good range. The transmission is fully automatic and the driver's position has a conventional steering yoke, gas pedal, and brake pedal. There are six roadwheels as well as three return rollers, and the suspension is by torsion bar with three shock absorbers on each side.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$191,826	D, A	1.2 tons	27 tons	3+7	12	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
141/101	35/23	620	306	Trtd	T4	TF13 TS6 TR4 HF24 HS12 HR6

Fire Control	Stabilization	Armament	Ammunition
+3	Good	35mm Oerlikon KDE, Type 74, 2xJyu-MAT ATGM Launchers	320x35mm, 3540x7.62mm, 6xJyu-MAT ATGM

AB-14 Temsah

Notes: The Jordanian Temsah (Crocodile) is a heavily armored APC designed in response to Israel's tank-based APCs and problems with Palestinian rebels. It is based on the chassis of the Centurion main battle tank, with the interior rearranged to provide a passenger compartment in the rear and the driver and engine in the front, and the suspension reworked accordingly. Most of the design work for this vehicle was done by South Africa, with help from GDLS's British division, but the modification work was carried out in Jordan by KADDB. The Temsah was introduced at an arms show in 2001, but doesn't appear to have been put into production as of yet, despite the appearance of many versions and being a prominent part in several military parades in Jordan.

The Temsah looks basically like what it is – the hull of a Centurion tank, driving in reverse (well, sort of). The engine of the original Centurion has been replaced with the AVDS-1790 as on the US M-60 tank, which is smaller and more powerful than the Centurion's engine, and burns diesel instead of gasoline fuel. The armor of the Centurion hull has been improved, especially in the area of the armored side skirts. (KADDB claims that the Temsah's frontal armor is proof against 120mm rounds; I personally find this difficult to believe.) The front and sides have lugs for ERA, and KADDB is said to be working on an appliqué armor package to provide the crew and passengers even more protection.

The early prototypes of the Temsah had a remote turret on the roof near the rear of the vehicle with a 20mm autocannon, machinegun, and launchers for ATGM; newer versions (after 2006) mount a Thales SWARM turret with a 20mm autocannon of British make and different ATGM launchers. Four-barreled smoke grenade launchers are found on either side of the turret. In this turret is also a detector for laser targeting devices; when a targeting device is detected, the grenade launchers automatically launch smoke grenades in the path of the laser, and diesel fuel is injected into the exhaust. On the front left, behind the glacis, is a hatch for the driver; beside him is the commander's station. Both appear to have all-around vision blocks. The passenger compartment is accessed through a large hatch in the rear. Near the front of the passenger compartment, behind the driver's station, is the gunner's station; this is below the turret. At the rear of the deck are two small hatches on the right and left; a third, somewhat larger hatch is to the right of the turret. No firing ports of any sort are evident. The night vision system, especially for the turret, is extensive; the commander is able to access the turret's night vision aids via a monitor. The crew is protected by an NBC overpressure system with a collective NBC backup.

Twilight 2000 Notes: This vehicle began low-rate production in 1996, but as the Twilight War commenced it was felt that even outmoded tanks were more valuable and Temsah conversions were nearly stopped after 1997.

Merc 2000 Notes: Some of these vehicles showed up in Iraqi service, and a very few were even used by South Africa, but it is still a rather rare vehicle.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$243,384	D, A	1.5 tons	45 tons	3+10	24	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
117/82	22/17	1037	388	CIH	T6	TF20 TS16 TR12 HF75Sp HS30Sp HR16*

Fire Control	Stabilization	Armament	Ammunition
+3	Good	20mm M-621 autocannon, MAG, 2xAT-4, ZT-3 or Ingwe ATGM launchers	350x20mm, 4750x7.62mm, 6xAT-4, ZT-3 or Ingwe ATGM

*Belly armor is 10Sp.

Sedena/Henschel HWK-11

Notes: The HWK-11 was designed by Henschel Wehrtechnik of then-West Germany in the mid-1960s at the request of the Mexican government for use as a general-purpose APC. The conditions that sealed the deal with the Germans over offers from the US to sell the Mexicans M-113s hinged on the willingness of the West Germans to do a total technology transfer for building the HWK-11. The West Germans were also willing to tailor the HWK-11 more specifically to Mexican requirements. The first dozen were built by the Germans, but most of the HWK-11s were built in Mexico by Sedena. The original HWK-11s were "basic box" APCs, but they have been steadily upgraded since then, and still remain in service in Mexico in small numbers. Mexico was originally going to have a fleet of 350 HWK-11s, but economic conditions and different opportunities intervened, and ultimately, only 40 were built, though most if not all remain in service. Two prototypes of a reconnaissance model, the HWK-13 were built, but production was decided against, as was a tank destroyer variant. Henschel offered the HWK 11 for export until the mid-1980s, but never found any buyers. Production ended in Mexico in 1966.

The Original HWK-11

The first version of the HWK-11 entered service in 1965. It was definitely a battlefield taxi, armed only with a single MG-3 machinegun which was mounted in a small turret atop the vehicle. Armor is of welded steel and is not especially heavy. The driver is on the front left behind a sloped glacis; the sides also have a decent slope to them. The crew compartment has only manual fire-extinguishing bottles, but the engine has an automatic fire detection and extinguishing system. The driver has three vision blocks to his front and giving him some side vision. The commander is behind the driver in the aforementioned turret, and has all-around vision blocks in addition to a periscope which can be turned 350 degrees (leaving him a small blind arc to the rear). The turret-mounted machinegun actually has a decent degree of movement; it can be elevated straight up and depressed to -15 degrees. Both the commander and driver had image intensifiers, the driver in the center vision block and the commander in the movable periscope that had an aiming reticule for the machinegun. (These were a last-minute add-on.) The troop compartment at the rear has two large hatches on the rear deck that open and lock straight upwards, and two large doors in the rear face for primary entry and exit. A pair of air intakes at the front of the vehicle provides ventilation and modicum of low-tech air conditioning in the form of a sort of high-speed fan. A bank of four smoke grenade launchers are found along each side of the glacis.

The engine first mounted in the HWK-11 was to be a 212-horsepower Chrysler gasoline engine, but before production commenced, a German 180-horsepower diesel was used instead. The suspension gave a rather good ride for this type of vehicle, using torsion bars with shock absorbers on the first, second, and fifth roadwheels (out of five) having hydraulic shock absorbers. The HWK-11 is not amphibious.

Upgrades

In 1980, the Israeli company NIMDA upgraded Mexico's HWK-11s, giving them a turret similar to the French Toucan II but with heavier armor. Appliqué armor was also added to the hull itself. The original engines were replaced with the same as fitted to US M-113A2, Detroit Diesel 6V53s with an output of 212 horsepower.

In 1993, the HWKs-11s were again upgraded, given German-made M-113A2-type tracks and an engine of unknown origin (but probably also German), with an estimated output of 280 horsepower. A turret similar to that mounted on the German Spähpanzer Luchs was mounted in place of the previous NIMDA turret; this turret has a ballistic computer.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
HWK-11 (1965)	\$86,708	D, A	1.2 tons	11 tons	2+10	6	Image Intensification (D, C)	Enclosed
HWK-11 (1980)	\$63,333	D, A	950 kg	11.5 tons	3+9	7	Image Intensification (D, C)	Enclosed
HWK-11 (1993)	\$112,466	D, A	950 kg	11.8 tons	3+9	7	Image Intensification (D, C), Passive IR (C)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
HWK-11 (1965)	125/88	27/20	300	73	CiH	T3	TF2 TS2 TR2 HF8 HS3 HR2
HWK-11 (1980)	138/97	30/22	300	110	Trtd	T3	TF4 TS4 TR3 HF10 HS5 HR3*
HWK-11 (1993)	168/118	37/27	300	147	Trtd	T3	TF6 TS4 TR3 HF10 HS5 HR3*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
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Mexican Tracked APCs

HWK-11 (1965)	None	None	MG-3 (C)	2100x7.62mm
HWK-11 (1980)	+1	Basic	20mm M-693 Autocannon, MG-3	700x20mm, 2000x7.62mm
HWK-11 (1993)	+2	Fair	20mm Rh-202 Autocannon, MG-3 (C)	600x20mm, 1000x7.62mm

*Belly armor is 3.

NM-135

Notes: The NM-135 is a Norwegian modification of the M-113A2, turning it into an ICV by the addition of a turret with a light autocannon. The NM-135 was originally intended to be a AAA vehicle, but during development, it was repurposed into an infantry combat vehicle instead, as other, more effective AAA vehicles were available, and the Norwegians (at the time) needed an infantry vehicle with a little more kick. The NM-135 has now been almost totally replaced by the CV-9030, and all are expected to be out of service by the end of 2010.

The NM-135 primary modification is the replacement of the commander's cupola with a small turret (the same as used on the Swedish Pbc-302 APC, with the addition of a coaxial machinegun), giving it the ability to provide better infantry supporting fires and better deal with soft-skinned vehicles, as well as some light armored vehicles. The turret also has a cluster of three smoke grenade launchers mounted on each side of the turret. At the rear of the turret is a Lyran light mortar; this is meant primarily for the launching of illumination rounds, but can launch conventional HE rounds and smoke rounds as well. On the turret deck is a small hatch (a tight squeeze), and the turret is one-man and manned by a dedicated gunner. The gunner has a modicum of night vision equipment and a ballistic computer to help his aiming, but vision and aiming are largely up to the skill of the gunner, and the turret has no stabilization features for the autocannon.

The turret does take up some room normally used to carry an infantry squad, and the passenger compartment capacity is reduced. The passenger compartment is otherwise largely the same as on a standard M-113A1, with a large rearward-opening hatch on the rear deck and a power-operated ramp in the rear face with a hatch in the ramp. (In Norwegian service, the rear deck hatch is sometimes unusable, as a framework for the carriage of additional supplies is sometimes carried on the rear deck. This, however, often prevents traverse of the turret to the rear.) The fuel tanks are still in the walls of passenger compartment, as are the shelves for the radios. The driver's compartment is on the front right deck; he has the customary vision blocks to the front and right side, with one of the front vision blocks being exchangeable for an IR vision block. To the right of the turret, behind the driver, is a position for the commander; he has vision blocks to the front, right, and rear, but no cupola and no weapon.

The NM-135 has the same powerpack as the M-113A1 – a General Motors 6V53 212-horsepower diesel engine. The driver steers and brakes using the same laterals, and has a gas pedal. The suspension, cooling system, and final drives, however, are updated to M-113A2 standards. (Their standard and specialist M-113A1s also have these modifications.) As with the M-113A1, the NM-135 is amphibious with preparation, rubber side skirts must be bolted on, a trim vane must be extended, and bilge pumps turned on. This preparation takes 5 minutes if the side skirts are already attached, or 12 minutes if they are not. In Bosnia, the Norwegian contingent of the IFOR deployed the NM-135 (as well as their standard and specialist M-113A1s) with appliqué armor added to the front and sides of the vehicle.

Twilight 2000 Story: Of the Norwegian's 250 M-113s at the beginning of the Twilight War, 53 were of the NM-135 type. (The CV-9030 did not make it into Norwegian service in the Twilight 2000 timeline.)

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
NM-135	\$183,088	D, A	1.2 tons	11.7 tons	3+8	6	Passive IR (D, G)	Shielded
NM-135 w/Appliqué	\$184,389	D, A	950 kg	12.2 tons	3+8	6	Passive IR (D, G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
NM-135	130/91	29/17/3	360	130	CiH	T2	TF2 TS2 TR2 HF6 HS4 HR4
NM-135 w/Appliqué	126/88	28/16/3	360	134	CiH	T2	TF2 TS2 TR2 HF9Sp HS6Sp HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
NM-135	+2	None	20mm Rh-202 Autocannon, MG-3, Lyran Mortar	505x20mm, 750x7.62mm, 10x71mm

Polish MT-LB Versions

Notes: Huta Stalowa Wola is a Polish company which started out as a steel mill in 1938, and after World War 2 has manufactured military vehicles. They have long has licenses to build a number of Soviet/Russian vehicles, and one of those is the MT-LB multipurpose carrier. They make the standard MT-LB as an APC, as well as a number of specialist versions, and some special APC versions, which will be discussed here. (The standard MT-LB APC version will be summarized here for convenience and comparison to their other MT-LB-based APCs.)

The MT-LB is essentially a “basic box” APC, with relatively thin armor and a standard configuration, and of all-steel construction except for a few minor parts. The driver is on the front left and has three vision blocks to his front; his hatch opens to the left. The commander is to the right of the driver in the center front with his hatch opening to the rear and with two wide-angle vision blocks to the front. He mans a driver’s position with manual transmission with a rather complex manual transmission in older models, though it becomes less complex in later versions, and eventually gives way to automatic transmission in the latest versions. The commander also controls a small overhead turret that is armed with a PKT machinegun; the turret is to the right of the commander’s seat in the same compartment, and has no hatch of its own. The commander sights the machinegun through a telescopic/direct sight scope. The driver can remove his center vision block and replace it with a night vision block, and the commander has night vision through his turret. The commander also has a turnable IR searchlight. In addition, there are vision blocks on each side of the front of the hull, to the left of the driver and to the right of the commander’s turret position. A narrow aisle goes into the passenger compartment, which has folding bench seats down the sides. The passenger compartment also has a small shelf for the radios. There are two smallish hatches on the rear deck for passengers to stand up, and two doors in the rear of the vehicle for the crew to enter and leave. The 240-horsepower YaMZ 238V diesel engine is located behind the driver. There is one firing port on each side of the passenger compartment; it is at the center of the compartment. The suspension is by conventional torsion bar and the ride can be rough; the MT-LB has six roadwheels and is rather long, and only the first and last set of roadwheels have shock absorbers. The MT-LB is amphibious with some preparation; a trim vane is erected at the front and bilge pumps switched on, and this takes 5 minutes. The MT-LB is one of the few vehicles of its period which has a heater adequate for all of the crew and passengers, and it also has a collective NBC system.

Some Polish MT-LBs have a somewhat larger commander’s turret armed with a DShK machinegun instead of a PKT. This is identical to the standard turret except for being a little bigger. Another version has the turret moved to the center front of the passenger compartment, and manned by a dedicated gunner; this turret is identical to that of the OT-64C SKOT-2AP wheeled APC, and in addition has a launcher for an AT-3 Sagger ATGM on each side of the turret. This version is often referred to as the MT-LB/WAT the type of turret called is a “WAT” turret).

The MT-LB-23M Krak was originally designed to be a light anti-aircraft vehicle, and can still be used as such. However, it’s primary role is as an ICV, with the gun providing support and for attacking soft-skinned vehicles and light armor. The turret is mounted near the rear; it is designed so that the gun is high above the vehicle and can fire over a wide upward and downward arc as well as having 360-degree traverse. It is a one-man turret with all-around armor protection, but is open-topped. The commander’s turret is retained.

The Opal I and Opal II are updated versions of the MT-LB APC versions. These versions have a stronger, reworked nose section that also give room for a better, automatic transmission and final drives, they are propelled in the water by hydrojets, and they have new turrets that are armed with NSVT machineguns. The Opal I is powered by an SW0680/167/1 245-horsepower turbocharged diesel engine; the Opal II is longer, with seven roadwheels on each side, and is powered by a 300-horsepower SW-680T turbocharged diesel engine. The hull of the Opal II is similar to the hull of the 2S1 Gvozdika SP howitzer (called the Grau by the Polish).

The WEM Lotos is an armored ambulance version. It carries a crew of three, all of whom are medics and two of which function as the commander and gunner. The turret is removed, and a pintle-mounted PKM is mounted in its place, by the commander’s hatch. (This is unusual, as medical vehicles are not normally armed.) The Lotos can take four stretcher patients, two stretcher patients and five seated patients, or nine seated patients. The Lotos has a small refrigerator for perishable medical supplies, a defibrillator, two oxygen administering sets, and the equivalent of two doctor’s medical bags as well as 20 personal medical kits, along with items like blankets and suchlike.

Several command variants exist; exact equipment depends upon their role. In general, they may be considered to have two long-range, two medium-range, and one short-range radios, with one of the long-range radios being data capable. The command variants usually have an inertial navigation system, and their commander’s stations have an artillery plotting ring around their hatches. The vehicles have various map boards, lockers, and plotting supplies and office supplies for use by the staff. They carry a hand-held image intensifier, thermal imager, and laser rangefinder, as well as four pairs of binoculars.

The SR MT-LB-R is an electronic warfare variant of the MT-LB used by Poland; this version carries little crew and no passengers, but is equipped with several radar and radio jamming devices in order to disrupt a wide spectrum of enemy signals, as well as radar and radio detectors. This version sports a large number of antennas and aerials. The crew of the SR MT-LB-R has uses Electronics, Intelligence, or Education skill to successfully jam communications or radar or detect them; the difficulty of this task depends on local conditions and the enemy equipment being jammed, but if Intelligence or Education attributes are being used instead of Electronics skill, difficulty levels are one greater. Jamming radius is a base of 12 kilometers, adjusted by terrain, weather, and the counter-jamming efforts of the enemy, as well as the equipment the crew is trying to jam.

Twilight 2000 Notes: The Opal I and Opal II are not available in the Twilight 2000 timeline. The MT-LB-23M Krak was produced only in small numbers before the Twilight War, with a few more (less than 50) being built during the war.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MT-LB (PKT)	\$50,595	D, A	2 tons	11.9 tons	2+11	6	Passive IR (D,	Shielded

MT-LB (DShK)	\$53,726	D, A	2 tons	11.9 tons	2+11	6	C), IR Searchlight Passive IR (D, C), IR	Shielded
MT-LB/WAT	\$67,241	D, A	1.8 tons	12.4 tons	3+9	8	Searchlight Passive IR (D, G), WL/IR	Shielded
MT-LB-23M Krak	\$196,978	D, A	1.4 tons	12.8 tons	3+8	8	Searchlight Passive IR (D, C)	Shielded
Opal I	\$33,045	D, A	2 tons	11.9 tons	2+11	8	Passive IR (D, C)	Shielded
Opal II	\$34,400	D, A	2 tons	12.8 tons	2+13	9	Passive IR (D, C)	Shielded
WEM Lotos	\$57,679	D, A	2 tons	11.9 tons	**	9	Passive IR (D)	Shielded
MT-LB CPV	\$77,695	D, A	1.3 tons	12.6 tons	2+6	10	Passive IR (D, C), WL/IR	Shielded
SR MT-LB-R	\$583,058	D, A	500 kg	12.6 tons	2+3	12	Searchlight Passive IR (D, C), WL/IR Searchlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
MT-LB/WEM Lotos	136/95	33/20/3	450	100	Std	T3	HF6 HS3 HR2
MT-LB/WAT	131/91	32/19/3	450	104	CiH	T3	TF4 TS3 TR2 HF6 HS3 HR2
MT-LB-23M Krak	127/88	31/18/3	450	107	Trtd	T3	TF2 TS2 TR2 HF6 HS3 HR2*
Opal I	139/97	34/20/3	450	128	Std	T3	HF6 HS3 HR2
Opal II	155/109	38/22/4	520	159	Std	T3	HF6 HS3 HR2
MT-LB CPV/SR MT-LB-R	128/89	31/19/3	450	106	Std	T3	HF6 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
MT-LB (PKT)/MT-LB CPV/SR MT-LB- R	None	None	PKT (C)	2500x7.62mm
MT-LB (DShK) MT-LB/WAT	None	None	DShK (C) KPVT, PKT, 2xAT-3 ATGM Launchers	1500x12.7mm 500x14.5mm, 2000x7.62mm, 4xAT-3 ATGMs
MT-LB-23M Krak	+2	Basic	23mm ZU-23 autocannon, PKT, PKT (C)	300x23mm, 2000x7.62mm
Opal I/II	None	None	NSVT (C)	1500x12.7mm
WEM Lotos	None	None	PKM (C)	1500x7.62mm

*The turret is open and has AV0.

**See Notes for seating arrangements.

MLI-84

Notes: The MLI-84 is a version of the BMP-1, so far used only by Romania. For the most part, the MLI-84 is a stock BMP-1, but the MLI-84 is lengthened by the addition of one roadwheel and almost a meter of length; this allows for the carriage of a larger infantry squad or more supplies in addition to a normal-sized squad. The MLI-84 has the standard BMP-1 turret, along with the same armament, except for the use of the Yugoslavian Maljutka ATGM instead of the AT-3 Sagger. In addition, the MLI-84 is further armed with a DShK machinegun at the left rear of the passenger compartment. There is a cluster of four smoke grenade launchers on each side of the front hull. The passenger compartment has the customary double rear doors with the fuel tanks in them. The MLI-84 began production in 1985, with production ending in 2000; 175 were produced, and many were later upgraded.

Following the BMP-1 design, the MLI-84 has a driver's hatch on the front right hull, and commander's and gunner's positions in the turret; the turret has one hatch for the commander. All three have night vision equipment. Unlike the BMP-1, the MLI-84 has only three roof hatches in the passenger compartment; large rectangular roof hatches are on either side of the deck of the passenger compartment at about the center, while the third hatch is a small circular hatch that allows manning of the DShK machinegun. (The position of this hatch makes use of the left rear passenger door impossible while the gun is being manned.) There are three firing ports on each side of the passenger compartment, and another is in the right rear door. The MLI-84 has a new engine, the Perkins CV-8V-1240 DTS supercharged diesel developing 355 horsepower; this is larger and heavier, but is more powerful than standard BMP-1 engine. The fitting of its engine and the associated automatic transmission required rebuilding and enlarging of the engine compartment. The increase in the length of the hull also allowed small fuel tanks to be incorporated into the walls, increasing the fuel capacity. The gaps between the roadwheels are also wider. Unfortunately, the suspension is still of the conventional torsion bar type with shock absorbers only on the first and last roadwheels on each side, so the ride can be even rougher than that of the BMP-1. The heavier weight of the MLI-84 also reduced its amphibious capability; it is slow in the water, and freeboard is greatly reduced. The crew and passenger are protected by a fire detection and extinguishing system, and the commander also has access to a Geiger counter and chemical agent detector.

After the fall of the Iron Curtain, the Romanians had access to Western developments in vehicle design. This allowed the development of the MLI-84M Jderul in 1997. The MLI-84M has a dramatic change in the turret in vehicle armament; it uses an Israeli OWS-25R OHWS, armed with an autocannon and coaxial machinegun, as well as a launcher on each side of the turret that is able to fire any variant of the AT-3 Sagger or the Maljutka. This upgrading of the MLI-84M has further increased the weight, so much that amphibious operations require not only the erection of a trim vane and the turning on of bilge pumps; the crew must also raise a floatation screen and attach rubber floats, and this can take as much as 30 minutes. The latest version of the MLI-84M has these modifications, but are armed with Israeli-made Spike ATGMs instead of AT-3-series missiles, and the gunner has better night vision equipment. In both cases, the smoke grenade launchers have been moved to the sides of the turret. Because of the additional weight, the Romanians have upgraded the engine as well; the CV-8T-400 supercharged diesel develops 396 horsepower.

The ABAL is called by the Romanians an "Armored Vehicle for Combat Supply." Based on the MLI-84, the ABAL has been reworked into an armored logistics vehicle, designed primarily for the transport of supplies (particularly ammunition) into combat areas. The ABAL has a hull which is externally almost identical to that of the MLI-84, but the sides of the vehicle have large armored stowage bins attached to them. These are meant primarily to allow troops to quickly off-load much-needed ammunition, but can also carry other supplies. These bins can carry up to 12 rounds of 125mm ammunition, 16 rounds of 100mm ammunition, or 26 rounds of 73mm ammunition, of that weight equivalent (about 400 kilograms of the total cargo capacity). The customary BMP-1-type turret is deleted, though there is a small commander's cupola with a pintle-mounted weapon.

The interior of the ABAL is largely open, and the floor includes rollers, lock-down, and tie-down points for cargo and containerized supplies. The walls also have some lockers for smaller supplies. The ABAL has a large powered ramp at the rear instead of the customary double rear doors of a BMP clone, though the fuel tanks are still located in the rear inside that ramp. Off-loading and loading of supplies is also helped by a large double hatch atop the rear compartment. The rear area does not have any seats, not even any fold-up seats or canvas sling-type seats; its primary role is not the transport of personnel. Unlike most such vehicles, the ABAL is equipped with a long-range radio as well as a short-range radio, and also has a Geiger counter, chemical agent detector, and a fire detection and suppression system for the rear area as well as the crew compartments and engine compartment, and more hand-held fire-extinguishing bottles than normal; the fire suppression system is a concession to the possibly dangerous cargo it may be carrying (such as large-caliber gun ammunition). Being a version of the MLI-84, the ABAL is powered by a CV-8V-1240 DTS supercharged diesel developing 355 horsepower and an automatic transmission.

The MLI-84M PCB (*Puncta de Comanda Batalion*) is, as the name suggests, a command variant of the MLI-84M converted into a command vehicle for use at battalion command level and above. The turret is deleted; instead, the MLI-84M PCB has a large raised superstructure. This allows the staff personnel inside to stand up while working. It has the standard fit (for game purposes) for such vehicles of two long-range, two medium-range, and one short-range radio, with one of the long-range vehicles being data-capable. A hand-held image intensifier, thermal imager, and laser rangefinder is provided for the staff, and a ruggedized laptop computer is also onboard. The MLI-84M PCB has a large mapboard on one wall, and lockers and drawers for plotting, office, and other such supplies. Seats are provided for the working staff, and a small folding table and chairs are also carried. An external outlet is provided to allow a generator to be hooked up to the vehicle.

The MLI-84M VEM (Vehicul de Evacuare Medicală) is an armored ambulance; it is based on the same hull as the MLI-84M PCB, but carries space for four stretcher patients or two stretcher patients and four seated patients. The interior has a small refrigerator for perishable medical supplies, a defibrillator, two sets of oxygen administration gear, and the equivalent of two doctor's medical bags and 20 personal medical kits. This version is unarmed.

Twilight 2000 Notes: Only the original version of the MLI-84 and the ABAL exist in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MLI-84	\$182,263	D, A	1.1 tons	16.6 tons	3+10	8	Passive IR (D, G, C)	Shielded
MLI-84M	\$209,901	D, A	1.1 tons	17.6 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G)	Shielded
MLI-84M (Late Production)	\$239,901	D, A	1.1 tons	17.6 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
ABAL	\$32,909	D, A	2.1 tons	13.5 tons	2	5	Passive IR (D)	Shielded
MLI-84M PCB	\$95,154	D, A	800 kg	16.6 tons	2+6	10	Passive IR (D)	Shielded
MLI-84M VEM	\$85,270	D, A	1 ton	16.6 tons	**	9	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
MLI-84	157/110	38/23/3	545	189	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4*
MLI-84M	152/107	37/27/3	600	192	Trtd	T3	TF5 TS3 TR3 HF8 HS4 HR4*
ABAL	184/129	44/26/3	545	161	Std	T3	HF8 HS4 HR4*
MLI-74M	161/113	39/29/3	600	180	Std	T3	HF8 HS4 HR4*
PCB/MLI-84M VEM							

Vehicle	Fire Control	Stabilization	Armament	Ammunition
MLI-84	+1	Fair	73mm Gun, PKT, DShK (Rear), AT-3 ATGM Launcher	40x73mm, 2000x7.62mm, 500x12.7mm, 4xMaljutka ATGM
MLI-84M	+2	Fair	25mm KBA Autocannon, PKT, DShK (Rear), 2xAT-3/Maljutka ATGM Launcher	200x25mm, 2000x7.62mm, 500x12.7mm, 4xAT-3/Maljutka ATGM
MLI-84M (Late Production)	+2	Fair	25mm KBA Autocannon, PKT, DShK (Rear), 2xAT-3/Maljutka or Spike ATGM Launcher	200x25mm, 2000x7.62mm, 500x12.7mm, 4xAT-3/Maljutka or Spike ATGM
ABAL/MLI-84M PCB/MLI-84M	None	None	PKT (C)	2000x7.62mm

*Belly and deck armor is 3.

**See Notes for capacity.

MLVM Mountaineers' Combat Vehicle

Notes: This vehicle was designed for operations in Romania's rugged mountains. It is used as both a personnel carrier and a logistical support vehicle, and is designed to carry either a small squad of troops or supplies and ammunition. Currently, the Romanian Army has 73 MLVMs remaining in service. Production of the MLVM ceased in the late 1990s.

Construction is largely of steel, but armor is relatively light. The hull layout is almost like a scaled-down BMP-1, having the same general shape, though the MLVM is not related to the BMP series. The driver is on the front left and has three vision blocks to the front, the center of which can be replaced by a night vision block. To his rear is the commander's hatch; he commander has a hatch two wide-angle vision blocks to his sides and a periscope/vision block which can be raised and rotated to allow the commander to view the area around the vehicle from under armor. The turret is normally manned by the squad leader; he has a large telescopic day sight mounted behind a protective cage, but no night vision. The rather cramped passenger compartment has three firing ports in each side and two in the rear door. The passenger compartment is accessible by a pair of rectangular roof hatches and a large door in the rear. Like the BMP series, the rear doors carry some of the vehicle's fuel supply. The MLVM is powered by a 154-horsepower Model 798-05M2 supercharged diesel engine. The MLVM is amphibious with a minimum of preparation; a trim vane must be erected at the front and bilge pumps turned on, taking no more than 5 minutes.

In the same way that the MLI-84 was upgraded for the modern battlefield, an upgrade program has begun for the MLVM. The largest change is, like the MLI-84M, the use of the Israeli-designed OWS-25R OHWS. In addition, the upgraded MLVM is to be fitted with a laser warning system, linked to the smoke grenade launchers on the vehicle. The system also provides target information (distance, range, and estimated time of weapon impact if applicable). The MLVM differs in that it has clusters of three smoke grenades on the upper front hull. The gunner is provided with excellent day and night vision, and the commander's periscope is fitted with an image intensifier. A major upgrade will also be in the powerpack – the MLVM will receive a giant power upgrade by installation

of a compact 340-horsepower Mercedes-Benz supercharged diesel engine coupled to an automatic transmission, as well as an associated suspension upgrade. The vehicle will be further protected by an automatic fire detection and suppression system, one for the crew/passenger compartment and one for the engine. Radios are to be upgraded with up-to-date British-made Thales frequency-hopping types that are NATO-compatible. The easy amphibious operation is retained; water speed is actually increased due to the increase in engine power.

A package of appliqué armor has been devised for the MLVM, consisting of bolt-on spaced steel plates. The extra weight is a problem for the basic MLVM, but for the upgraded model, the extra engine power makes the appliqué armor package less detrimental to performance.

A small amount of armored ambulance versions of the MLVM have been built. These look sort of like a smaller version of the ABAL and can carry 2 stretcher-borne patients and three seated patients. They have the same sort of equipment as the MLI-84M VEM above. These vehicles have no turrets and no armament. They can use the same appliqué armor package.

Twilight 2000 Notes: The Upgraded MVLM is not available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MLVM	\$37,329	D, A	800 kg	11.3 tons	3+8	5	Passive IR (D)	Enclosed
MLVM	\$39,421	D, A	500 kg	12.8 tons	3+8	6	Passive IR (D)	Enclosed
w/Appliqué MLVM (Upgraded)	\$149,581	D, A	900 kg	12.3 tons	3+7	6	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
MLVM (Upgraded, Appliqué)	\$151,673	D, A	600 kg	13.8 tons	3+7	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
MLVM Ambulance	\$42,929	D, A	1.2 tons	10.5 tons	*	7	Passive IR (D)	Enclosed
MLVM Ambulance w/Appliqué	\$45,021	D, A	800 kg	12 tons	*	7	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
MLVM	111/77	27/16/3	480	76	CiH	T2	TF2 TS2 TR2 HF7 HS3 HR3
MLVM	98/68	24/14/2	480	86	CiH	T2	TF3 TS3 TR2 HF11Sp HS5Sp HR3
w/Appliqué MLVM (Upgraded)	174/122	42/25/4	480	161	Trtd	T2	TF5 TS3 TR3 HF7 HS3 HR3
MLVM (Upgraded, Appliqué)	155/109	37/22/4	480	180	Trtd	T2	TF5 TS3 TR3 HF11Sp HS5Sp HR3
MLVM Ambulance	120/83	29/17/3	480	71	Stnd	T2	HF7 HS3 HR3
MLVM Ambulance w/Appliqué	106/73	26/15/3	480	81	Stnd	T2	HF11Sp HS5Sp HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
MLVM	None	None	KPV, PKT	600x14.5mm, 2500x7.62mm
MLVM (Upgraded)	+2	Fair	25mm KBA Autocannon, PKT, 2xAT- 3/Maljutka or Spike ATGM Launcher	200x25mm, 2000x7.62mm, 500x12.7mm, 4xAT-3/Maljutka or Spike ATGM

*See Notes above for capacity.

AT-P

Notes: Perhaps one of the oldest military vehicles still found in service, the AT-P can still be found in some remote corners of the Third World. The AT-P was originally developed as an artillery tractor for the 85mm D-48 field gun and the 100mm T-12 field gun by the Soviet Union in the early 1950s, but in Third World countries, was later pressed into service as an APC. In most former Soviet Bloc countries, it has been replaced by the MT-LBs, other such vehicles, or even simply trucks. However, as late as the early 1980s, the AT-P was still found in reserve Soviet formations and some reserve Warsaw Pact units.

The AT-P is basically an armored box on tracks, with the driver on the front left, a machinegunner on the front right, and the gun crew or troops in the rear. The crew compartment is open-topped, with only the driver, bow machinegunner, and commander enclosed; a tarpaulin is provided to cover the passenger compartment if desired. The only armament is that of the bow machinegunner, who mans an SGM machinegun with a traverse of over 75 degrees, elevation of 30 degrees, and depression of 10 degrees. Troops exit and enter through the rear compartment, going over the sides, or through small doors in the sides of the vehicle at about the center. The driver, commander, and bow machinegunner all have hatches on the deck, with the commander to the rear and center of the hatches of the driver and bow machinegunner. The crew members have simple vision blocks; the driver has three to the front, the bow machinegunner has a wide-angle vision block to the front, and the commander has vision blocks in all directions except the rear. The bow machinegunner doubles as the radio operator. Later versions have a night vision block which can be mounted in place of the central driver's vision block. The AT-P has a trainable searchlight mounted above the rear compartment. The troops in the rear share their compartment with racks behind their seats for ammunition; some AT-Ps are fitted out to carry only ammunition.

The rear-mounted engine of the AT-P is a ZIL-123F gasoline engine with an output of only 110 horsepower, so it is fortunate that the AT-P is a light vehicle. (Armor protection is correspondingly light, unfortunately.) The suspension is by conventional torsion bars and there are no shock absorbers, so the ride must be a bitch. The transmission is similarly low-tech. The AT-P can tow 3.7 tons.

\$15,449	G, A	1.2 tons	6 tons	3+6	4	Headlights	Open*
127/89	31/19	300	54	Std	T2	HF3 HS2 HR2	
None		None		SGMT (Bow)		500x7.62mm	

*The driver, commander, and bow machinegunner's positions are Enclosed.

Volgograd JSC BMD-1 Airborne Combat Vehicle

Notes: The original member of the BMD series, the BMD-1, was designed to give Soviet Airborne divisions a lightweight, air-droppable AFV that was light in weight but could provide significant fire support to Airborne forces. Some use of the BMD-1 was also made by Soviet Naval Infantry. The BMD-1 was first seen by the West in 1973. The BMD-1 was produced in relatively minor amounts compared to its BMP-1 counterpart. The export users included pre-*Iraqi Freedom* Iraq who don't use them anymore; those countries still using the BMP-1 include Angola, Armenia, Azerbaijan, Belarus, India (status unknown), Iran (the largest non-Russian users, with 200 on the rolls), Ukraine, Moldova, Ukraine, and Uzbekistan. (Most of these are, of course, former Soviet vehicles left behind after the breakup of the Soviet Union.) The Russians still use some 700 BMD-1s, and have almost 2500 in storage.

An interesting note: Soviet doctrine had the BMD's driver and gunner being airdropped *inside* the vehicle! The BMD-1 is also equipped with a transponder allowing the rest of the crew to find it quickly after a drop. (To be fair, the BMD-1 drops on a special platform equipped with retrorockets and several parachutes to make for a fairly soft landing.)

The BMD-1

The BMD-1 looks very much like a smaller version of the BMP-1, but the two designs are only tangentially similar and are not directly related to one another. (The BMD-1 is in fact more closely related to the PT-76 than anything else.) The driver is in the center front hull, but the engine is in the rear and the troops enter and exit through hatches on the rear deck. The rear area is therefore small and carries only a maximum of three troops. (Technically, the BMD-1 has seats for four troops in the rear, but even the Russians found that jamming that many troops in the rear was unacceptably cramped.) One more of the troops doubles as the left bow machinegunner; the commander doubles as the right bow machinegunner. The bow machineguns have a narrow field of fire – depending on the source, 20-30 degrees. The right machinegunner enters from the rear, and has no hatch of his own; the commander has his own hatch. The turret looks similar to that of the BMP-1, but is quite a bit smaller; it is a one-man turret with a hatch on top for the gunner. On each side of the hull are two firing ports. The commander's cramped space is shared with a radio, and he and the driver have night vision blocks which can replace their day vision blocks. The commander also has a traversable periscope. The right machinegunner has the same equipment as the commander, minus the radio.

Armament of the BMD-1 is impressive for such a small vehicle, including a 73mm main gun with coaxial machinegun, an ATGM launcher, and a pair of bow machineguns. The engine is 270-horsepower 5D-20 diesel engine, giving the BMD-1 good power for its light weight; the transmission is manual. Armor protection is surprisingly good given the light weight; however, to save weight, the

Soviets used magnesium alloy for the armor, which could go up like a Roman candle when hit. The suspension is specially-designed for the BMD-1's role; it is a variable-height hydropneumatic suspension that allows the BMD-1 to "squat" when being carried in aircraft and being airdropped. The roadwheels are likewise small, and the tracks are a mere 230mm wide. A side-effect of this suspension appears to be a relatively decent ride. The BMD-1 is amphibious with a little preparation – a trim vane must be erected, bilge pumps turned on, and a periscope must be inserted into a socket and extended by the driver. The bilge pump has a manual backup. This takes 10 minutes. Propulsion in the water is by hydrojets. The hydrojets have shutters which allow for surprising maneuverability when swimming – the BMD-1 can turn a complete circle in place while floating. This is aided by the hydrojets' being able to suck in water as well as expel it.

Later BMD-1 Variants

In the 1980s, the BMD-1P variant was introduced. This replaced the AT-3 Sagger mount with a launcher beside the gunner's hatch able to launch all variants of the AT-4 or AT-5 ATGMs. The ATGM launcher is reloaded from the rear deck hatch, as the AT-4 and AT-5 missiles are too large to pass through the gunner's hatch, and having the gunner reload the ATGM launcher would be awkward at best due to the position of the launcher. For game purposes, this is identical to the standard BMP-1 except for the launcher and missiles.

Some BMD-1s were seen in Afghanistan and later with a 30mm autocannon in place of the 73mm gun. These may have been testbeds for the BMP-2. Also in Afghanistan, some BMD-1s were seen with the 73mm gun replaced with an AGS-17 grenade launcher. The Soviets appear to have taken this model out of service after Afghanistan. These two variants appear to have had no official designation other than "BMD-1." Both versions used the new launcher for AT-4/AT-5 ATGMs.

A minor variant, often incorrectly called the BMD-1M, has improved interior ventilation, four smoke grenade launchers on either side of the turret, and stronger roadwheels. For game purposes, this is identical to the standard BMD-1, except for what was mentioned before, and the addition of \$54 of cost.

A newer modification (post-Iron Curtain) has the BMD-1 hull topped with the Kliver turret, and is called the BMP-1M. The Kliver turret is a semi-overhead weapons station armed with an autocannon and coaxial machinegun capable of great elevation (almost straight up) and depression (able to engage enemy troops that are as little as 10 meters from the vehicle). The Kliver turret also has four launchers for AT-14 ATGMs, which are modular and can be replaced by up to four SA-18 SAMs (the missiles on each side of the turret must be replaced in pairs when doing this). The gun and coax are fully stabilized and equipped with modern fire control equipment, and the gunner has excellent day and night vision sights (which may be accessed by the commander via a downlinked monitor). The turret also has a cluster of four smoke grenade launchers on each side. This version does not carry bow machineguns, though the seats are still there for carrying the commander and one troop.

Other BMD-1 APC Variants

The BMD-1K (sometimes called simply the BMD-K) is a lower-echelon command version of the BMD-1. It is largely unchanged from the BMD-1, except for the addition of an extra long-range and medium-range radios and a pair of "Clothes Rail" antennas, which run horizontally over the length of the vehicle.

The same sort of version exists for the BMD-1P, called the BMD-1PK. However, the BMD-1PK has more command equipment, including a gyrocompass, radiation and chemical weapon detectors, and another long-range radio, as well as improved day and night vision equipment. This extra equipment takes up the space of the left bow machinegun, as well as one of the rear troop seats; some space for ammunition has also been lost.

BMD-1 (Standard)	\$271,896	D, A	600 kg	13.3 tons	3+5	8	Passive IR (D, G, C, LBG), WL/IR Searchlight	Shielded
BMD-1 (Autocannon-Armed)	\$182,821	D, A	700 kg	12.8 tons	3+5	8	Passive IR (D, G, C, LBG), WL/IR Searchlight	Shielded
BMD-1 (GL-Armed)	\$170,519	D, A	700 kg	12.8 tons	3+5	8	Passive IR (D, G, C, LBG), WL/IR Searchlight	Shielded
BMD-1M	\$179,629	D, A	600 kg	13 tons	3+5	8	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
BMD-1K	\$272,496	D, A	400 kg	13.4 tons	3+5	9	Passive IR (D, G, C, LBG), WL/IR Searchlight	Shielded
BMD-1PK	\$217,384	D, A	400 kg	13.5 tons	3+3	10	Passive IR (D, G, C, LBG), Image	Shielded

							Intensification (G, C), WL/IR Searchlight						
BMD-1 (Standard)/BMD-1K	148/104	36/22/9	300	112	Trtd	T3	TF6	TS3	TR3	HF8	HS4	HR4	
BMD-1 (Autocannon-Armed)	154/108	37/23/9	300	108	Trtd	T3	TF6	TS3	TR3	HF8	HS4	HR4	
BMD-1 (GL-Armed)	154/108	37/23/9	300	108	Trtd	T3	TF6	TS3	TR3	HF8	HS4	HR4	
BMD-1M	151/106	36/23/9	300	110	CiH	T3	TF4	TS4	TR4	HF8	HS4	HR4	
BMD-1PK	145/102	35/22/9	300	114	Trtd	T3	TF6	TS3	TR3	HF8	HS4	HR4	

BMD-1 (Standard)/BMD-1K	+1	Fair	73mm 2A28 Gun, PKT, 2xPKT (Bow), AT-3 or AT-4/AT-5 ATGM Launcher				40x73mm, 2000x7.62mm, 4xAT-3 or AT-4/AT-5 ATGM					
BMD-1 (Autocannon-Armed)	+1	Fair	30mm 2A42 Autocannon, PKT, 2xPKT (Bow), AT4/AT-5 ATGM Launcher				300x30mm, 2000x7.62mm, 4xAT4/AT-5 ATGM					
BMD-1 (GL-Armed)	+1	Fair	30mm AGS-17 AGL, PKT, 2xPKT (Bow), AT-4/AT-5 ATGM Launcher				450x30mm, 2000x7.62mm, 4xAT-4/AT-5 ATGM					
BMD-1M	+3	Good	30mm 2A72 Autocannon, PKT, up to 4xAT-15 ATGM and/or 4xSA-18 SAM Launchers				300x30mm, 2000x7.62mm, up to 4xAT-14 ATGM and/or 4xSA-18 SAMs					
BMD-1PK	+1	Fair	73mm 2A28 Gun, PKT, PKT (Right Bow), AT-4/AT-5 ATGM Launcher				40x73mm, 1750x7.62mm, 3xAT-4/AT-5 ATGMs					

Volgograd JSC BMD-2 Airborne Combat Vehicle

Notes: The war in Afghanistan and the experience of allies with the BMD-1 really brought home to the Soviets the deficiencies of the vehicle, particularly the fire-prone magnesium alloy armor and the inability of the 73mm gun to engage targets at high elevation, as well as that gun's relative inaccuracy and lack of range. Though the BMD-2 is still based on the BMD-1 design, they are new-build vehicles rather than rebuilds of BMD-1s. Development of the BMD-2 began shortly before the Russians withdrew from Afghanistan, and the BMD-2 entered main-line service in 1985, though the initial pre-production versions were used in Afghanistan as early as 1981. Users other than the Russians include India, Ukraine, and a small number used by Uzbekistan. The Russians have about 360 on active duty and over 1500 in storage.

Though the layout is basically the same as the BMD-1 (complete with cramped interior), the armor is of aluminum alloy instead of magnesium alloy. The new armor composition increases the weight of the BMD-2 over the BMD-1, and this does degrade performance somewhat, as the BMD-2 uses a modernized form of the same engine as the BMD (it develops 300 horsepower instead of 270 horsepower). The interior layout is largely the same as the BMD-1 (particularly the autocannon-armed version of the BMD-1), but the left side (commander's) bow machinegun has been eliminated, and the right side bow machinegun has about double the traverse, elevation, and depression. The rear deck has two larger hatches instead of the four smaller hatches of the BMD-1. The smaller engine allows for a rear door to be installed; unfortunately, like the BMP series, there is a large fuel tank in this door. (The moving of this fuel tank is part of what allowed the addition of a rear door, but of course presents problems against enemy fire of its own; if heavy combat is expected, the fuel supply from that rear tank can be cut off from the rest of the vehicle.) The base BMD-2 uses the AT-4/AT-5 (9P135M-1) ATGM launcher exclusively; it does not mount AT-3 ATGMs. More compact radios, the lack of the commander's bow machinegun and the associated ammunition storage, and some other equipment rearrangement have allowed for an increase in machinegun ammunition. As with the versions of the BMD-1 that are armed with the AT-4/AT-5 launcher, the missiles are reloaded through the deck hatch over the passenger compartment. One less ATGM is carried; this makes the passenger compartment a bit less cramped. Night vision is somewhat improved, as has fire control, and the crew has a collective NBC system to tap into. The BMD-2 is still amphibious in the same manner as the BMD-1, though internal flotation compartment balance had to be changed due to the difference in weight and center of balance. Radiation shielding has been added.

As said above, the BMD-2 uses virtually the same engine as the BMD-1. The suspension is likewise the same, and the driver and gunner still make drops inside the vehicle. It should also be noted that the Soviets had also made a decision at the same time that the BMD-1 and BMD-2 were too small; originally, a larger version of the BMD-2 was also to be built, but this design was delayed, improved, and eventually became the BMP-3.

Very few variants of the BMD-2 were built; these include the BMD-2M, which includes a number of small improvements, chief of which is the addition of four smoke grenade launchers on each side of the turret. For game purposes, the BMD-2M is identical to the BMD-2, except for the smoke grenade launchers and the addition of \$54 to the game price for those smoke grenade launchers. The BMD-2K command version of the BMP-2K closely follows the lines of the BMD-1K and BMD-1PK in that it has an extra long-range and medium-range radio, a gyroscopic compass, a radiation and chemical weapon detector, and space for two fold-up tables and chairs. Thusfar, the BMD-2 has not been seen with the Kliver turret modification.

BMD-2	\$138,873	D, A	600 kg	14.3 tons	3+5	8	Passive IR (D, G, C), Image Intensification (G)	Shielded
BMD-2K	\$140,973	D, A	300 kg	14.5 tons	3+3	10	Passive IR (D, G, C), Image Intensification (G)	Shielded

BMD-2/BMD-2K	143/100	35/21/9	300	114	Trtd	T3	TF6 TS3 TR3 HF8 HS4 HR4
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BMD-2	+2	Fair	30mm 2A42 Autocannon, PKT, PKT (Right Bow), AT-4/AT-5 ATGM Launcher				300x30mm, 2940x7.62mm, 3xAT-4/AT-5 ATGMs
BMD-2K	+2	Fair	30mm 2A42 Autocannon, PKT, PKT (Right Bow), AT-4/AT-5 ATGM Launcher				300x30mm, 2665x7.62mm, 2xAT-4/AT-5 ATGMs

Volgograd JSC BMD-3 Airborne Combat Vehicle

Notes: The BMD-3 is a new-build vehicle – though it is an attempt to address most of the shortcomings of the BMD-2, it is not merely an upgrade of the BMD-2. It has a new hull with a new interior arrangement, new armament arrangements, better fire control and armor protection, and a better suspension with a much more powerful engine – yet technological advances make it a lighter vehicle than the BMD-2. The combination of a more powerful engine and lighter weight, in particular, are strong improvements and give the BMD-3 outstanding agility and speed. Design work began almost in tandem with the BMD-2, but the BMD-3 did not enter service until 1990 with the then-Soviet Union. While past versions of the BMD series were airdropped with the driver and gunner onboard, the BMD-3's seats are designed so that the entire crew, including passengers, can be dropped inside the vehicle; larger parachutes and a different retrorocket system assists in this capability. Thusfar, the BMD-3 is used only by Russia, who have about 940 on hand. Though the Russian/Soviet Naval Infantry never used the BMD-2, they do use small numbers of the BMD-3.

The BMD-3

The BMD-3 looks at first glance very much like a BMD-2, but another look will tell you that even externally, it is a different vehicle. It is a more compact vehicle, yet interior space, though still cramped, is better utilized due to better-thought-out arrangements and improved technology. The passenger compartment, however, is still very cramped – though in an extreme case, up to 7 passengers could be crammed in, a more normal complement for the rear space is four troops. The driver is in the usual place in the center front hull, with a bow gunner on the driver's left manning an AGS-17 grenade launcher, and the commander on the driver's right who also mans an RPKS-74 automatic rifle. The RPKS-74 can be removed and used as a dismounted weapon, but doing so reportedly requires a contortionist to accomplish. Both mounts give their weapons about 30 degrees of traverse and elevation and 10 degrees of depression. The bow gunner, commander, and driver all have forward-facing vision blocks; the bow gunner also has vision blocks to the left, and the commander to the right. All three can remove their center forward vision blocks and replace them with night vision blocks. The commander also has an extendible periscope that rotates 360 degrees, but it has only a day vision channel.

The turret is essentially straight off the BMD-2, but the fire control equipment is modernized and much more compact, and stabilization is improved. Three smoke grenade launchers are also present on each side of the hull. The revised interior arrangements give the BMD-3 a greater ammunition supply. Like the BMD-2, the ATGM launcher of the BMD-3 is reloaded through the roof hatch of the passenger compartment, but the BMD-3 has only one large hatch which opens to the rear. The passenger compartment has a rear door (which has a fuel tank in it, though the fuel supply from that tank can be cut off if it is on fire), and two firing ports on each side of the hull. The troops have a collective NBC system.

The engine used on the BMD-3 is a 2V-06-2 450-horsepower supercharged diesel, coupled to an automatic transmission. The suspension type is the same – a hydropneumatic variable-height suspension, but the height adjustment capability is different (130-530mm, versus 100-450mm for the BMD-1 and BMD-2). Preparation for amphibious operations and amphibious performance is largely the same as the BMD-1 and BMD-2 (though the BMP-3 is faster when swimming).

The BMD-4 Bakhcha

One can be forgiven for looking at the BMD-4 and thinking that the BMD-4 has no relation to the BMD-3 – but the BMD-4 is

basically a BMD-3 hull topped with a turret that is a somewhat smaller version of the turret used on the BMP-3 IFV. This basically makes the BMD-4 a fire support vehicle more than anything else, as the space needed for the new turret, weapons fit, and ammunition severely limits space in the rear for troops. However, the increase in firepower is, of course, quite dramatic. Like the BMP-3, the BMD-4's new turret has a comprehensive and modern fire control and night vision suite, and the gun fires both conventional ammunition and ATGMs. The turret also has three smoke grenade launchers on each side of the gun mounting on the sides of the turret. In addition to the turret-mounted weapons, the BMD-4 retains the bow-mounted AGS-17 and RPKS-74 of the BMP-3, giving the BMD-4 considerable firepower in the frontal arc – though a version seen at an arms show in 2004 did not have any bow armament. (The RPKS-74 is manned by one of the troops carried, like the AGS-17 is on the left bow, as the commander has been relocated into the turret.) The commander and the gunner have independent day and night vision sights, giving the BMD-4 a hunter-killer capability. In addition, a target selected by the commander can be inputted into the fire control computer while the gunner is engaging other targets, and the turret and gun will automatically slew to that target at the touch of a button when the gunner has finished with his target; this can also be used by the commander to override the gunner's target selection if necessary. The commander has auxiliary controls for the main gun, coaxial autocannon, and coaxial machinegun; he does not have the equipment necessary to fire an ATGM, however. The gun stabilization and gun recoil buffering is said by the Russians to be enough that the 100mm gun can even be fired repeatedly while the vehicle is swimming. The firing ports and rear door are retained on the BMD-4. Performance does suffer, as the BMD-4 is considerably heavier than the BMD-3, but amphibious capability is retained. The final BMD-4 design was not seen until 2007, and only about 60 are known to be in Russian service by April 2010. No other country uses the BMD-4, though it is offered for sale internationally. (The turret system itself is also for sale, and is being used by China to development of a new IFV.)

The BMD-3M Kurgan

The BMD-3M was seen at arms shows as early as 2001, but it still appears to be a prototype, and no substantive development seems to have taken place on the BMD-3M since 2007. The BMD-3M is a less-expensive aftermarket upgrade kit for the BMD-3, a less complicated and costly version of the BMD-4 – sort of a “BMD-4 minus.” The interior layout is closer to that of a BMD-3, and the fire control and night vision suite are not as advanced; most notably, the BMD-3M lacks the hunter-killer capability of the BMD-4, though the commander can access the gunner's sights. The BMD-3M does not have the extensive interior rearrangement of the BMD-4, so it carries less ammunition. It's a bit more of a kludge, and weighs a bit more than the BMD-4. The BMD-3M does not appear to have interested any customers, and it is not even certain that Volgograd JSC will continue to offer it on the international market or even continue development.

Twilight 2000 Notes: The BMD-3 was widely used by Soviet Airborne and Naval Infantry forces during the Twilight War. The BMD-4, however, was a rare bird – an Airborne or Naval Infantry battalion would be lucky to have three or four of them, and these would generally be used to crack tough strongpoints or for scouting. The BMD-3M was an even rarer variant during the Twilight War – most appear to have been assembled in-theater by support units from kits, and an Airborne or Naval Infantry brigade would be lucky to have two or three on hand.

BMD-3	\$155,481	D, A	700 kg	12.9 tons	3+6	8	Passive IR (D, G, C, LBG), Image Intensification (G)	Shielded
BMD-4	\$395,261	D, A	400 kg	14.6 tons	3+4	9	Passive IR (D, G, C, LBG), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded
BMD-3M	\$335,060	D, A	400 kg	14.7 tons	3+4	9	Passive IR (D, G, C, LBG), Image Intensification (G), Thermal Imaging (G)	Shielded

BMD-3	205/143	50/30/13	450	224	Trtd	T3	TF10 TS6 TR4 HF9 HS5 HR4
BMD-4/BMD-3M	183/128	45/27/11	450	253	Trtd	T3	TF11Sp TS4Sp TR4 HF9 HS5 HR4

BMD-3	+2	Good	30mm 2A42 Autocannon, PKT, AGS-17 (Left Bow), RPKS-74 (Right Bow), AT-4/AT-5 ATGM Launcher				860x30mm, 2000x7.62mm, 551x30mm Grenades, 2160x5.45mm, 6xAT-4/AT-5 ATGMs
BMD-4	+3	Good	100mm 2A70 Gun, 30mm 2A72 Autocannon, PKT, AGS-17 (Left Bow), RPKS-74 (Right Bow)				44x100mm, 8xAT-10 ATGM, 550x30mm, 2000x7.62mm, 350x30mm Grenades, 2160x5.45mm
BMD-3M	+2	Good	100mm 2A70 Gun, 30mm 2A72				40x100mm, 6xAT-10 ATGM, 500x30mm,

Autocannon, PKT, AGS-17 (Left Bow),
RPKS-74 (Right Bow)

2000x7.62mm, 320x30mm Grenades,
2160x5.45mm

KMZ BMP-1 Korshun

Notes: One of the first true infantry fighting vehicles (an armored personnel carrier with significant antiarmor and fire support capability), the BMP-1 was introduced by Russian in the mid-1960s and first seen in public in 1967. The BMP-1 marked a wide divergence from the “battlefield taxi” philosophy prevalent at the time for APC design. It reflected the Soviet tactical and strategic doctrine of the time -- that a World War 3 battlefield would inevitably include nuclear, biological, and chemical weapon use, and that infantrymen would need to be able to fight effectively from inside the protection of their vehicles. It also reflected the Soviet strategy for an invasion of Western Europe at that time – the use of blitzkrieg tactics and rapidly-moving, overwhelming force. The BMP-1 was designed with these ideas in mind, as well as to significantly increase the firepower of a mechanized infantry squad. The design was also meant to provide as low a profile as possible, and the comfort of the crew and infantry squad was a rather remote consideration. The typical Western infantryman would consider the interior of the BMP-1 unacceptably small, and indeed, the combat effectiveness of a Soviet infantry squad, especially after even a moderate-length trip, is still considered by many questionable. Regardless, the BMP-1 was a revolutionary vehicle at the time of its inception, and influenced almost all subsequent infantry vehicle design for decades to come. The BMP-1 first saw combat use in the 1973 Yom Kippur War in the hands of Egyptian and Syrian forces, and has since seen combat in dozens of conflicts; the BMP-1 or its variants continue to serve in at least 25 countries worldwide, including some that the original Soviet designers would never have imagined. Production licenses seem to have been given out everywhere, and unlicensed production was done in even more countries. Even the US and Britain own a number of them, used in the OPFOR role for training purposes. Today, the BMP-1 is one of the most common IFVs in the world. (An interesting note: Afghanistan’s BMP fleet was largely destroyed by the US during the 2002 invasion, but afterwards, the US brokered a deal between Russia and Afghanistan for 80 BMP-1s and BMP-2s for the new Afghan Army. Iraq’s BMP fleet was likewise largely destroyed, but again the US intervened and got them some more BMP-1s.)

The BMP-1 – The Initial Versions

The Soviet government first drew up their requirements for the vehicle that became the BMP-1 in the late 1950s. Literally scores of concepts were explored and discarded, with elements taken from many of those designs and later incorporated into the final product. Eventually, the Kurgan Engineering Works (KMZ) Ob'yekt 764 was selected as the best design; the original prototype appeared in 1965, and initial limited production began in 1966. Large-scale production followed in 1967. The BMP-1 featured a low-profile turret armed with a 73mm main gun which fired low-pressure rounds adapted from those fired by the SPG-9 recoilless rifle, though the two weapons cannot fire each other’s rounds. The rather short barrel of the main gun greatly limited engagement ranges, and the small caliber was insufficient to engage tanks – it was primarily meant to take out enemy light armored and soft-skinned vehicles, and to crack strongpoints, though at the time of the BMP-1’s introduction, the main gun could penetrate the front, side and rear armor of NATO tanks. For longer-ranged engagements or for if the BMP-1 did actually have to engage a tank, KMZ mounted a launching rail above the main gun which fired the then-new 9M14 Malyutka (NATO reporting name: AT-3 Sagger) wire-guided ATGM, with controls for the ATGM controls requiring the gunner to stick at least his head out of his hatch (the ATGM cannot be fired if the BMP-1 is buttoned-up). For infantry engagements, the turret had a coaxial PKT machinegun. The production versions had a rather poor suspension, engine, and transmission, all of which were prone to failure; nonetheless, this initial version was produced until 1969, when it was replaced by a version with a beefed-up suspension and more reliable engine and transmission that was manufactured until 1973. The improvements did increase the weight of the vehicle. Further improvements in reliability and the suspension were again introduced in 1973, and this improved version was produced until 1979. Except for the weight of these three versions and the performance consequences of the increased weight, these three versions are essentially identical for game purposes. It should be noted that NATO went left and right with their initial designations for the BMP-1, mostly because they didn’t know the actual designation – variant designations included the M-1967 and various spins on the BMP designation, including BMP-A, BMP-76PB, or simply BMP (when it was the only BMP known to be in existence). US troops often refer to the BMP-1 (and to a lesser degree, other BMP versions), as the “Bimp.”

The driver is located in the left front of the hull, with the engine to his right. He is seated behind a sharply-raked glacis plate which allows the BMP-1 to have much better frontal armor protection than the thin metal of the armor would otherwise provide. The driver has three vision blocks to his front; the center block can be removed and replaced by a night vision block. The first version used an active IR block; later improvements gave the driver a passive IR block to be used in conjunction with IR headlights or an IR searchlight. The driver’s controls are remarkably simple for APCs and IFVs of the period: the driver has a steering yoke and a conventional gas and brake pedal. To the rear of the driver is the commander’s position; though many mistakenly believe the BMP-1’s turret contains both the commander’s and gunner’s positions, the turret is in fact a one-man turret. The commander has control of a rotatable IR searchlight; a periscopic IR vision head is part of this searchlight, as is a conventional day vision periscope. The day periscope has a magnification of x5, while the night head has a magnification of x4.2. The commander’s vision blocks have heating devices to help remove fogging due to weather as well as wipers to remove moisture due to rain or mud. The commander also has a radio at his position; this is normally a medium-range radio, but this can vary depending upon what level of the command structure the commander occupies.

The gunner occupies the turret. He has a hatch on the roof of the turret. In addition to the obvious uses, he must use it to fire the AT-3 ATGM as well as to reload the launcher (a difficult exercise which is also dangerous in combat – to reload the launcher, he had

to climb atop the turret to reach the launcher. Because of this, the launcher would more likely be reloaded by the commander, who would only have to expose his head, arms, and torso. In either case, the Sagger missile barely fits through the hatches). The turret has electrical traverse, and gun electrical elevation and depression. The main gun has two defects that are rather dangerous to the crew. One is that the main gun has a "dead zone" into which it cannot fire – if the gun is traversed to between the 10:00 and 11:00 of the BMP-1's hull, the main gun and coaxial machinegun have to be elevated past their normal maximum elevation to avoid destroying the commander's IR searchlight, and the main gun is designed to automatically do this regardless of the desires of the crew. In addition, the main gun is fed by an autoloader that gets over-enthusiastic -- the autoloader on the 73mm gun tends to malfunction, trying to stuff the gunner's left arm into the breech of the gun instead of a 73mm shell. If this occurs, the gunner takes 1D6 damage to the left arm and requires 6 phases (30 seconds) to extricate his arm from the gun and replace it with a 73mm round. The autoloader is also a high-maintenance piece of equipment that can work its way out of alignment rather easily if not constantly paid attention to. For this reason, many BMP-1 crews disabled the autoloader before going into combat; BMP-1s with a disabled autoloader may fire the main gun every other phase instead of each phase of combat. The low profile of the turret also means that the main gun and coaxial machinegun have virtually no depression capability (a bit less than 3 degrees), and enemy infantrymen within 20 meters of the BMP-1 have little to fear from the turret's weapons as long as they don't stand up. The low profile of the BMP-1 in general also means that the main gun and coaxial machinegun are less than two meters from the ground; if you are a friendly infantryman near the BMP-1, you'd better duck when the vehicle provides supporting fire. The original BMP-1 versions have a basic day/night sight (with x6/x6.7 magnification) and a simple optical rangefinder. The main gun had no stabilization at all. The gunner can also mount a white light or IR searchlight atop his turret, though the BMP-1 was not produced with a searchlight that had both white light and IR channels. The ATGM launcher installation has another problem of its own – the AT-3 sights have no access to the BMP-1's night vision equipment and cannot benefit from the IR searchlights, and this is in addition to the significant shortcomings of the AT-3 ATGM system itself. On the turret is also located an NBC sensor; though not quite as capable as a full Geiger counter or chemical agent sensor, it was able to alert the crew as to the presence of such agents.

The rear troop compartment has four firing ports on each side of the hull and a single firing port in the left rear door. The roof of the troop compartment has four D-shaped hatches for use by standing troops. The primary access to the passenger compartment is by two large doors in the rear of the vehicle. The designers decided to also put a fuel tank in both of these rear doors – it is a significant design flaw, and I can tell you from experience that hitting the rear doors of a BMP-1 can cause a flash fire in the BMP-1 that is a truly impressive sight. The main fuel tank, containing just over 329 liters, is in the floor between the troop benches, with 66.5 liters of fuel in each door tank. In case of fire, the flow from these tanks can be cut off by the commander or driver, but it's not an automatic system (let's hope they're quick). The troops four to a side and back-to-back, facing outwards. The interior is so cramped, however, that many armies reduce the troop complement to seven or even six, rather than try to cram eight troops inside and reducing their effectiveness due to lack of space and exhaustion caused by the close accommodations. The cramped interior often leads to personal gear and extra equipment being stowed on the rear deck, often stopping the turret from traversing to the rear. Though the BMP-1 has an NBC overpressure system with a collective NBC backup, it has no actual ventilation or anything that might cool the interior of the vehicle – and it doesn't have a heater either. This, along with the cramped interior, makes the BMP-1's interior absolutely oppressive in hot climates. This proved a serious problem in both the Middle East and Afghanistan; the crews would keep the roof hatches open under almost all conditions, and the crew and troops were then vulnerable to sharpshooters and machinegunners. On early versions of the BMP-1, the protection of the crew and passengers from radiation is also considered questionable.

The UTD-20 300-horsepower diesel engine is mounted in the front to the right of the driver, and is coupled to a manual transmission. The BMP-1's engine has a limited multi-fuel capability – it can burn almost any grade of diesel fuel, and it can also burn kerosene. The BMP-1 may lay a thick, oily smoke screen by injecting diesel fuel into its exhaust. The ground pressure is relatively low, and the BMP-1 can cross fairly deep snow without getting bogged down; it can also traverse some swampy terrain with a reasonable chance of success. The BMP-1 is also amphibious with minimal preparation; a trim vane must be erected at the front and bilge pumps turned on. The hull is airtight once the rear doors are closed, and buoyancy is assisted by hollow roadwheels and roadwheel arms with air chambers in them. The amphibious capability is rather limited – a current as little as 1.2 meters per second (4.3 kilometers per hour) can swamp a BMP-1. Cross-country travel, however, is unpleasant for the crew and passengers, particularly on a long trip or at high speeds, as even on the improved versions, the shock absorbers suck and the ride is bouncy, sometimes to the point of being violently bouncy.

The BMP-1 is constructed by and large of steel. Though the original requirements were that the armor be able to stop hits from 23mm autocannons through the frontal arc, 12.7mm machineguns on the sides, and 7.62mm guns from the rear, the front and side armor requirements were drastically scaled back in the interests of saving weight (and money) and improving speed. As a result, even the frontal armor can often be penetrated by .50-caliber machinegun rounds, and the rear of the vehicle is vulnerable to 7.62mm NATO ammunition. In Afghanistan, this weakness led to crews sometimes filling the rear fuel tanks with sand, and improving the rest of the armor with whatever metal or wood scraps they could find. The turret armor is a bit better, but still not what the original design specifications called for. BMP-1s had walls with radiation shielding installed in them, but in models exported to the Middle East before the 1973 war, the radiation shielding was replaced with simple fiberboard coverings.

The improved version of the BMP-1 (produced from 1969-73), as stated above, had a number of reliability improvements, particularly to the suspension. In their pre-production forms, the original BMP-1 was referred to by the Soviets as the Ob'yekt 765Sp1 and the first improved model was the Ob'yekt 765Sp2, but both carried the official designation of BMP-1. The first improved version is regarded as the first standard production version. Changes from the initial version included a higher hull and changes to nose section

for better flotation that increased length by 200mm, making the BMP-1 a better swimming platform. The exhaust port behind the turret was fitted with an extendible snorkel for amphibious operations and deep fording. A small air intake to the left of and in front of the driver was removed, again to increase swimming integrity. This version also added a shelf around the rear and part of the sides of the turret; this was for stowage of a rolled-up camouflage net or tarp. This version was further improved or short time later; some rudimentary gun stabilization was added. Improvements were made to the NBC system and engine to improve reliability. The autoloader for the main gun was less accident-prone, though some arm-grabs did still occur. Night vision was also slightly updated. In 1976, a further improved version was fielded; until the introduction of this version, the BMP-1's main gun fired only HEAT rounds. The Ob'yekt 765Sp3 (M-1976) had stowage and modified sights which allowed for the use of the new OG-15V HE-FRAG round. The M-1976 completely deleted the autoloader, at the request of the crews.

Later BMP-1 Modifications

Based on early experience in Afghanistan, the Soviets added an AGS-17 AGL on a pintle mount at on corner of the turret, manned by a soldier standing on the rear deck. The weapon and the ammunition storage take up the space of one passenger. Large numbers of these modifications were made. Though this version is generally referred to as the "BMP-1G" (as I have below), and sometimes by NATO as the M-1979/1, the variant had no official designation in the Soviet Army. Another common modification was the addition of three smoke grenade launchers on each side of the turret. Though sometimes called the BMP-1M, this too is not an official designation; the smoke grenade launchers were actually added to a number of BMP-1 (and other BMP) variants. For game terms, this variant is identical to any other BMP-1 (or variant), except that the grenade launchers add \$54 to the cost of the vehicle.

The Finnish, and later the Germans, Greeks, and Swedish, did a minor modification, one that some other countries also did on an unofficial basis – they disabled or removed the troublesome autoloader for the main gun. Even the Soviets, Warsaw Pact, Russians, and former Russian Republics did this on an unofficial basis to some of their BMP-1s. This has no game effect except to slow the rate of fire; such a BMP-1 can fire its main gun every other round instead of every round.

The BMP-1P was the result of experience gained from the 1973 Yom Kippur War and the Angolan Civil War three years later, where the shortcomings of the AT-3 Sagger and its control system became all too apparent. This resulted in the AT-3 launchers above the main gun being replaced by a launcher mounted on the turret beside the gunner's hatch that used the superior 9M113 Konkurs (AT-5 Spandrel) ATGM. Though this launcher required that the gunner stand in the hatch with his head, arms, and torso outside of the vehicle to use the missiles sight and guidance equipment, the AT-5 was so superior to the AT-3 that the sacrifice was deemed to be worth it. The launcher can also accept clip-on night vision equipment and has a superior guidance unit. The launcher is loaded through one of the hatches atop the troop compartment, as the missiles are too large to pass through the gunner's or commander's hatch and the mounting of the missile launcher makes it impossible for them to load the ATGM without getting completely out of the vehicle and climbing out onto the rear deck. A short time later, this launcher itself was replaced by one that could use both the 9M113 Konkurs and the 9M111 Fagot (AT-4 Spigot) ATGMs interchangeably. Other modifications came in special NBC coverings for the engine compartment access hatch, inside and outside the turret, and at the driver's and commander's hatches, solving an overpressure leakage problem. The engine and transmission were also improved in reliability – in the 1973 Yom Kippur War, the Syrians lost about 60% of their BMP-1 force, and most of these were lost when the crews abandoned broken-down vehicles that actually had easy-to-fix problems. Interior ventilation was improved, as this also proved to be a problem in the 1973 war and the Middle East's hot climate. The Soviets also analyzed the use of napalm by US forces against North Vietnamese armor and added an automatic fire detection and suppression system for the engine, crew, and troop compartments. Two more firing ports were added – one on the left side of the hull, and one just in front of the turret. A subtype of the BMP-1P, the BMP-1PM2, has *kovriki* appliqué turret armor and three smoke grenade launchers on each side of the turret. A further modification, the BMP-1PG, itself had three variants. The first had an AGS-17 AGL mounted on a pintle mount at the left top of the turret, which was to be manned by one soldier standing on the rear deck. A later version of the BMP-1PG added the tracks and drive sprockets of the BMP-2; a subsequent modification also gave the BMP-1PG a minor chassis overhaul and the small side skirts and the mudguards of the BMP-2 as well. In addition, this version had a rearranged troop compartment that was basically the same as that of the BMP-2, which is a little roomier due to rearranged stowage.

The BMP-1D was called the "Afghan" variant by Russian troops. This version is characterized by the appliqué armor on its sides and front as well as increased belly and deck armor, and armored side skirts to protect the suspension. The belly armor is even heavier under the driver's and commander's positions, the most likely casualties in a mine attack. The *kovriki* appliqué turret armor is also employed. The side appliqué armor has holes cut in it to allow the troops to continue using the firing ports. Firing ports were also added to the four overhead hatches, so the troops could fight while standing up, using the hatches as cover. Though not all BMP-1Ds had them, they were often seen with an armored stowage box at the rear of the vehicle on the deck. Four smoke grenade launchers are added to each side of the turret. The BMP-1D modifications add considerable weight to the vehicle; in addition, the center of gravity changes so much that amphibious operations are impossible. A sub-type of this variant mounted an AGS-17 AGL in place of the AT-4/AT-4 ATGM launcher, as the AGS-17 was much more useful in Afghanistan than the ATGM launcher. After the Soviet withdrawal from Afghanistan, the BMP-1Ds were "downgraded" back into standard BMP-1s or converted into other BMP-1 versions. The Iraqis developed a similar version to the BMP-1D on their own, fielding the modifications on some of their BMP-1s starting in 1988. For game purposes, this Iraqi version is identical to the BMP-1D.

The BMP-1-30 is an upgrade kit for the BMP-1 that sold poorly and was quickly discontinued. It used a standard BMP-1 chassis, but was topped with a turret similar in concept to that of the BMP-2, though the autocannon used was different. The engine was also replaced with a UTD-230 supercharged diesel engine developing 360 horsepower. (A similar idea, the BMP-1 Razbezhka, replaced

the BMP-1's turret with that of the BMP-2, but never left the design phase.) The crew was increased from three to six, with a radar operator in the nose of the vehicle, a radio operator, and two command personnel.

The BMP-1M is an upgrade that the Russian Army hopes to apply to all the BMP-1s and BMP-1Ps that they still have in service, as well as get decent sales from internationally. The first test vehicle was built in 1998, and the BMP-1M was first shown internationally at the IDEX 99 International Arms Exhibition in Abu Dhabi. The BMP-1M upgrade can be applied to any version of the BMP-1. It is unknown how many BMP-1M modifications have been made by Russia. The BMP-1M uses the Kliver turret in place of the standard BMP-1 turret, which is armed with an autocannon/machinegun/ATGM combination along with greatly-superior sights, night vision, and gun stabilization. The Kliver turret includes four launchers for AT-14 ATGMs, which are modular and can be replaced by up to four SA-18 SAMs (the missiles on each side of the turret must be replaced in pairs when doing this). The commander can access the gunner's sights and vision devices via a downlinked monitor. The Kliver turret includes a cluster of four smoke grenade launchers on each side of the turret.

The Recon Variant – The BRM-1

Work on the reconnaissance/scout version of the BMP-1 started almost as soon as the BMP-1 entered service, with development beginning in the late 1960s, first issue to Soviet units and low-rate initial production starting in 1972, and full production in 1973. The first BRM-1s were externally very similar to BMP-1s, but could be distinguished by the extra antennas and the wider, flat turret mounted near the rear of the hull instead of near the front like on the BMP-1. The rear hull deck also has a pair of hatches at each corner of the rear that are smaller than standard BMP-1 roof hatches. The larger turret primarily housed some of the extra radio equipment and interfaces for the BRM-1's inertial navigation system, and also gave the turret room for two crewmembers so that the commander could conduct better observation while the gunner kept the weapons manned. The turret has hatches for both the commander and gunner. (The inertial navigation system used in the initial production batches of the BRM-1 was relatively primitive and had to be reset every 30 minutes; in the late 1970s, a better inertial navigation system was fitted that largely solved this problem.) The BRM-1 carries a crew of four (driver, gunner, commander, and navigator), but the passenger compartment carries only a small dismount scout team of two troops; most of the rest of the space is used by extra communications and other specialized scouting aids and by extra supplies for the crew and scout team on long reconnaissance missions. The armament was also initially identical to the BMP-1, though the autoloader for the main gun was deleted. Soon after the BRM-1s introduction, the Tall Mike ground surveillance radar was added to the rear of the turret and the ATGM launcher and missile reloads were deleted. Other equipment of the BRM-1 includes a laser rangefinder (not linked to the main gun, and not part of a fire control system), an additional short-range radio, and a medium-range and long-range radio; the latter is data-capable. A radio mast is carried on the rear of the vehicle which can be erected on the ground next to the BRM-1 when it is halted, and this increases the range of the long-range radio to 300 kilometers (with the radio's standard whip antenna, the range is 50 kilometers). The Tall Mike ground surveillance radar could detect vehicles at 7 kilometers and personnel at 2 kilometers; in 1993, Doppler radar ranging was added to the system which allowed for more precision identification of targets and automatic tracking of moving and static targets. Most BRM-1s have a cluster of three smoke grenade launchers on each side of the turret. Some later versions also have the three whip antennas used by the BRM-1 relocated to the rear of the turret. The BRM-1 retains the firing ports of the BMP-1, though of course there are much fewer personnel to man them. When the BRM-1 was first identified by the West, it was given the designation BMP M-1976/1, and later BMP-R, until the true Soviet designation was known.

An enhanced version of the BRM-1, used primarily as a command reconnaissance vehicle, entered service at the same time as the standard BRM-1. This is the BRM-1K. The BRM-1K is not only has the same equipment as the BRM-1 (including the Tall Mike GSR system), it has some extra systems as well. In addition to the BRM-1 equipment listed above, the BRM-1K is equipped with a turret-mounted 50mm flare rocket launcher, a longer-ranged laser rangefinder (with a range of about 4 kilometers, as opposed to the 2-kilometer range of the BRM-1's laser rangefinder), a radio direction finder/detector, a device that detects and measures both radiation and chemical contamination (and another that can identify the type of chemical weapon that may be contaminating the area), a mine detector located in the front hull, and a compact 1kW gasoline-powered APU that is carried internally. The BRM-1K is fitted with an extendible radio mast instead of the ground-mounted long-range mast of the BRM-1; the range of the radios is 50 kilometers using the long whip antenna, and 300 kilometers with the extendible mast antenna which extends at the rear. The crew is provided several pairs of binoculars, a hand-held IR night vision device, two hand-held image intensifiers designed for day use, and one hand-held image intensifier that is designed for night use. Secure radios are fitted. The inertial navigation system is more advanced than that of the BRM-1, and did not need to be reset as often since it has a gyrocompass backup and the BRM-1K is also equipped with computerized surveying system. Later upgrades included those of the BRM-1K and also included a GLONASS GPS system with an inertial navigation backup, and a computerized mapping system; thermal imaging is also added. Of course, this extra equipment comes at a cost; the BRM-1K carries only half the normal ammunition for its main gun and an ATGM launcher was never fitted to the BRM-1K. The BRM-1K is also a little heavier than the BRM-1.

The Hungarians use a similar vehicle, but it carries a 3-man dismount team and a dirt bike strapped into the right side of the passenger compartment in place of the troop seats. It is designated the GHR-1F, (the BMP is designated the GH in Hungarian service) and is otherwise based on the BRM-1 with the upgrades of the 1993 version, though it does not have the amount of radios of the BRM-1, having two long-range data-capable radios, one medium-range radio, and one short-range radio.

The Czechoslovakians used a similar vehicle to the BRM-1, called BPvZ Svatava. The principal difference is a more comprehensive long-distance vision and night vision suite and an eight-barreled smoke grenade launcher on the rear of the turret. The BPvZ is based on the 1993 upgrades (though it was first deployed in the late 1980s). It is equipped with the long-barreled

Zarnitsa gun. The coaxial machinegun is an NSVT (later replaced with an M2HB) while the commander has a pintle-mounted PKM (later changed to a MAG). These vehicles are still in use by the Czech Republic and Slovakia.

Command and Staff Variants (Not Including Artillery, Air Defense, and Missile Command Vehicles)

Various command versions of the BMP-1 exist. The basic command versions of the BMP-1 are called the BMP-1K and look externally almost identical to a standard BMP-1, except for having extra radio antennas (one or two). Internally, they are rearranged to carry more radios, tables, map boards, and other command equipment. The interior seating is designed for the needs of the command mission and seating for only three personnel is provided along one side. The firing ports are welded shut and the associated vision blocks removed, except for the one in the rear. The BMP-1K1 is a platoon leader's vehicle and has two additional medium-range radios. The BMP-1K2 company commander's vehicle is virtually identical, but one of the medium-range radios is data-capable. The BMP-1K3 battalion commander's vehicle is also virtually identical, but instead of two additional medium-range radios, it has one additional medium-range and one additional long-range radio; the long-range radio is data-capable. All three have additional equipment to help the commander to accurately call for artillery strikes. In the mid-1990s, these vehicles were modified to carry the GLONASS GPS system and the radios were updated; the BMP-1K2 and BMP-1K3 also had ruggedized laptop computers added. All of these versions carry standard BMP-1 armament and ammunition. The updated versions were designed primarily for export, as lower-cost upgrades to foreign customers' command versions of the BMP-1K. The BMP-1K was initially issued to Soviet troops in 1973.

The base BMP-1K (the one simply designated "BMP-1K") differs significantly from the standard BMP-1; it retains the turret and the armament contained within (with a reduced amount of ammunition for the main gun), but instead has a raised roofline behind the turret, allowing the commander and his staff to almost stand straight up inside the vehicle. Despite being designed specifically for brigade/regimental commanders, the BMP-1K is one of the most common of the base BMP-1 modifications, and they are often found at battalion and company command levels, though often with a different mix of radios. The standard BMP-1K does not carry troops beyond the command and part of the staff, other than the turret crew and driver. The troop compartment has a fold-down table and three fold-up chairs, as well as room for a radio operator and two other staff members. On the walls are found map boards and strips of wood with clips for other good-to-know information. The BMP-1K has an additional long-range radio, generally mounted on the turret, though some are mounted on the right rear corner. This antenna may be retracted, with a length from 2-8 meters possible. The BMP-1K has two long-range radios, two medium-range radios, and one short-range radio, all of which are data capable, and all of which are paired with the Soviet/Russian equivalent of US VINSON encrypting modules. (For that matter, the other command variants have the same sort of modules.) The BMP-1K is equipped with a GPK-69 inertial navigation system, along with a computerized mapping module (it was primitive compared to Western counterparts of the time, but functional). In the late 1980s, this was replaced with a far better mapping module paired with a GLONASS navigation system; a version so equipped was known as the BMP-1KM, and usually was equipped with more advanced frequency-hopping radios. (This version should not be confused with the BMP-1M above; though the BMP-1KM *may* one day receive these modifications, there are no plans to do this at this time.)

BMP-1PK-type vehicles have the *kovriki* turret applique armor, and they also have applique armor added to the glacis and sides, while in most cases the side firing ports are plated off. (This was, however, a unit modification, left up to the individual units.) BMP-1PKs are also equipped with six grenade launchers on each side of the turret; three are 81mm smoke grenade launchers, while the other three are 60mm flare launchers. The BMP-1PK could, *in extremis*, be used as an NBC Recon vehicle for the command element, as it is equipped WPChR chemical detection device, and an optical chemical sniffer. Other accouterments include a DKRM-1 laser rangefinder detector, an EERS-1 RDF/Radar detector. The turret is ringed with vision blocks, and there are also five more wide angle vision blocks around the vehicle, including three which include firing ports. Hand-held devices deployable include an image intensifier, a thermal imager, and a set of day/night binoculars.

Command versions of the BMP-1P were also built, and began to replace most of the BMP-1Ks in Russian service in the late 1970s alongside the BMP-1P; these versions are the BMP-1PKs, and there are versions equivalent to the BMP-1K series (BMP-1PK1, BMP-1PK2, and BMP-1PK3). They retain the turret and weapons of the BMP-1P, and can be equipped with the *kovriki* applique turret armor, as well as the applique hull armor of the BMP-1K. The BMP-1PK3 also has a telescoping sensor and observation mast at the right rear of the vehicle, equipped with telescopic sights and night vision devices. They too were modernized in the mid-1990s. A command version of the BMP-1M has also been designed and is entering service with the Russians; this is the BMP-1KM, and has the same sort of equipment as the BMP-1K3 of the mid-1990s (though even more up-to-date), but does not have the mast-mounted sensors. The BMP-1KM can also use its laser rangefinder as a designator for laser-guided weapons launched by artillery or aircraft, and the command crew can access the gunner's sights via downlinked monitors. The BMP-1PK3 and BMP-1PKM have ruggedized laptop computers as part of their equipment.

The BMP-1KSh Potok is a command vehicle used at brigade level and above in Motorized Infantry Divisions and some Corps-sized units. It first appeared in 1978. It is also used by some units as a forward observation post, and as an FDC vehicle at brigade level and above, and some other specialized command and control units. The turret's weapons are deleted; the turret is still present, but it is fixed in place and cannot rotate, being used only as a commander's cupola. Normally, the BMP-1KSh is sometimes unarmed, though normally it has a pintle-mounted weapon at the commander's hatch. The interior has been given substantial rearrangement of the interior into space for the command staff and their equipment, including one short-range, two medium-range, and two long range radios (one of which is data-capable); the exact radio complement depends upon the vehicle and its role. Atop the vehicle is a 10-meter folding mast for an AMU long-range antenna; the vehicle also has a 10-meter telescoping mast at the right rear, similar to that of BMP-1PK3, with observation equipment. The BMP-1KSh is also festooned with normal whip antennas, normally having no less than

four of them. The BMP-1KSh has an inertial navigation with a gyrocompass as a backup, and on the rear deck are a pair of 1kW gasoline-fueled APUs to power the vehicles equipment when the engine is off. Two of the roof hatches are deleted to make room for these generators, and there are also racks on the deck for fuel cans for those APUs. It has a ruggedized laptop computer. Exact command equipment varies with the role of the BMP-1KSh in question. In the 1990s, these vehicles were given an upgrade; these vehicles are called BMP-1KShMs (though this is an unofficial designation given as a placeholder by NATO intelligence). They have modernized command and control equipment, as well as modernized observation equipment. The GLONASS GPS system has been added, with an inertial navigation backup; the thermal imager on the mast is also replaced with a FLIR, and a laser rangefinder is added. A ruggedized laptop computer is carried. The pair of 1kW APUs are replaced with a single 5kW diesel-fueled generator which can run off of the vehicle's fuel tanks as well as its own. Radios are also modern frequency-hopping radios.

Other APC-Type BMP-1 Modifications

The Egyptians, though they now have largely replaced their BMP-1s with BMP-2s, EIFVs, and Bradleys, for a time used their own variant of the BMP-1, the BMP-1S. 200 such modifications being made from 1979 onward, and some still serve today. This version had a French-made (later built under license in Egypt) Poyaud 520 6L CS2 turbocharged engine developing 310 horsepower. Though not much more powerful, more importantly, the new engine was much easier to service, required fewer total parts in general, and had much greater sand and dust resistance. The commander's station has a new laser device which can be used as a designator or as a dazzler. To decrease crew fatigue, the number of passengers was reduced to seven. Finally, the gun, while the same base 2A28 gun, has two-plane stabilization, a ballistic computer, and a laser rangefinder. The BMP-1S was based on the BMP-1 (1976).

Finland also uses the BMP-1PG, and their BMP-1K1s have also been updated to the BMP-1PG standard. These are designated BMP-1PS. They also have their autoloaders deleted from their license-produced vehicles, and the Russian smoke grenade launchers replaced by two Lyran 71mm smoke/illumination launchers on the left side of the rear of the turret. These can fire smoke or illumination rounds. They are to be loaded by the main gun's gunner, as loading by the commander would require him to completely leave the turret. There are also four 76mm Wegmann smoke grenade launchers on the right side of the turret. Applique armor has been applied to the turret and hull.

After reunification, former East German BMP-1Ps were modified by the German Army to bring them up to Western safety requirements, including a new Halon-based multi-compartment fire detection/suppression system. The rear door fuel tanks were filled with injected foam. New IR/WL driving lights were installed, rear-view mirrors were added to the driver's position, MB smoke grenade launchers replaced the East German-made ones, and the ATGM launchers were removed. Better non-slip surfaces were applied and the electrical and hydraulic systems completely modernized. Some slight fire control improvements were made. 581 such modifications were made and designated BMP-1A1 Ost (sometimes incorrectly referred to as the BMP-1A2). After the Panzergrenadier units using them were partially disbanded, the BMP-1A1 Osts were replaced by Marder 1A3s in the remaining units, and the BMP-1A1 were used as the basis for German BMP-1s sold on the international market, where they proved popular. Some 500 were sold to Greece with some further modifications (and 32 of these were sold to Iraq, see below), a few were sold to Finland with (again) more modifications to bring them up to the BMP-1PS standard, and several more were sold to various countries who wished to update their BMP-1, generally as kits, and sometimes with OWS add-ons. A very few were de-militarized and sold to private owners, while some others were sold to the US for training American and allied nations' troops at NTC and JRTC. Some others were sold to museums, after being restored to initial condition (though still with fire, electrical, and hydraulic upgrades).

The BMP-1A1 Osts sold to the INA (Iraqi National Army) were originally part of a large order that was being sold to the Hellenic Army at the time. Greece agreed to allow 32 of them to be sold to Iraq in return for a small amount of *gratis* work on their new BMP-1s by the Germans. These BMP-1A1s began as standard BMP-1A1 Osts, but received a number of further upgrades in addition. The commander's position was armed with a Milan ATGM launcher, able to launch any type or make of Milan missile. In addition to the upgraded fire control computers, the Iraqi BMP-1A1s were equipped with a nearly jam-proof laser rangefinder. A small amount of applique armor was applied in the form of thin aluminum armor plates bolted on to the turret and hull. Inertial navigation was added, along with a mapping computer. The coaxial MG3 was replaced by an M240, and the commander's position has also been equipped with a pintle-mounted M240. Finally, the night vision suite was upgraded, and the searchlights removed. The vehicles have been overhauled to a "zero-miles" condition. These are designated BMP-1A2s by some sources, while some simply call them BMP-1A1s (without the "Ost"). I have used BMP-1A2 below, though I do not know what the proper designation actually is.

Before and after Operation Enduring Freedom, the Afghani Army converted some of their BMP-1s with a modified turret ring, allowing a turntable to be mounted with a ZU-23-2 AAA autocannon pair. (Most of these modifications are based on BMP-1Ps.) The high elevation was normally used to shoot insurgents high on mountain passes, while the guns could be depressed below 0 degrees to fire at ground targets. All of the remaining vehicles are now operated by the ANA (Afghani National Army), and they have made a few more of these modifications. The various militias also have some of these modified BMP-1s; whether or not they have turned them over to the ANA depends upon the tribe. I do not know what the designation of this version is either; I have elected to designate them BMP-1/23-2 for game purposes.

Belarus employs several modified BMP-1; most of them are upgraded to the BMP-1P standard, but those modernized in the early 2000s or later also have a more modernized fire control system, up-to-date night vision and telescopic sights, and a system to prevent laser dazzling and jam-resistant laser range finders and a jam-resistant laser designator. A current modification of the BMP-1 is a cooperative development between Slovakia and Belarus, designed primarily for the Belarussian Army. It uses an overhead weapons mount that mounts a 2A42 Cobra autocannon with its own fire control and sighting devices, designed by Slovakia. A second variant mounts two AT-5 Spandrel missiles in addition to the autocannon, and a third version uses a PKM machinegun coaxial to the 2A42

(but without the missiles). The modified BMP-1 also uses the floatation skirts and mudguards of the BMP-2, and is equipped with applique armor on the hull front and sides and the front and sides of the turret. The sides of the hull have lugs for ERA. All are equipped with GPS and a mapping module, the engines, transmissions, electrical systems, and suspensions have been completely overhauled. Despite the heavier weight, the Belarussian/Slovakian BMP-1 modification is still amphibious unless ERA is mounted. The version with side-mounted ATGMs seem to be the direction that Belarus is now going in. I have designated these "BMP-1B" for game purposes, though this is not by any means an official designation.

The BMP-1 has always been criticized, most of all by its crews, for its thin hull armor, particularly on the sides and rear. Therefore the Iraqis, in 1988, began applying spaced applique armor to the hull sides. This did not seem to help the survivability under Coalition fire, and most Iraqi BMP-1s, even those equipped with this applique, were destroyed in Desert Storm and Operation Iraqi Freedom. These modifications were based on the BMP-1P, and were provided mostly to the Iraqi Republican Guard.

The Also-Rans – Experimental Modifications of the BMP-1

Several countries tried several experimental and modified versions of the BMP-1 that, while in many cases not without merit, were not proceeded with due to expense, lack of enough of an upgrade in performance or value, or were simply half-baked ideas that never came to full fruition. These are listed below, but none of these came any further than advanced prototypes, demonstrators, or test vehicles.

The Russian BMP-1-OWS-25 was experimentally fitted with an Israeli-made Overhead Weapons System which is modified from the OWS-25M, mounting two AT-8 ATGM that can be aimed, and fired from within the turret. The modified BMP-1 does not carry reloads for the AT-8 launcher, though reloads may be carried as cargo. The OWS-25M can be rotated independently from the turret and has its own set of fire control systems and night/observation devices. The modified OWS-25M is equipped with the BMP-2's 30mm autocannon as well as a PKM machinegun as main armament. Both the 25mm autocannon and machinegun can be aimed, reloaded, and fired from within the OWS's protection. The OWS-25M has the same degree of armor protection as the BMP-1 and has a hatch on top, allowing the commander a greater degree of observation if desired. Though the BMP-1-OWS-25 received considerable interest and field testing from the Russian Army brass, in the end it was not proceeded with. The modified OWS-25M, however, was offered, and is still being offered, on the export market as a modification for the BMP series.

The Russians are currently testing the BMP-1 with a modified (primarily for fit to the turret ring) version of BMP-3's turret and is called the BMP-1 Bakhcha-U (the modified turret is known as the Bakhcha-U weapons station). Turret armor is not as comprehensive as that of the BMP-3. The 30mm autocannon is an earlier model used due to the smaller size of the Bakhcha-U turret. This turret is otherwise identical to that of the BMP-3. The Russians may also in the future offer the Bakhcha-U turret on the international market as a kit to upgrade existing BMP-1s. The Russians are currently using the chassis of an older BMP-1G chassis, but the upgrade could be applied to any BMP-1 chassis.

An experimental variant of the BMP-1, Ob'yekt 768, was devised and put into field trials in 1972. The turret is heavily-modified, being armed with a 73mm "Zarnitsa" main gun, which fired more normal tank-type cannon shells with greater range than the normal BMP-1, which uses a gun that fires a variant of the rounds fired by the SPG-9 recoilless rifle. The coaxial machinegun was also upgraded, being a DShK. The commander's hatch is topped with an OWS mounting a PKT and an ATGM launcher. This station, perhaps one of the earliest OWSs deployed, allows the commander to aim, fire, and reload the PKT without breaking armor and has its own night vision and telescopic sights. The top of the OWS has a hatch, allowing the commander to use a missile launcher able to AT-5 ATGM and its variants; unfortunately, he must raise his chest, arms, and head out of the vehicle to load the missile, though the missile itself may be aimed and fired from under armor. The tracks have hydropneumatic grills, allowing it a somewhat higher swimming speed. Ob'yekt 768 had a significantly longer and strengthened nose section, bowing to troop complaints, passenger complement was reduced to 7. Despite all the good points of the new design, the Soviets decided not to spend the money, citing the complexity and rise in profile of the OWS, and only two prototypes were produced. One of the Ob'yekt 768 prototype hulls was used to produce Ob'yekt 769, which is essentially an Ob'yekt 768 topped by a modified BMP-2 turret (the BMP-2 was then nearly developed enough to almost be in LRIP production). It was later developed into the BMP-1-30, which is now an export upgrade kit for BMP-1s. Ob'yekt 769 was fitted with the OWS of the Ob'yekt 768, and was fitted with a new engine developing 321 horsepower. The hull and turret are, for most other purposes, the same as those of the Ob'yekt 768 and BMP-2, respectively. As the BMP-2 was nearing production standard, Ob'yekt 769 was cancelled (even though, in my opinion, it is a better BMP-2 than the real BMP-2.)

Ob'yekt 680 essentially experimented with a kit to upgrade Soviet BMP-1s to a sort of BMP-2 standard. The hull remained the same; the BMP-2 turret was modified for fit and the gun was an earlier version of the BMP-2's cannon, the 2A38 autocannon. Ob'yekt 680 had a coaxial PKT along with a pintle-mounted PKT at the commander's hatch, as well as an increased amount of ammunition for them. It did benefit from a very light weight for a BMP-1-based vehicle, primarily to the smaller turret and gun, though the lack of a missile launcher and ATGMs also lightened the weight. The Soviet Army decided that no such upgrades were needed for Soviet Army BMP-1s, and the project was halted before field testing. Like Ob'yekt 768 and 769, Ob'yekt 680 was produced in 1972.

Ob'yekt 675 and Ob'yekt 681 were first built in 1977. They both used the BMP-1 (1976) chassis, with Ob'yekt 675 using a variant of the BMP-2 turret, and Ob'yekt 681 using a variant of the BMP-1 turret. The primary modifications in the turrets was the use a gun stabilized in two planes, and the use of a sophisticated fire control computer with a laser rangefinder. This gave them guns with excellent accuracy and stability, able to make accurate shots while at full gallop. However, this same sophisticated fire control system, particularly the computers, were troublesome, and their improvements would not be carried forward to current BMP improvements. Ob'yekt 681 also used a NSVT as a coaxial machinegun, and Ob'yekt 681 may have been a further modified Ob'yekt 768, as it also used the Zarnitsa gun. In either case, the ATGM guidance module is on top of the turret and the commander guides the missiles from

under armor, though he must expose his head, chest, and arms to reload the launcher.

A Finnish prototype of the BMP-1P placed a LAV-25 turret on a BMP-1P hull. It is not known whether the Finnish Army was satisfied with the result or why it was not proceeded with. For game purposes, I have designated the BMP-1P/25 here, though this is not an official designation.

Twilight/Merc 2000 Notes: The BMP-1M does not exist in the Twilight 2000 World, nor do any of the variants based on it. The upgrades of BMP-1s listed above as having occurred in 1995 or later are very rare. The various "Ob'yekt" prototypes still exist (assuming they have not been nuked or otherwise destroyed, appropriated, or sabotaged) at the Kubinka Tank Museum about 40 kilometers outside of Moscow; this does not guarantee that they are in working condition or that there are spare parts for them. The two Finnish BMP-1/25 prototypes are at the Parola Tank Museum in Finland, preserved in working condition, and presumably ready to go with the addition of ammunition, radios, and fuel.

BMP-1 (M-1967)	\$228,659	D, A	1 ton	12.6 tons	3+8	8	Active IR (D, G, C), IR Searchlight (G, C)	Shielded
BMP-1 (M-1969)	\$231,394	D, A	1 ton	13 tons	3+8	8	Active IR (D, G, C), IR Searchlight (G, C)	Shielded
BMP-1 (M-1976)	\$168,394	D, A	1 ton	13.2 tons	3+8	8	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1G	\$176,384	D, A	1 ton	13.2 tons	3+7	8	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1P	\$173,157	D, A	1 ton	13.4 tons	3+8	8	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP- 1PG	\$194,517	D, A	1 ton	13.4 tons	3+7	8	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP- 1PM2	\$171,269	D, A	1 ton	13.5 tons	3+8	8	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1D	\$176,912	D, A	1 ton	14.5 tons	3+8	8	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP- 1DG	\$180,258	D, A	1 ton	14.5 tons	3+7	8	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1- 30	\$75,608	D, A	1 ton	13.8 tons	3+8	8	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1M	\$176,657	D, A	1 ton	12.9 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
BRM-1	\$767,934	D, A	500 kg	12.9 tons	4+2	13	Passive IR (D, G, C), Image Intensification (G, C), IR Searchlight (G, C), WL Searchlight (G), GSR Radar (20 km)	Shielded
BRM-1 (1993)	\$1,030,594	D, A	500 kg	12.9 tons	4+2	13	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C), IR Searchlight (G, C), WL Searchlight (G), GSR/MCB Radar (30 km)	Shielded
BRM-1K	\$938,583	D, A	500 kg	13.2 tons	4+2	13	Passive IR (D, G, C), Image Intensification (G, C), IR Searchlight (G, C), WL Searchlight (G), GSR Radar (40 km)	Shielded
BRM-1K	\$953,028	D, A	500 kg	13.2 tons	4+2	13	Passive IR (D, G, C), Image	Shielded

(1993)								Intensification (G, C), Thermal Imaging (G, C), IR Searchlight (G, C), WL Searchlight (G), GSR/MBC Radar (40 km)	
BMP-1K1	\$230,929	D, A	500 kg	13 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1K2	\$230,979	D, A	500 kg	13 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1K3	\$232,144	D, A	500 kg	13 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1K1 (1995)	\$187,929	D, A	500 kg	13 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1K1 (1995)	\$248,644	D, A	500 kg	13 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1K1 (1995)	\$249,144	D, A	500 kg	13 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1PK1	\$169,826	D, A	500 kg	13.4 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1PK2	\$169,876	D, A	500 kg	13.4 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1PK3	\$233,001	D, A	500 kg	13.4 tons	3+3	10		Passive IR (D, G, C, Mast), Image Intensification (Mast), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1PK1 (1995)	\$150,131	D, A	500 kg	13.4 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1PK1 (1995)	\$150,181	D, A	500 kg	13.4 tons	3+3	10		Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1PK1 (1995)	\$221,048	D, A	500 kg	13.4 tons	3+3	10		Passive IR (D, G, C, Mast), Image Intensification (Mast), Thermal Imaging (Mast), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1KM	\$235,707	D, A	500 kg	12.9 tons	3+3	10		Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
BMP-1KSh	\$388,523	D, A	500 kg	13 tons	3+4	12		Passive IR (D, G, C, Mast), Image Intensification (Mast), Thermal Imaging (Mast), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1KShM	\$276,686	D, A	500 kg	13 tons	3+4	12		Passive IR (D, G, C, Mast), Image Intensification (Mast), FLIR (Mast), IR Searchlight (G, C), WL Searchlight (G)	Shielded
GHR-1F	\$1,167,143	D, A	290 kg	13.74 tons	5+3	15		Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C), IR Searchlight (G, C), WL Searchlight (G), GSR/MBC Radar (40 km)	Shielded

BPzV Svavata	\$965,609	D, A	500 kg	13.37 tons	3+2	15	Passive IR (D, G, C, Mast), Image Intensification (Mast, G), FLIR (Mast), IR Searchlight (G, C), WL Searchlight (G), LLTV (Mast, C), GSR/MCB Radar (40 km)	Shielded
BMP-1S	\$255,980	D, A	1 ton	13.2 tons	3+7	13	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1PS	\$200,490	D, A	1 ton	13.75 tons	3+7	9	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1A1 Ost	\$309,822	D, A	1 ton	13.2 tons	3+8	10	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1A2	\$433,200	D, A	813 kg	14.15 tons	3+7	12	Image Intensification (D, G, C), Thermal Imaging (G, C)	Shielded
BMP-1/23-2	\$81,257	D, A	1.28 tons	12.07 tons	4+7	7	Passive IR (D, G), WL Searchlight (C)	Shielded****
BMP-1B1	\$526,636	D, A	898 kg	13.81 tons	3+7	10	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G, C), LLTV Backup Camera (D)	Shielded
BMP-1B2	\$736,190	D, A	866 kg	13.94 tons	3+7	12	Passive IR (D, G), Image Intensification (G, C), Thermal Imaging (G, C), LLTV Backup Camera (D)	Shielded
BMP-1B3	\$771,190	D, A	851 kg	14 tons	3+7	13	Passive IR (D, G), Image Intensification (G, C), Thermal Imaging (G, C), LLTV Backup Camera (D)	Shielded
BMP-1B4	\$745,958	D, A	1 ton	13.81 tons	3+7	12	Passive IR (D, G), Image Intensification (G, C), Thermal Imaging (G, C), LLTV Backup Camera (D)	Shielded
BMP-1P (IRG)	\$179,232	D, A	868 kg	13.93 tons	3+8	9	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
BMP-1/OWS-25	\$550,869	D, A	500 kg	13.38 tons	3+7	11	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G), Thermal Imaging (C), Image Intensification (C)	Shielded
BMP-1 Bakhcha-U	\$897,606	D, A	500 kg	15.95 tons	3+7	10	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (C)	Shielded
Ob'yekt 768	\$605,795	D, A	1 ton	13.6 tons	3+7	12	Passive IR (D, G, C), IR Searchlight (G, C), WL Searchlight (G)	Shielded
Ob'yekt 769	\$633,957	D, A	900 kg	13.8 tons	3+7	12	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (Gun, C)	Shielded
Ob'yekt 680	\$315,754	D, A	1 ton	13 tons	3+7	10	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (G)	Shielded
Ob'yekt 675	\$552,982	D, A	1 ton	13.6 tons	3+7	11	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G), IR Searchlight (G)	Shielded
Ob'yekt 681	\$584,786	D, A	1 ton	13.6 tons	3+7	11	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G), IR Searchlight (G)	Shielded

Finnish BMP- 1/25	\$242,988	D, A	1 ton	13.1 tons	3+7	8	Passive IR (D, G), Image Intensification (G)	Shielded***
BMP-1 (M- 1967)	156/109	38/23/4	462	126	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
BMP-1 (M- 1969)/BMP- 1K/BRM-1	152/107	37/22/4	462	130	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
BMP-1 (M- 1976)/BMP- 1G	151/106	37/22/4	462	131	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
BMP- 1P/BMP- 1PG/BMP- 1PK	150/105	37/22/4	462	134	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
BMP-1PM2	147/103	36/22/4	462	137	Trtd	T3	TF11 TS7 TR7 HF8 HS4 HR4	
BMP- 1D/BMP- 1DG	137/96	34/20	462	144	Trtd	T3	TF11 TS7 TR7 HF10Sp HS6Sp HR4*	
BMP-1-30	145/102	36/21/4	462	138	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
BMP- 1M/BMP- 1KM	154/108	38/23/4	462	128	CiH	T3	TF4 TS4 TR4 HF8 HS4 HR4	
BMP- 1KSh/BRM- 1	152/107	37/22/4	462	130	Stnd	T3	HF8 HS4 HR4	
BRM-1K	149/105	36/22/4	462	133	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
GHR-1F	148/104	36/22/4	462	134	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
BPzV	149/105	35/22/4	462	132	Trtd	T3	TF11 TS7 TR7 HF8 HS4 HR4	
Svavata								
BMP- 1/OVS-25	150/105	37/22/4	462	132	Trtd	T3	TF11 TS7 TR6 HF8 HS4 HR4	
BMP-1S	162/113	45/31/4	462	135	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
BMP-1PS	148/104	37/22/4	462	136	Trtd	T3	TF12 TS8 TR6 HF12 HS6 HR4	
BMP-1A1 Ost	151/106	37/22/4	329	131	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR5	
BMP-1A2	149/104	41/29	329	129	Trtd	T3	TF11 TS6 TR6 HF9 HS5 HR5	
BMP-1/23-2	163/114	45/32/5	462	115	Stnd	T3	HF8 HS4 HR4	
BMP-1B1	152/106	42/30/4	462	129	Trtd	T3	TF12Sp TS8Sp TR6 HF10Sp HS5 HR4	
BMP-1B2	151/105	42/30/4	462	130	Trtd	T3	TF12Sp TS8Sp TR6 HF10Sp HS5 HR4*****	
BMP-1B3	151/105	42/30/4	462	130	Trtd	T3	TF12Sp TS8Sp TR6 HF10Sp HS5 HR4*****	
BMP-1B4	152/106	42/30/4	462	129	Trtd	T3	TF12Sp TS8Sp TR6 HF10Sp HS5 HR4*****	
BMP-1P (IRG)	147/103	36/22/4	462	137	Trtd	T3	TF10 TS6 TR6 HF8 HS6Sp HR4	
BMP-1 Bakhcha-U	138/97	34/20/4	462	145	Trtd	T3	TF8 TS6 TR3 HF8 HS4 HR4	
Ob'yekt 768	150/105	36/22/5	462	132	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4**	
Ob'yekt 769	149/104	36/22/5	462	133	Trtd	T3	TF11 TS7 TR6 HF8 HS4 HS4**	
Ob'yekt 680	153/107	37/23/5	462	130	Trtd	T3	TF8 TS5 TR4 HS8 HR4 HS4	
Ob'yekt 675	150/105	36/22/4	462	132	Trtd	T3	TF11 TS7 TR6 HF8 HS4 HR4	
Ob'yekt 681	150/105	36/22/4	462	132	Trtd	T3	TF10 TS6 TR6 HF8 HS4 HR4	
Finnish BMP-1/25	152/106	37/22/4	462	133	Trtd	T3	TF6 TS4 TR4 HF8 HS4 HR4	

BMP-1 (M-1967)	+1	None	73mm 2A28 Gun, PKT, AT-3 ATGM Launcher	40x73mm, 2000x7.62mm, 5xAT-3 ATGMs
BMP-1 (M-1969/1976)/BMP-1K	+1	Fair	73mm 2A28 Gun, PKT, AT-3 ATGM Launcher	40x73mm, 2000x7.62mm, 5xAT-3 ATGMs
BMP-1G	+1	Fair	73mm 2A28 Gun, PKT, AGS-17 AGL, AT-3 ATGM Launcher	40x73mm, 2000x7.62mm, 290x30mm, 5xAT-3 ATGMs
BMP-1P/BMP-1PM2/BMP-1PK/BMP-1P (IRG)	+1	Fair	73mm 2A28 Gun, PKT, AT-4/AT-5 ATGM Launcher	40x73mm, 2000x7.62mm, 5xAT-4/AT-5 ATGMs
BMP-1PG/PS	+1	Fair	73mm 2A28 Gun, PKT, AGS-17 AGL, AT-4/AT-5 ATGM Launcher	40x73mm, 2000x7.62mm, 290x30mm, 5xAT-4/AT-5 ATGMs
BMP-1D	+1	Fair	73mm 2A28 Gun, PKT, AT-4/AT-5 ATGM Launcher	40x73mm, 2000x7.62mm, 5xAT-4/AT-5 ATGMs
BMP-1DG	+1	Fair	73mm 2A28 Gun, PKT, AGS-17 AGL	40x73mm, 2000x7.62mm, 290x30mm
BMP-1-30	+1	Fair	30mm 2A72 Autocannon, PKT, AT-4/AT-5 ATGM Launcher	500x30mm, 2000x7.62mm, 5xAT-4/AT-5 ATGMs
BMP-1M/BMP-1KM	+3	Good	30mm 2A72 Autocannon, PKT, up to 4xAT-15 ATGM and/or 4xSA-18 SAM Launchers	300x30mm, 2000x7.62mm, up to 4xAT-14 ATGM and/or 4xSA-18 SAMs
BRM-1	+1	Fair	73mm 2A28 Gun, PKT	40x73mm, 2000x7.62mm
BRM-1K	+1	Fair	73mm 2A28 Gun, PKT	20x73mm, 2000x7.62mm
BMP-1KSh	None	None	PK (C)	2000x7.62mm
GHR-1F	+1	Fair	73mm 2A28 Gun, PKT, PKM (C)	40x73mm, 2000x7.62mm
BPvZ Svavata	+3	Good	73mm Zarnitsa Gun, NSVT (or M2HB), PKT (or MAG) (C)	30x73mm, 1000x12.7mm (or .50), 1000x7.62mm
BMP-1S	+4	Good	73mm 2A28 Gun, PKT, AT-3 ATGM Launcher	40x73mm, 2000x7.62mm, 5xAT-3 ATGMs
BMP-1A1 Ost	+2	Fair	73mm 2A28 Gun, MG3	40x73mm, 2000x7.62mm
BMP-1A2	+3	Fair	73mm 2A28 Gun, M-240, M-240(C), Milan ATGM Launcher	40x73mm, 4000x7.62mm, 5xMilan ATGM
BMP-1/23-2	Nil	Fair	ZU-23-3 Autocannon Pair, PKM (C)	650x23mm. 2000x7.62mm
BMP-1B1	+3	Good	73mm 2A28 Gun, PKT, PKM (C), AT-4/AT-5 ATGM Launcher	40x73mm, 2000x7.62mm, 5xAT-4/AT-5 ATGMs
BMP-1B2	+3*****	Good*****	73mm 2A28 Gun, PKT, 30mm 2A42 autocannon (C)	40x73mm, 2000x7.62mm, 300x30mm
BMP-1B3	+3*****	Good*****	73mm 2A28 Gun, PKT, 30mm 2A42 autocannon (C), 2xAT-5 ATGM Launchers	40x73mm, 2000x7.62mm, 300x30mm, 4xAT-5 ATGMs
BMP-1B4	+3*****	Good*****	73mm 2A28 Gun, PKT, 30mm 2A42 autocannon (C), PKT (C)	40x73mm, 4000x7.62mm, 300x30mm
BMP-1/OWS-25	+1 (+3 for OWS)	Fair (Good for OWS)	30mm 2A72 Autocannon, 25mm M242 Chaingun, 2xPKT, 2xAT-8 ATGM Launchers	500x30mm, 300x25mm, 2000x7.62mm, 2xAT-8 ATGMs
BMP-1 Bakhcha-U	+2	Fair	2A70 100mm Gun, 2A72 30mm Autocannon, PKT	40x100mm, 4xAT-10 ATGM, 500x30mm, 2000x7.62mm
Ob'yekt 768	+1	Fair	73mm Zarnitsa Gun, DShK, PKT, 2xAT-5 ATGM Launchers (OWS)	40x73mm, 1000x12.7mm, 1000x7.62mm, 2xAT-5 ATGMs
Ob'yekt 769	+1	Fair	30mm 2A42 Autocannon, PKT, PKT, 2xAT-5 ATGM Launchers (OWS)	750x30mm, 2500x7.62mm, 2xAT-5 ATGMs
Ob'yekt 680	+1	Fair	30mm 2A38 Autocannon, PKT, PKT (C)	500x30mm, 4000x7.62mm
Ob'yekt 675	+3	Good	30mm 2A42 Autocannon, PKT, PKT (C), AT4/5 ATGM Launcher	500x30mm, 2000x7.62mm, 6xAT-4 or 4xAT-5 ATGMs

Ob'yekt 681	+3	Good	73mm Zarnitsa gun, NSVT, PKT (C), AT-4/AT-5 ATGM Launcher	40x73mm, 500x12.7mm, 2400x7.62mm, 6xAT-4 or 4xAT-5 ATGM
Finnish BMP-1/25	+1	Basic	25mm M-242 ChainGun, L6, L6 (C)	630x25mm, 1620x7.62mm

*Belly armor for the BMD-1D and BMP-1DG is 4; the belly armor under the driver's and commander's position (an area of about 1.5 meters long and 1 meter wide) is 5.

**The OWS has an AV of OWSF3, OWSS2, and OWSR2.

***The BMP-1/25's Hull is Shielded, but it's Turret is Enclosed. However, the entire vehicle does have NBC Overpressure protection.

****The turntable area with the gun mount is radiologically Open and does not benefit from Overpressure protection. This includes the gunner, loader, commander, and any additional ammo handlers that may be operating on top of the vehicle.

*****The OWS has an AV OWSF 3Sp, OWSS3Sp, OWSR 2Sp. Fire Control for the OWS's gun is +2, and Stabilization is Fair. On the BMP-1B3, the commander must expose his torso, chest, head, and arms to reload the launchers, but may aim and fire the launchers (rotating them by rotating the OWS) from under armor.

BMP-2

Notes: Russian troops realized early on that the BMP-1 had numerous shortcomings, especially in the area of armor protection and its armament. The performance of the BMP-1 in the 1973 Yom Kippur War intensified this realization, even to the high levels of the Soviet Army – the 73mm gun proved to fall off rapidly in accuracy, the sighting and control equipment used for the AT-3 ATGM on the BMP-1 were even more difficult to use than those of the manpacked AT-3, and the BMP-1's frontal armor could be penetrated by even .50-caliber machinegun fire. The commander's IR searchlight was a critical flaw, giving enemy troops a handy avenue of approach where they knew they would not be vulnerable to the BMP-1's turret-mounted weapons. The vision blocks of the BMP-1's firing ports had a very narrow field of view.

The Soviet experience in Afghanistan further intensified knowledge of these flaws, and revealed others – the vision blocks of the BMP-1 make observation of troops on the ground within 20 meters of the BMP-1 difficult, the commander's periscope also has a very narrow field of view. But the worst flaw revealed by Soviet experience in Afghanistan was revealed by the mountainous terrain – the BMP-1's turret-mounted weapons were simply incapable of elevating to the point of being useful against enemies even moderately high above the vehicle, and it cost the Soviets a huge amount of lives.

The Soviets had started to study improvements to the BMP-1 in 1974, and this resulted in some of the BMP-1 variants listed above as well as about 10 other prototypes. Eventually, in the mid-1970s, this research resulted in the BMP-2, which was first issued to Soviet units in 1974 and saw its first combat use in the Angolan Civil War in 1975. However, high-rate mass production did not really take off until the late 1970s, and though BMP-2s were part of the initial invasion of Afghanistan by the Soviet Union in 1979, large-scale use in combat did not occur until 1980, and it was not until 1984 that the Soviet Union employed more BMP-2s than BMP-1s. The BMP-2 is still used by some 33 nations in active military service, and in the past has been used by six more; the US and Britain also use an undisclosed number of them in the OPFOR role for training purposes. Production numbers of the BMP-2 possibly exceeds that of the BMP-1. Users can be found on every continent of the planet except Australia.

The BMP-2 – The Initial Version

The basic BMP-2 hull is very similar to the BMP-1 – in fact, many Russian BMP-2s are upgraded BMP-1s. The biggest difference in the BMP-2 is, of course, the turret. The 73mm gun and the AT-3 Sagger ATGM are replaced by a 30mm dual-feed autocannon and an external ATGM launcher mounted over the commander's station that can use both 9M111 Fagot (NATO reporting name: AT-4 Spigot) and 9M113 and 9M-113M Konkurs (NATO reporting name: AT-5 Spandrel) missiles. (An astute observer can tell which type of missile is loaded – the AT-5 tube is only a little longer, but if an AT-5 is loaded, it will be angled up from the turret quite a bit further than if an AT-4 missile is loaded. The end of the launch tube on the AT-5 also has a small thickened section, which the AT-4 does not have.) The turret itself is larger than that of the BMP-1, allowing the commander's station to be moved into the turret; this eliminated the problematic placement of the commander's station and his searchlight in relation to the turret armament. (The larger turret had a price – a smaller troop compartment.) The turret is situated a little further back on the hull, more towards the center of the vehicle. The commander and gunner both have hatches, with the commander to the right and gunner to the left; the gunner's hatch is smaller than that of the commander. The commander has three wide-angle vision blocks which allow forward vision and vision somewhat to the sides (about a 130-degree arc). He also has an independent day sight for use with the turret armament's auxiliary controls, and this has magnification channels of 1x, 2x, and 4x. Unlike the gunner's day sight, which is geared primarily towards the engagement of ground targets, the commander's sight is designed primarily for the engagement of helicopters and other slow-flying aircraft. He also has a rotatable periscopic sight with a day magnification of 1-4.75x and a night (IR) magnification of 4x. The commander also has a rotatable IR searchlight mounted on the turret roof. The commander also normally fires the ATGM launcher, using sights on the ATGM mount, though these are downlinked to sighting equipment inside the turret. The AT-4 and AT-5 ATGMs are a substantial improvement over the AT-3, as are the sights and controls on the launcher. The commander cannot reload the launcher due to its positioning (unless he leaves his position in the vehicle), and it must be reloaded by the gunner or one of the troops in the rear through one of the roof hatches over the passenger compartment. The BMP-2 also carries a ground mount for the ATGMs as standard equipment; if necessary, they can be used away from the vehicle.

The turret armament has a small degree of stabilization (better than that of the BMP-1, but the difference is not quantifiable in *Twilight 2000 v2.2* terms) but the sights are similar in concept to those of the BMP-1 (though specifically designed for use with the

BMP-2's armament). The gunner's position has only one vision block, and it faces rearward. The gunner's sight was replaced with an improved sight in the mid-1980s, though the difference in the sights is also not quantifiable in *Twilight 2000* v2.2 terms. The gunner's day sight is similar to the commander's day weapons sight, with the same magnification ranges. He also has a similar IR night vision channel, as well as an image intensifier, and he can steer the IR searchlight from his position. The main gun and coaxial machinegun can be elevated to 74 degrees, but depression is still only 5 degrees – not much of an improvement over the BMP-1. Turret traverse, however, is much faster, about 36 degrees per second; this is almost double that of the BMP-1. The autocannon is fed by belts that lead through chutes from two trays in the turret floor; the design of these ammunition trays is quite poor and a sore point among BMP-2 crews, as getting the belted ammunition into the trays and fitting it to feed the autocannon properly can take as much as two hours; even a good crew can find themselves futzing with the ammunition feed for an unduly-long period. Ventilation of the autocannon's gasses is also a problem; the 2A42 autocannon can be fired at either 300 rounds per minute or 550 rounds per minute, but informally the higher cyclic rate is not recommended except in emergencies as exhaust gas will quickly build up to dangerous levels. The gunner is also able to use the ATGM launcher, using the same sort of downlinked sight equipment as the commander. The turret has an IR searchlight mounted coaxially to the main gun opposite the coaxial machinegun, and it can be activated by both the commander and gunner. On each side of the turret is a bank of three smoke grenade launchers.

The rear of the BMP-2 is largely the same as that of the BMP-1, but it is smaller due to the larger turret. As a result, it holds only six troops, with a seventh sitting back-to-back behind the driver in a rather tight space. The six troops in the rear sit back-to-back facing outwards behind a firing port and a vision block that has an improved field of vision over those of the BMP-1. The familiar pair of rear doors are present on the BMP-2; the left one has a firing port with a vision block, while the right one has only a vision block. The rear deck has two larger hatches over the troop compartment instead of the four small ones of the BMP-1. Like the BMP-1, the interior of the BMP-2 is very cramped, and most crew and troop equipment must be carried strapped to the exterior of the vehicle, with a long ride being rather miserable. (In the 1990s, an air conditioner was added to improve crew comfort, but it only helps so much.) The crew is protected by an NBC overpressure system with a collective NBC backup (though use of ATGM launcher of course makes the overpressure system useless), and the BMP-2 also has an automatic fire detection and suppression system.

The driver of the BMP-2 is in the front left hull with the engine to his right. He has three vision blocks to his front, and the center block can be removed and replaced with a night vision block. The engine has the same power as the BMP-1 – 300 horsepower – but is an improved supercharged diesel engine called the UTD-20/3 that has greater reliability and acceleration than that of the BMP-1. The transmission is semiautomatic instead of manual and easier on the driver than that of the BMP-1. The driver (and commander) have access to a gyrocompass to help them navigate. The BMP-2 is amphibious with a little preparation, requiring the extension of a trim vane at the front and the switching on of bilge pumps, and requiring 5 minutes. Some sources say the BMP-2 is propelled in the water by its tracks, and others say that propulsion when swimming is switched to waterjets; I have not been able to determine which is correct. If the BMP-2 is propelled by waterjets, they must be of low power, since the swimming speed reported in BMP-2s with waterjets is not as high as most vehicles equipped with waterjets – indeed, no higher than BMP-2s reported as being propelled by their tracks. Amphibious operations can be dangerous in the BMP-2, particularly in a strong current; and the suspension's bearings are not airtight, and freeboard is not great. In recognition of this fact, Russian Army regulations require that the crew and maintenance personnel ensure that the BMP-2 has a working radio whenever amphibious operations are a possibility, since if the BMP-2's engine floods and dies, the vehicle stands a good possibility of being carried off by the current or sinking. Also in recognition of this possibility, the shallow side skirts are hollow and filled with foam to increase buoyancy. The suspension is improved, though the ride is still quite rough and bouncy.

Protection is still an issue with the BMP-2. Armor was improved, but only just barely. The low profile is retained, though the turret is a bit higher, and the ATGM launcher does project well above the turret. The suspension is still unprotected by side skirts, and the BMP-2 is still very vulnerable to mines due to thin belly armor, though the floor armor is slightly improved, especially in part of the front half of the vehicle. The troops in the rear of the BMP-2 are still sitting on top of the main fuel tank, separated by only a thin metal plate, and the rear doors still contain fuel tanks that hold 66.5 liters of fuel in each door. The driver can selectively feed from the rear door fuel tanks first, and if the fuel tanks catch fire, the flow from them can be cut off by any member of the crew or by the troops in the rear nearest to the doors. The fuel supply in the door tanks can also be flushed and dumped from the vehicle, and they are filled independently from the main fuel tank. (Current Russian doctrine calls for the rear door tanks to be used only to extend the range of the BMP-2, and for them to be emptied before entering combat.)

A slight upgrade in 1984 (the BMP-2 M-1984) has *kovriki* appliqué armor on the turret, similar in concept to that fitted to the BMP-1PM2, though requiring more appliqué to cover the larger turret. (The *kovriki* upgrade is quite common and almost standard among BMP-2 users these days.) In 1986, the improvements to the sights mentioned above were made, and the resulting vehicle called the BMP-2 M-1986, though as stated above, the difference in sight quality is not quantifiable in *Twilight 2000* v2.2 rules. Some Russian BMP-2s have had steel armored track skirts added; these skirts are thin, but add a little side protection. These vehicles are designated BMP-2E. Since the 1993, some Russian BMP-2s had had an externally-mounted thermal imager added; this is also a common export option selected by customers of the BMP-2.

The ATGM launchers on the Czech version, the BVP-2, are designed for use only with the AT-4 ATGM, and cannot fire the AT-5.

Later BMP-2 Modifications

For service in Afghanistan, many BMP-2s were modified with the same appliqué armor package as the BMP-1D, resulting in the BMP-2D version (also referred to as the "Afghan" variant). For convenience, I will reiterate the particulars of that package (with differences as they apply to the BMP-2): the belly armor is further increased under the driver's position and turret, *kovriki*-type appliqué

armor is added to the turret, spaced appliqué armor is added to the hull sides and front, the side appliqué armor has holes cut in it to allow for use of the firing ports, the two rear deck hatches have firing ports cut into them so that they can be used as cover when the troops in the rear are fighting while standing up, most had an armored storage box added to the rear deck, and four smoke grenade launchers were added to each side of the turret. The BMP-2D modifications add considerable weight to the vehicle; in addition, the center of gravity changes so much that amphibious operations are impossible. The BMP-2D also has attachments on the front of the hull for a mine plow. A sub-type of this variant mounted an AGS-17 AGL in place of the AT-4/AT-5 ATGM launcher, as the AGS-17 was much more useful in Afghanistan than the ATGM launcher; this makes the BMP-2 into the BMP-2DG. (This modification was much less common on the BMP-2D than the BMP-1D, as the 30mm autocannon could deal with many of the same situations.) Like the BMP-1D, the BMP-2Ds were “downgraded” back to the BMP-2 M-1986 version after the Soviet withdrawal from Afghanistan. Western observers at first called the BMP-2D variant the “BMP-2E” until its proper designation was known; the BMP-2E is in fact another modification (see above). The only other country to employ the BMP-2D modification was Poland, who for a while used their own locally-produced version, the BWP-2D. (Poland no longer uses either the BWP-2 or BWP-2D, having sold them in 1995 to Angola.)

The BMP-2M modification (sometimes called the “Berezhok” modification) is similar to the BMP-1M modification, though even greater in scope; though the Russians began modifying some BMP-2s to the BMP-2M standard in 1994, these upgrades have proceeded very slowly due to a general lack of funding, and large-scale upgrading did not start until 1998, and it is believed that the Russians have even by 2010 been able to modify less than a quarter of their BMP-2 fleet into BMP-2Ms. The BMP-2M involves removal of the BMP-2’s turret and replacing it with the Kliver turret, which is armed with an autocannon/machinegun/ATGM combination along with greatly-superior sights, night vision, and gun stabilization. The Kliver turret includes four launchers for AT-14 ATGMs, which are modular and can be replaced by up to four SA-18 SAMs (the missiles on each side of the turret must be replaced in pairs when doing this). The commander can access the gunner’s sights and vision devices via a downlinked monitor. The BMP-2M’s Kliver turret also includes a vehicular version of the AGS-17 (the AG-17) which is externally-mounted in a flexible mount and fed by an ammunition box that is also externally-mounted, in an integral magazine which is generally reloaded from one of the rear deck hatches. The AG-17’s magazine holds 100 rounds of the total grenade ammunition supply. The Kliver turret includes a cluster of four smoke grenade launchers on each side of the turret. The BMP-2M’s modifications also include a thin layer of appliqué armor for the hull, turret, and hull floor, as well as the installation of the UTD-230 supercharged diesel engine developing 360 horsepower. An air conditioner is also included, as the BMP-2M’s export market is primarily aimed at the Middle East, India, and Pakistan. The BMP-2M modification is being internationally marketed, though as of yet Algeria is the only known export customer.

The Ukrainians use small amounts of two locally-produced variants of the BMP-2. The first is the BMP-2G; it uses a locally-produced version of the 2A42 autocannon (the KBA-2) that has computer-aided fire control, and at the left rear of the turret is an external mount for the AG-17 grenade launcher. The installation of the AG-17 is similar in some ways to that used on the Russian BMP-2M modification, in that it uses an external 100-round magazine, but the mount is also flexible and can be elevated independently of the turret and its weapons to +70 degrees, -5 degrees, and 45 degrees to either side. The AG-17 is controlled by the gunner; the commander has no auxiliary controls for it. Another addition is a French-built SAGEM thermal imager, also externally mounted on the turret, which can be accessed by both the commander and gunner. The second modification, also called the BMP-2M (though not related to the Russian BMP-2M upgrade) deletes the AG-17 and the AT-4/AT-5 ATGM launcher, but adds a mount at the rear of the turret for four locally-designed R-2 Bar’er laser-guided ATGMs. These ATGMs can be fired by either the commander or gunner. Both these upgrade kits use a locally-produced analogue of the UTD-230 360-horsepower supercharged diesel engine, along with a fully automatic transmission. They too include an air conditioner, as the two upgrade kits are both being internationally marketed and these days, the inclusion of an air conditioner increases sales possibilities. Both have *kovriki*-type appliqué armor, as this is virtually standard on Ukrainian BMP-2s.

The French produce an upgrade package for the BMP-2 called the SNPE kit. This includes appliqué armor similar in protection to the BMP-2D modifications, though much lighter in weight, lugs for ERA on the front and sides of the hull, Kevlar anti-spall liners on the interior walls, an air conditioner, an externally-mounted thermal imager, and a French-made 360-horsepower supercharged diesel engine. It is believed by defense experts that the reason this kit has sound no customers as of yet is that the mounting of ERA on IFVs potentially jeopardizes the safety of troops that may be operating on the ground near the vehicle; similar kits for other APCs and IFVs by the French and other countries have also met with little success.

A joint French/German Flame-V modification kit replaces the AT-4/AT-5 ATGM launcher with a launcher for Milan 1, Milan 2, and Milan 3 ATGMs, and also adds a thermal imager. It also adds a laser rangefinder/designator and ballistic computer. It is possible this upgrade has had some sales, but this is not confirmed.

The addition of an externally-mounted thermal imager and/or an external flexible-mounted AG-17 grenade launcher is a common export upgrade option, and is offered by and bought by many countries since the mid-1990s. The addition of an air conditioner is also a common upgrade option, again offered by and bought by many countries. When a BMP-2 has a thermal imager added, the IR searchlights are normally deleted, except on Russian vehicles. An AG-17 addition adds 100 kg to the weight of the BMP-2 and \$7123 to the cost; performance can be inferred by comparing the new weight to one of the vehicle weights listed below. A thermal imager addition adds \$30,000 to the cost of the BMP-2 and negligible weight, but the normal associated deletion of the two IR searchlights removes \$16,000 from the cost of the BMP-2. An air conditioner addition adds \$1000 to the cost of the BMP-2 and also has negligible weight.

Command Version – The BMP-2K

In Russian Motorized Infantry Divisions (and their Soviet predecessors), the command versions of the BMP-1 were for the most part retained instead of producing a lot of command variants of the BMP-2. However, a single command variant of the BMP-2, the BMP-2K, was developed for use by platoon leaders and some company commanders in Motorized Infantry units equipped with the BMP-2, primarily for purposes of interoperability and common supply in lower echelons. Externally, the BMP-2K is virtually identical, but it sports several whip antennas (on the right and left hull roof and on the deck behind the turret). In front of the whip antenna on the left rear (which is an IFF antenna; the BMP-2K has an IFF transmitter) is a support for a long-range telescopic antenna mast. The mast does not telescope *from* the vehicle; it is mounted externally and telescopes from its mount. (We employed something similar on the M-577 command vehicle in the Army when I served; driving with the antenna erected is *highly* discouraged and is virtually *certain* to cause the mast to fall and be destroyed almost immediately upon movement; in addition, guy lines are required if the mast is to be deployed more than about a meter and a half high.) The rearmost firing ports are deleted from either side of the BMP-2K. The turret antenna is deleted, as the other antennas take its place. The interior is rearranged to provide space for the command staff and more radios, tables, map boards, and other command equipment. The interior seating is designed for the needs of the command mission and seating for only three personnel is provided along one side. The BMP-2K carries a total of one long-range, two medium-range, and one short-range radios, with the long-range radio being data-capable. In 1995, the radios were updated, a ruggedized laptop computer was added, and a GLONASS GPS system was added with a gyroscopic backup.

Twilight 2000 Notes: The BMP-2 was fairly common in the Russian Army in the Twilight 2000 timeline, comprising about a third of the BMP forces of that country. It was also quite common in Warsaw Pact forces, and could be encountered in virtually every corner of the world. The Russians also used some BMP-2D modifications as well as some with side skirts (a kit for both, to be installed by forward support troops, was devised during the war). A kit to add *kovriki* appliqué to the turret was also widely distributed. The BMP-2M modification is very rare, comprising less than 5% of the Russian BMP-2 force, and absent outside of the Soviet Army. No other variants of the BMP-2 were present in the Twilight War, except for versions with added AG-17s, thermal imagers, and/or in air conditioners.

BMP-2	\$117,591	D, A	1 ton	14.3 tons	3+7	6	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (Gun, C)	Shielded
BMP-2 M-1984	\$118,400	D, A	1 ton	14.4 tons	3+7	6	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (Gun, C)	Shielded
BMP-2E	\$119,900	D, A	1 ton	14.5 tons	3+7	6	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (Gun, C)	Shielded
BMP-2D	\$119,268	D, A	1 ton	15.6 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (Gun, C)	Shielded
BMP-2DG	\$120,857	D, A	1 ton	15.6 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (Gun, C)	Shielded
BMP-2M	\$186,597	D, A	1 ton	14.2 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
BMP-2G	\$176,213	D, A	1 ton	14.5 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
Ukrainian BMP-2M	\$182,732	D, A	1 ton	14.4 tons	3+7	9	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
BMP-2 SNPE Upgrade	\$121,198	D, A	1 ton	14.9 tons	3+7	10	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
BMP-2 Flame-V Upgrade	\$179,582	D, A	1 ton	14.3 tons	3+7	9	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
BMP-2K	\$129,736	D, A	500 kg	14.3 tons	3+3	8	Passive IR (D, G, C), Image Intensification (G), IR Searchlight (Gun, C)	Shielded
BMP-2K (1995)	\$181,706	D, A	500 kg	14.4 tons	3+3	8	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging	Shielded

BMP-2/BMP-2K	141/99	34/21/3	462	157	Trtd	T3	TF11 TS7 TR6 HF9 HS5 HR4*
BMP-2 M-1984/BMP-2 Flame-V/BMP-2K (1995)	140/98	34/21/3	462	159	Trtd	T3	TF12 TS8 TR7 HF9 HS5 HR4*
BMP-2E	139/97	33/21/3	462	160	Trtd	T3	TF12 TS8 TR7 HF9 HS6Sp HR4*
BMP-2D/BMP-2DG	130/91	31/19	462	171	Trtd	T3	TF12 TS8 TR7 HF11Sp HS7Sp HR4**
BMP-2M	152/106	37/23/4	462	172	CiH	T3	TF5 TS5 TR5 HF10 HS6 HR4**
BMP-2G	149/104	36/23/4	462	175	Trtd	T3	TF12 TS8 TR7 HF9 HS5 HR4*
Ukrainian BMP-2M	150/105	36/23/4	462	173	Trtd	T3	TF12 TS8 TR7 HF9 HS5 HR4*
BMP-2 SNPE Upgrade	146/102	35/22/4	462	178	Trtd	T3	TF12 TS8 TR7 HF11Sp HS8Sp HR5***

BMP-2/BMP-2 M-1984/BMP-2 M-1986/BMP-2D/BMP-2 SNPE/BMP-2K	+1	Fair	30mm 2A42 Autocannon, PKT, AT-4/AT-5 ATGM Launcher	500x30mm, 2000x7.62mm, 5xAT-4/AT-5 ATGMs
BMP-2DG	+1	Fair	30mm 2A42 Autocannon, PKT, AGS-17 AGL	500x30mm, 2000x7.62mm, 290x30mm Grenades
BMP-2M	+3	Good	30mm 2A72 Autocannon, PKT, AGS-17 AGL, up to 4xAT-15 ATGM and/or 4xSA-18 SAM Launchers	300x30mm, 2000x7.62mm, 300x30mm Grenades, up to 4xAT-14 ATGM and/or 4xSA-18 SAMs
BMP-2G	+2	Fair	30mm KBA-2 Autocannon, PKT, AG-17 AGL, AT-4/AT-5 ATGM Launcher	500x30mm, 2000x7.62mm, 300x30mm Grenades, 5xAT-4/AT-4 ATGMs
Ukrainian BMP-2M	+2	Fair	30mm KBA-2 Autocannon, PKT, 4xR-2 ATGM Launchers	500x30mm, 2000x7.62mm, 4xR-2 ATGMs
BMP-2 Flame-V Upgrade	+3	Fair	30mm 2A42 Autocannon, PKT, Milan ATGM Launcher	500x30mm, 2000x7.62mm, 6xMilan 1/2/3 ATGMs

*Hull floor armor for the BMP-2 and most of its variants is 3, except in the part of the vehicle under the driver and turret, where it is 4.

**Hull floor armor for the BMP-2D and BMP-2DG is 5, except under the driver's position and turret, where it is 6.

***Hull floor armor for the SNPE Upgrade kit is 6 for the entire vehicle.

Kurganmashzavod/KBP BMP-3 Troyka

Notes: The BMP-3 was designed in recognition of the fact that the BMP-1 and BMP-2, despite upgrades and appliqué armor modifications, were still inadequate in many ways for their roles; in particular, the cramped interior, lack of protection, and relatively difficult-to-use ATGM were sore points that were inhibiting export sales and proved to be a severe detriment in Afghanistan. The BMP-3 was originally conceived as two vehicles on a common chassis – a larger version of the BMP-2 and a light fire support vehicle. The idea of simply enlarging the BMP-2 was dropped, and the fire support vehicle's role was taken over by the 2S25 light tank (see Russian Tracked Light Combat Vehicles). The hull of what would become the BMP-3 remained relatively unchanged during development, but the turret changed radically, turning the BMP-3 into a vehicle unlike any other – part fire support vehicle, part light tank, and part IFV. The turret system itself is self-contained and can be installed on most armored vehicles with little modification, and both the turret system and the entire vehicle are being heavily marketed all over the world; the BMP-3 is used by a dozen countries ranging from Venezuela to South Korea. The largest operator of the BMP-3 is in fact not the Russians – it is the United Arab Emirates, which have about 450 in their armies. The UAE is also considering buying more BMP-3s, in the form of BMP-3Fs. The hulls

and most of its components are built by Kurganmashzavod, while the turret system is made by KBP of Tula. The BMP-3 entered service with the Soviet Army in 1987.

The Original BMP-3

The design of the BMP-3's hull at first glance resembles that of the BMP-1 and BMP-2, but it is much larger. Armor protection was improved, both due to thicker armor and the use of more advanced metal technology. The interior of the BMP-3, including the engine compartment and the drive train under the floor, also have Kevlar anti-spalling liners. The BMP-3 is almost certainly the most heavily-armed IFVs in service – turret armament consists of both a new 100mm main gun that also fires ATGMs, but also a coaxial machinegun on one side of the main gun and a coaxial autocannon on the other side of the main gun. In each bow of the BMP-3, there is a PKT machinegun (though they have limited traverse and elevation). The main gun fires both conventional ammunition (though not the same as that fired by the T-54/T-55's main gun) as well as the 9M117 Arkan (NATO reporting name: AT-10 Stabber; the complete system is also known as the Basnya system) laser-guided ATGM. (That said, the Russian military is said to not be happy with the gun-fired ATGMs – reportedly, the Russian Army has never been happy with their ATGM-firing tanks, preferring that Russia put the required resources into better main guns and fire control equipment instead.) The ATGM's laser designator is separate from the BMP-3's laser rangefinder used with the rest of the turret armament. Being command-guided, it would require a skilled gunner indeed to guide the AT-10 guide the BMP-3 is moving – and if the target is moving, such a trick would be virtually impossible. However, guiding an AT-10 against a fast-moving target while the BMP-3 has been demonstrated to be quite feasible – the AT-10 can even be used, with computer aid, against fast-moving, low-flying helicopters. All three turret weapons are capable of great elevation; some sources put the elevation capability at as much as +70 degrees, though depression is still small at -6 degrees. The main gun is fed by an autoloader, with the ammunition located under the turret floor. The BMP-3's fire control computer can be set to automatically track a target and rotate the turret and elevate and depress the weapons as necessary, in a manner similar to that of the newest generation of main battle tanks such as the M-1 Abrams, Challenger, or T-90. Sights and the night vision suite are modern, including a fire control computer, two-plane electric stabilization, and comprehensive day/night sights for the gunner which can also be accessed by the commander. The commander himself also has day/night sights and auxiliary controls for the turret weapons, but he does not have a hunter/killer capability; he does have an IR searchlight available. The commander and gunner can also control the bow machineguns via a fiberoptic link if the troops which man them are not present (those troops are considered a part of the infantry dismount squad); the sights available to the commander and gunner for these bow guns do not give the commander or gunner a very good view for these guns.

The driver of the BMP-3 sits in the center front of the vehicle, with the engine and transmission to his front in a unified powerpack. He has three vision blocks, and the center block can be removed and replaced with a night vision block. His controls are a conventional steering yoke with a gas and brake pedal; the transmission is automatic. Early production versions of the BMP-3 were equipped with a 450-horsepower UTD-29 supercharged diesel engine, but this was quickly replaced in production with the 500-horsepower UTD-29M version, and most early-production BMP-3s were retrofitted with this engine. The longer hull uses six roadwheels and three return rollers on each side, with the return rollers being under a shallow side skirt that is there primarily to increase floatation. The BMP-3 is amphibious with preparation (a trim vane must be extended at the front and a bilge pump turned on); once in the water, propulsion is switched to hydrojets until the tracks touch ground again on the other side of the water obstacle. Maneuverability in the water is similar to that of the BMD-1, though due to the heavier weight the BMP-3 is not as susceptible to water currents. The BMP-3 also normally carries a snorkel device – the BMP-3, when swimming, does not have a lot of freeboard and the snorkel is used when the water is too deep to simply drive across, but not deep enough for the BMP-3 to float. The BMP-3 has proven itself to be quite adept at operations in desert terrain, even to the point that it is mechanically quite capable of continuing to operate at full speed in a Middle East dust storm (seeing where you're going and finding a target are of course another matter). This was not always the case; early BMP-3s demonstrated to Middle Eastern countries were noted for the frequency of mechanical failures due to deficiencies in the air filtration system and the resulting damage from dirt to the engine and transmission. The early BMP-3s were also plagued by mechanical failures in general, as well as failures in its fire control system, and it was not until 1992 that both the Russian Army and export buyers really had confidence in the BMP-3. The BMP-3 has also been praised by several export buyers for its ability to overcome vertical obstacles and trenches that might stop another tracked IFV. Navigation is aided by an inertial navigation with both a gyroscopic and transceiver backup; these are available to both the driver and commander. Each roadwheel on the BMP-3 has separate hydropneumatic suspension elements, giving the BMP-3 a ride that is remarkably smooth compared to previous Russian tracked vehicles.

The rear compartment normally houses five troops, though seven can be squeezed in if necessary. Two more troops occupy seats on either side of the driver and man the bow machineguns if they are present. In normal Russian practice, they dismount with the rest of the infantry squad. Headroom and side room is better than previous BMPs, though still rather cramped. The BMP-3 has an NBC overpressure system with a collective NBC backup, and most versions also have an air conditioner and heater. The standard ventilation system also filters out particles like dust and smoke. On each side of the troop compartment are three firing ports; in the rear door are two more. The crew enters and exists through the two large rear doors, and two long hatches are found on the roof of the troop compartment.

Protection-wise – well, the armor of the BMP-3's hull has been further improved over that of the BMP-2, but only just so. Most of the armor increase is actually in the form of appliqué armor added to the hull in the end stages of construction rather than as an integral part of the vehicle. The hull, turret, and appliqué armor of the BMP-3 are all of aluminum alloy, except for the turret front, which has steel appliqué; it is rumored that over the frontal arc, that aluminum alloy includes titanium to add further strength without

unduly increasing weight. The hull floor has received additional protection as well, being thicker and composed of spaced armor instead of a simple armor plate. The spaced armor parts of the BMP-3 use a metal sandwich with rubber in between the armor plates. This construction also further increases buoyancy. Perhaps one of the biggest improvements in the BMP-3 is the absence of the fuel tanks that were mounted in the rear doors of every other version of the BMP-3; all fuel tanks are inside the hull. Several countries have also devised an ERA kit for the BMP-3 (not often used, as explosion of the ERA panels poses a hazard to dismounted troops), and the Russians have of late been installing the Shtora-1 soft-kill APS on the BMP-1, and on some vehicles, the Arena hard-kill APS.

The Shtora-1 consists of sensors and equipment mounted atop the turret and control systems mounted inside the turret and hull; the primary controls for the Shtora-1 on the BMP-3 are at the commander's station. The Shtora-1 system includes an electro-optical jamming system to jam wire-guided ATGMs (on a roll of 12+ on a d20, the difficulty to the ATGM gunner is increased by one level; outstanding success indicates that the incoming missile pre-detonates before it can hit the BMP-3). A laser warning system is also included with the Shtora-1; when the BMP-3 is being lased by a laser designator, an alarm sounds inside the BMP-3, and a pair of smoke grenades are automatically launched to help obscure the BMP-3 to the laser beam. The laser warning system can also be triggered manually by the commander. The smoke grenades can also be triggered by the gunner manually if he feels it is necessary; the BMP-3 has six smoke grenade launchers on each side of the turret. The Shtora-1 also includes a pair of IRCM lights (one on the turret on each side of and above the main gun) that emit coded, pulsed IR beams to decoy IR-guided munitions; their effectiveness is the same as listed for the electro-optical jammer above, and both have a 360-degree range of protection, as well as 180-degrees upwards. They can also temporarily blind IR sights and image intensifiers; this is successful on a roll of 8 on a d20 for IR sights and 5 for image intensifiers. A computer is provided to tie all of this information from the Shtora-1 and other sensors together. The Arena is an update of the Drozd system sometimes found on the T-62, T-64, T-72, and T-80. It works basically in the same way as the Drozd – the system uses a small, short-range radar system on the turret roof to detect incoming missiles and rockets (it doesn't work fast enough to stop tank and autocannon rounds), and launches special rounds in the path of the missile that quickly break up into a cloud of tungsten pellets, destroying the missile before it can hit the tank. The Arena has 16 of these rounds available, and they are 75% likely to destroy the incoming missile about 10 meters from the BMP. The Arena system protects the BMP-3 in a 180-degree dome around the tank. Again, a computer ties the entire Arena system together. The BMP-3 can mount either the Shtora-1 or Arena systems – there isn't enough room to mount both of them at once. Like the BMP-3 itself and its turret, the Russians will also sell the Shtora-1 and Arena systems – but only to carefully-selected customers. In current Russian use, about 1 in 5 BMP3s have the Shtora-1 system, and 1 in 10 the Arena system.

The initial BMP-3 was followed by three upgrade variants – The BMP-3A, BMP-3B, and BMP-3C. The BMP-3A has some parts of the main gun and autocannon redesigned, as well as the feed chutes for the autocannon and parts of the 100mm gun's autoloader; this allows the BMP-3A to use some new 100mm and 30mm rounds that were developed in the late 1980s as well as an improved version of the AT-10 ATGM (the 9KM117M1 Arkan-B). The fire control computer was also replaced on the BMP-3A to take into account the characteristics of the new ammunition. The BMP-3B upgrades the fire control system, adding a thermal imager for the gunner (which can also be accessed by the commander), a laser rangefinder, and an LCD display of the gunner's sight view for the commander. Though the laser rangefinder can be slaved to these machineguns, the sights available to the commander and gunner for these bow guns still do not give the commander or gunner a very good view for sighting these guns. The BMP-3C version improves upon the displays for the commander and the commander also has a separate laser rangefinder; this is primarily used to assist in targeting supporting artillery fires, though it can be used as a backup to aim the turret weaponry. Ammunition storage is rearranged; while this makes the turret a little roomier, the primary reason for the rearrangement was to improve the reliability of feed for the main gun's autoloader.

A Few Other Variants

The BMP-3F is the Naval Infantry variant. The primary external differences are the larger snorkel carried, and a somewhat longer length of hull. The increase in length combines with a larger trim vane and rearrangement of the interior (for better weight distribution) to make the BMP-3F more stable in water surf conditions than a standard BMP-3. The BMP-3F is able to operate in the open water in up to Sea Force 3 conditions (wind of up to 19 kmh, wave height of up to 1 meter); it can also come ashore in breakers of up to 1.5 meters, provided the tracks are on the ground. Like the BMP-3, there are BMP-BF and BMP-CF versions; there is no BMP-AF version (the basic BMP-3F is equivalent to a BMP-3A). Though it has been seen on some BMP-3Fs, BMP-3Fs don't normally mount the Shtora-1 or Arena APS systems; it is possible that the systems make the BMP-3F too top-heavy to operate properly in high surf, but more likely that the Naval Infantry has less priority for installation of these systems. On the BMP-3F, the bilge pumps have also been strengthened and the waterjets made more powerful. All joint seals (such as the hatches, doors, and turret) are improved to better seal out water. Readyng the BMP-3F for amphibious operations takes a little more time than on the BMP-3 (as the capabilities are greater); the trim vane is larger and takes more time and muscle to emplace, a second bilge pump is used, and anti-surge vanes are erected around the turret as well. The standard BMP-3 takes 5 minutes to ready for amphibious operations; the BMP-3F takes 8 minutes. The BMP-3F is stable enough that any of the weapons can be safely fired while the BMP-3F is swimming, even in high surf (accuracy would probably be a problem in the latter case). The sensors, such as the sights and for night vision, are behind waterproof windows and also given improved seals. The BMP-3F also has tow hooks on the upper rear hull to allow it to tow small boats or rafts. Kurganmashzavod states that the BMP-3 can endure 7 hours of amphibious operations.

The BMP-3M is a modernized version of the BMP-3C. The turret, armament, and hull remain largely the same, but the fire control system is modernized, for the most part by incorporating French-built components into the system; this includes the computer, laser

range-finder, and thermal imager. The designator for the AT-10 ATGMs is also French-designed. The loading system for the autoloader is also improved in reliability; apparently there were residual issues with it. The new loading system also allows for even more advanced 100mm rounds to be fired by the main gun, including long-rod penetrators. The feed system for the autocannon also allows for further-improved 30mm rounds. The BMP-3M also uses improved appliqué armor, again designed with French help. ERA lugs are an option. The engine used on the BMP-3M is the UTD-32 660-horsepower supercharged diesel engine; this not only provides an increase in power, it helps the BMP-3M cope with the increased weight. Though the Russians are attempting to field the BMP-3M in greater numbers, cost is a problem; the BMP-3M has actually had more export customers than sales to the Russian Army.

Another form of the BMP-3M uses the smaller, lighter Bachkha-U turret used on the BMD-4, and is generally referred to as the BMP-4; the weapons and electronics are simplified over those of the BMP-3M, and the turret is lighter and the turret considerably more cramped. The autoloader does not allow for the use of the improved ammunition used in the BMP-3M. The turret is too small to mount either the Shtora-1 or Arena systems, and lacks the BMP-3M's appliqué turret armor. The Russian have been evaluating the BMP-4 since 1999, but have yet to field any substantial numbers, nor has the BMP-4 seen any export sales; however, the BMP-4 is believed to be aimed primarily at the export market, as a lower-cost alternative to the BMP-3B and BMP-3C. (Though the game price of the BMP-4 higher than the BMP-3B or BMP-3C, the real-life price is lower.)

The BRM-3K is the reconnaissance/scout version of the BMP-3 – the BMP-3's counterpart to the BRM-1, or perhaps the BRM-1K, as it combines the BRM-1's and BRM-1K's role into one vehicle. The BRM-1K carries only a small dismount squad of three troops, as the interior is primarily given over to extra electronics, radios, and racks for extra rations and equipment for long reconnaissance missions. The BRM-3K is equipped with the modernized form of the Tall Mike ground surveillance radar system at the rear of the turret; this system and the required electronics takes the place of the 100mm gun, which is deleted on the BRM-3K. The Tall Mike system is capable of detecting and identifying vehicles at a range of 12 kilometers and personnel at 3 kilometers. Also deleted are the two bow machineguns, as well as the positions for the bow machinegunners; the areas vacated by the bow machinegun positions' removal is also used for electronics and supply racks, as well as storage for extra ammunition. Extra equipment includes an extra long-range and medium-radio; the long-range radio is data-capable. The BRM-3K is equipped with a thermal imager, as it is based on the BMP-3B version, as well as a 2nd-generation image intensifier with a range of 1.5 kilometers in the day and 1.2 kilometers at night, and provides a 7x magnification. The commander has a second hand-held thermal imager, and several pairs of binoculars are carried. The BRM-3K is equipped with an inertial navigation device (later versions, modified in about 1995, make the inertial navigation system a backup to a GLONASS GPS system). The BRM-3K has an internally-mounted 4kW generator to power the equipment if the engine is off; this blocks egress from the right rear door, though the door is still there, and used to access the generator for maintenance. The BRM-3K is equipped with a ruggedized laptop computer, and the front hull has a mine detector.

The BMP-3K is a tactical command version, to be used at company command level and below; it is based on the BMP-3B. Externally, the BMP-3K is distinguishable primarily by the extra antennas on both sides of the rear hull, the lack of an antenna on the turret, and if one looks carefully, the lack of bow machinegun ports. Internally, the BMP-3K of course does not have those bow machineguns, and the interior is rearranged to provide space for the command staff and more radios, tables, map boards, and other command equipment. An extra long-range and medium-range radio is carried; the long-range radio is data-capable. The communications system is capable of communicating with UAVs, and the BMP-3K's systems allows for the control of UAVs as well. The interior seating is designed for the needs of the command mission and seating for only three personnel is provided along one side, along with two other seats at the front and rear of the passenger compartment. The BMP-3K is equipped with the GLONASS GPS system with an inertial navigation backup. A ruggedized laptop computer is added. The BMP-3K commander's position has an inscribed circle to aid in calling for artillery and air strikes. A hand-held thermal imager, image intensifier, and laser range-finder are carried. The BMP-3K carries an internal compact 1kW generator to power the equipment when the engine is off. The BMP-3K also has an interesting capability: it carries the Ainet round fuzing system, along with the associated special fuzes. This system allows the BMP-3K gunner to attach the Ainet fuze to a special HEAT-MP round or a special FRAG-HE round for the 100mm gun; the gunner can then set the round using the fire control computer to detonate at any range after firing and produce a shower of fragments in a wide spray. This round is therefore very useful against troops in the open, soft-skin vehicles, and helicopters; it can also be set to produce a delayed detonation after the round has penetrated the walls of a building or fortification. The last effect is more possible with the HEAT-MP round; the HEAT charge penetrates the walls, and then a second charge produces the fragments.

Some other add-on modifications are also offered, both by the Russians and by other countries. The installation of an external AG-17 grenade launcher, as mentioned for the BMP-2 above, is also offered for the BMP-3. A separate thermal imager accessible from inside the turret is offered for the commander's position along with associated equipment, along with a separate image intensifier (though this does not give the BMP-3 a true hunter-killer capability, it does help observation and finding targets in the first place). An added thermal imager can also be added to the BMP-3 and BMP-3A; both the Russians and some export customers of earlier versions of the BMP-3 have added a thermal imager – most notably the UAE, which has added a thermal imager to all its BMP-3s. . An AG-17 addition adds 100 kg to the weight of the BMP-3 and \$7123 to the cost; performance can be inferred by comparing the new weight to one of the vehicle weights listed below. An added thermal imaging system itself adds \$30,000 to the cost of the BMP-3 and negligible weight; the new night vision system for the commander mentioned above also has negligible weight, but adds \$37,950 to the cost of the BMP-3. Lugs for ERA are common, as is additional appliqué armor or replacement appliqué armor kits of several types and made by several countries; there are so many such kits being offered that I have not detailed them here, as this already-large entry would definitely become unwieldy.

Important Note: The designations BMP-3A, BMP-3B, BMP-3C, BMP-3BRF, and BMP-3CF are **not official designations**. There

are versions of the BMP-3 that are known as the A, B, and C upgrades, and the BMP-3F does include versions that have the characteristics of the BMP-3's B and C modifications. The designations I gave these vehicles are a simple, if not official, way to easily note and distinguish these variants. In Russian practice, the A, B, and C versions of the BMP-3 are all called BMP-3s, while the similar variations of the BMP-F are all called the BMP-F.

Twilight 2000 Notes: The BMP-3 comprised about a fifth of all BMP-3s found in Russian service during the Twilight War, and most were used by unit commanders or scout elements. Half of these were BMP-3s or BMP-3As, with most of the rest being BMP-3Bs. No BMP-3Cs or BMP-3Ms were produced, nor were any BMP-3Fs or BMP-4s. The BRM-3K was very rare, as was the BMP-3K. In the cases of BMP-3s and BMP-3As, the addition of a thermal imager was quite common, though the separate commander's thermal imager/image intensifier installation was not available for the Twilight War.

BMP-3/BMP-3A	\$322,023	D, G, AvG, A	1.5 tons	18.7 tons	3+7	10	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), IR Searchlight (C)	Shielded
BMP-3B	\$365,023	D, G, AvG, A	1.5 tons	18.7 tons	3+7	10	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3C	\$394,053	D, G, AvG, A	1.5 tons	18.7 tons	3+7	10	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3/BMP-3A w/Shtora-1	\$340,078	D, G, AvG, A	1.5 tons	18.8 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), IR Searchlight (C)	Shielded
BMP-3B w/Shtora-1	\$407,119	D, G, AvG, A	1.5 tons	18.8 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3C w/Shtora-1	\$466,083	D, G, AvG, A	1.5 tons	18.8 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3/BMP-3A w/Arena	\$364,119	D, G, AvG, A	1.5 tons	18.8 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), IR Searchlight (C)	Shielded
BMP-3B w/Arena	\$393,144	D, G, AvG, A	1.5 tons	18.8 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3C w/Arena	\$417,119	D, G, AvG, A	1.5 tons	18.8 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3F	\$322,338	D, G, AvG, A	1.5 tons	18.8 tons	3+7	10	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), IR Searchlight (C)	Shielded
BMP-3BF	\$365,338	D, G, AvG, A	1.5 tons	18.8 tons	3+7	10	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3CF	\$375,338	D, G, AvG, A	1.5 tons	18.8 tons	3+7	10	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3F w/Shtora-1	\$394,368	D, G, AvG, A	1.5 tons	18.9 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), IR Searchlight (C)	Shielded

BMP-3BF w/Shtora-1	\$437,368	D, G, AvG, A	1.5 tons	18.9 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3CF w/Shtora-1	\$447,368	D, G, AvG, A	1.5 tons	18.9 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3F w/Arena	\$364,434	D, G, AvG, A	1.5 tons	18.9 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), IR Searchlight (C)	Shielded
BMP-3BF w/Arena	\$407,434	D, G, AvG, A	1.5 tons	18.9 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3CF w/Arena	\$417,434	D, G, AvG, A	1.5 tons	18.9 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3M	\$376,084	D, G, AvG, A	1.5 tons	19.3 tons	3+7	10	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3M w/Shtora-1	\$448,114	D, G, AvG, A	1.5 tons	19.4 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3M w/Arena	\$418,180	D, G, AvG, A	1.5 tons	19.4 tons	3+7	11	Passive IR (D, G, C, LBG, RBG), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-4	\$381,794	D, G, AvG, A	1.5 tons	18.5 tons	3+7	10	Passive IR (D, G, LBG, RBG), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded
BMP-3K	\$473,010	D, G, AvG, A	750 kg	18.7 tons	3+5	12	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3K w/Shtora-1	\$545,040	D, G, AvG, A	750 kg	18.7 tons	3+5	12	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BMP-3K w/Arena	\$447,881	D, G, AvG, A	750 kg	18.7 tons	3+5	12	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
BRM-3K	\$535,980	D, G, AvG, A	750 kg	19 tons	3+3	13	Passive IR (D, G), 2 nd -Gen Image Intensification (G, C), Thermal Imaging (G), IR Searchlight (C), GSR Radar	Shielded
BRM-3K w/Shtora-1	\$608,010	D, G, AvG, A	750 kg	19 tons	3+3	13	Passive IR (D, G), 2 nd -Gen Image Intensification (G, C), Thermal Imaging (G), IR Searchlight (C), GSR Radar	Shielded
BRM-3K w/Arena	\$578,076	D, G, AvG, A	750 kg	19 tons	3+3	13	Passive IR (D, G), 2 nd -Gen Image Intensification (G, C), Thermal Imaging (G), IR Searchlight (C), GSR Radar	Shielded
BRM-3K (1995)	\$534,030	D, G, AvG, A	750 kg	19 tons	3+3	13	Passive IR (D, G), 2 nd -Gen Image Intensification (G, C), Thermal Imaging (G), IR Searchlight (C), GSR Radar	Shielded

BRM-3K (1995) w/Shtora-1	\$609,060	D, G, AvG, A	750 kg	19 tons	3+3	13	Passive IR (D, G), 2 nd -Gen Image Intensification (G, C), Thermal Imaging (G), IR Searchlight (C), GSR Radar	Shielded
BRM-3K (1995) w/Arena	\$578,126	D, G, AvG, A	750 kg	19 tons	3+3	13	Passive IR (D, G), 2 nd -Gen Image Intensification (G, C), Thermal Imaging (G), IR Searchlight (C), GSR Radar	Shielded

BMP-3, BMP-3K	165/116	40/25/6	690	251	Trtd	T3	TF12Sp TS6Sp TR4 HF10Sp HS6Sp HR5
BMP-3 w/Arena or Shtora-1	163/115	40/25/6	690	254	Trtd	T3	TF12Sp TS6Sp TR4 HF10Sp HS6Sp HR5
BMP-3F	163/115	40/26/8	690	254	Trtd	T3	TF12Sp TS6Sp TR4 HF10Sp HS6Sp HR5
BMP-3F w/Arena or Shtora-1	161/114	39/25/8	690	257	Trtd	T3	TF12Sp TS6Sp TR4 HF10Sp HS6Sp HR5
BMP-3M	207/145	50/31/7	690	338	Trtd	T3	TF13Sp TS6Sp TR4 HF11Sp HS7Sp HR5
BMP-3M w/Arena or Shtora-1	205/144	50/31/7	690	342	Trtd	T3	TF13Sp TS6Sp TR4 HF11Sp HS7Sp HR5
BMP-4	167/117	40/26/6	690	248	Trtd	T3	TF11 TS4 TR4 HF10Sp HS6Sp HR5
BRM-3K	162/114	39/25/5	690	256	Trtd	T3	TF12Sp TS6Sp TR4 HF10Sp HS6Sp HR5
BRM-3K w/Arena or Shtora-1	160/113	39/25/5	690	259	Trtd	T3	TF12Sp TS6Sp TR4 HF10Sp HS6Sp HR5

BMP-3/BMP-3A/BMP-3F	+2	Good	100mm 2A70 Gun, 2A72 30mm Autocannon, PKT, 2xPKT (Bow)	40x100mm, 8xAT-10 ATGM, 500x30mm, 6000x7.62mm
BMP-3B/BMP-3C/BMP-3FB/BMP-3FC/BMP-4	+3	Good	100mm 2A70 Gun, 2A72 30mm Autocannon, PKT, 2xPKT (Bow)	40x100mm, 8xAT-10 ATGM, 500x30mm, 6000x7.62mm
BMP-3M	+4	Good	100mm 2A70 Gun, 2A72 30mm Autocannon, PKT, 2xPKT (Bow)	40x100mm, 8xAT-10 ATGM, 500x30mm, 6000x7.62mm
BMP-3K	+2	Good	100mm 2A70 Gun, 2A72 30mm Autocannon, PKT	40x100mm, 8xAT-10 ATGM, 500x30mm, 2000x7.62mm
BRM-3K	+3	Good	2A72 Autocannon, PKT	600x30mm, 2500x7.62mm

*The Fire Control and Stabilization modifications do not apply to the bow machineguns, even when fired from the turret, for the BMP-3, BMP-3A, BMP-3B, BMP-3BF, and BMP-4. For the BMP-3C and BMP-3M, only the laser rangefinder modification applies (+1 addition), but the stabilization modifier still does not apply.

**Belly armor for the BMP-3 is 6.

Kurganmashzavod BTR-50

Notes: The BTR-50 is an ancient tracked APC ---a huge, underpowered lightly-armored box that is a relic from another age of warfare. Despite this, the BTR-50 can still be found quite often in the world, particularly in the Third World and even parts of the Second World; even the Russians still kept them around and reasonably functional until recently for their Category III and Mobilization-Only units. Over time, the BTR-50 was used by over 30 countries worldwide and could be found in virtually every corner of the world. The BTR-50 was based on the chassis of the PT-76 light tank and has 60% parts commonality with that vehicle. Enough countries are still using the BTR-50 that several countries are selling upgrade kits for it. Low-rate initial production and the first small issues to Russian troops were made in 1952; mass production and issue began in 1954. The BTR-50PK version did not appear until 1958. The Israelis are noted for their innovative use of the BTR-50; like many captured enemy vehicles, they used it to conduct rear-area raids. The Polish/Czech OT-62 series is a development of the BTR-50; analysts thought at first that the Chinese Type 77 was also a Chinese version of the BTR-50, though it is now known that the Type 77 has a very different hull based on the Type 63 light tank. The "BTR" designation is sort of an aberration in Russian service – most tracked APCs and IFVs use a "BMP" designation. The "BTR" is a

Russian acronym for “armored transporter,” while the “BMP” designation stands for “infantry fighting vehicle;” this probably reflects the rather basic APC nature of the BTR-50.

The Basic APC Variants

The basic form of the BTR-50 reflects its PT-76 cousin, with a flat, wide, boat-shaped hull. About half the BTR-50's hull has a raised superstructure; this part houses the commander's station and most of the troops, as well as the driver's position. At the rear is the engine and transmission; this again reflects the fact that the BTR-50 is derived from a light tank. The front has a sharply-raked glacis plate. On Naval Infantry versions, this nose section is a bit longer than the standard BTR-50. The commander's position is to the left of the driver; he has a stand to see out of the top of the vehicle, while the driver uses a small hatch on the superstructure face; this hatch is too small to enter and exit through, and is there simply to give the driver a better view when the tactical conditions permit it. (The driver's position is probably the best-protected in the entire vehicle.) In the initial version, the BTR-50P, the superstructure is open-topped; on the BTR-50PK versions, the top is closed and has a commander's hatch plus two oval hatches, one to the left of the commander just right of center and one on the left side of the superstructure. (In this case, the “K” in the designation stands for *krisha*, or roof, instead of *kommand*, or command). The rear mounted engine does not allow for a rear door or ramp, and the troops enter and exit by climbing over the top of the hull (whether the BTR-50 in question is open-topped or has hatches. The driver must also enter or exit through the open top or one of the roof hatches; depending on the model, the commander enters and exits over the top or through his own hatch. Small projections and hand-holds help the crew and troops climb in, and there is a small step above the tracks on each side. On some BTR-50PKs, a firing port is found in each side of the superstructure, but this is a simple hole cut in the side with a shutter to close it and a small vision block installed above it. Later production BTR-50PKs had two firing ports on each side of the superstructure.

On any version of the BTR-50, the commander does not have a weapon or weapon mount. Instead, a pintle mount is placed on the other side of the superstructure at the front, and is to be manned by one of the troops. On the BTR-50P, the weapon mounted is an SGMB machinegun, and on another open-topped version, the BTR-50PA, the weapon mounted is a KPVT. On the closed-top BTR-50PK, the mount for an SGMB is at the front of the right roof hatch. (Some BTR-50Ps, BTR-50Pas, and BTR-50PKs shift the pintle mount to the commander's position, but this is a later modification generally done at the unit maintenance level, and no BTR-50 was manufactured that way.) The commander's position is bulged out from the front of the superstructure and has wide-angle vision blocks to the front and diagonally to the sides; on the right side of the BTR-50PK version is another such projection on the superstructure, though this projection has no hatch of its own; instead, the pintle mount for the BTR-50PK's weapon is mounted on top of it. The projection for the commander on the BTR-50PK has its own hatch on the superstructure roof; in addition, on the BTR-50PK, the commander on the BTR-50PK has a fourth vision block to the rear. On all BTR-50s, the commander has an IR searchlight, primarily used with the IR vision device of the driver to show him where to go and allow him to see better when using it. On the original BTR-50P, the rear deck carried ramps to allow a 57mm ZiS-2, 76.2mm ZiS-3, or 85mm D-44 field gun to be loaded onto the deck. This gun could be locked securely down, to the extent that the gun could be fired while the BTR-50 was swimming and the waterjets going at full speed. It could also be fired while the vehicle was moving on land. (One could imagine that fire on the move would be inaccurate to say the least.) This system was apparently not satisfactory, as these ramps and the lock-down points were deleted after a few years and most vehicles in service had theirs removed, the primary reason seems to be that firing the gun from the deck produced a lot of gasses from the muzzle that tended to stay in the superstructure. Finding one equipped with those features these days is rare. The closed-top BTR-50PK carries less troops; part of this is due to the decreased headroom caused by the closed-top superstructure, but the loss of troop space is also caused by increased internal storage racks for crew and troop equipment and the addition of racks for dismount troop weapons such as RPG-7s, SA-7 missiles, extra ammunition and grenades, and suchlike, and the addition of a collective NBC system. The troops in the BTR-50 sit on bench seats that run down both sides of the vehicle; over half of this seat space is under the superstructure, but some is under the lower-topped rear section. While these troops do not have to worry about an open roof, even on the BTR-50P and BTR-50PA, their headroom is severely limited, and one can barely even crouch under this roof.

The driver of the BTR-50 uses laterals to steer and brake the vehicle and a gas pedal to control speed. In addition, as the BTR-50 has a manual transmission, he has a shift lever and a clutch pedal to contend with. The BTR-50 is capable of pivot steering. There is a single vision block in the driver's hatch, which can be removed and replaced with a night vision block; initially, this night vision block had a range of only 60 meters, but later substantially-improved ones were used. I have not been able to find the designation for the engine, but it is a V-6 water-cooled diesel developing 240 horsepower. Though the crew has no heater, the engine does have a pre-heater for use in cold climates. The BTR-50 has six large roadwheels on each side, with the first and last roadwheels on each side having shock absorbers. (I've ridden in a BTR-50PK for just a short joy ride; you'd never know that it has any sort of shock absorption, as the ride is almost violently bouncy over even moderately rough terrain.) The fuel is distributed between three fuel tanks, two on the right side of the rear of the vehicle in front of the engine and one at the rear of the engine. At the rear of the vehicle are attachments for a drum-type auxiliary fuel tank; on each side of the vehicle at the rear are attachments for two flat-type fuel tanks. These tanks hold 60 liters each. The BTR-50 actually swims quite well, due to the design of the hull. The crew erects a trim vane at the front and switches on bilge pumps to enter the water; the driver also attaches an extended periscopic vision block in place of his standard vision block (takes 8 minutes). Once in the water and the BTR-50's tracks are no longer in contact with the ground, waterjets are switched on to propel the vehicle in the water. If more power is needed in the water, a pair of auxiliary waterjets just above the tracks under the side steps can also be switched on. The waterjets have lids that can be rotated open or closed selectively, allowing steering while in the water. However, the BTR-50 has very little freeboard; it is not recommended that the BTR-50 swim except in calm waters.

The BTR-50's hull is made of steel, and is comically-thin by modern standards – from the front, it is possible that even 7.62mm NATO AP rounds could penetrate, and the sides and rear are even less protected. It is possible for even fragments from a close artillery explosion to penetrate the rear of the vehicle, and the floor and top armor is almost non-existent. The BTR-50P and BTR-50PA have no sort of NBC protection, though command versions of the BTR-50PK have a collective NBC system. The BTR-50 has no fire suppression system except for manual fire extinguishers. There is no sort of environmental system, not even a heater, though on the BTR-50PK there are two vents with blowers at the front right. Even with this blower system, the BTR-50 gets hot inside fast, even in cold climates; the fact that there is only a rather thin firewall between the engine and troop compartment helps make this heating possible. (For most cold climates, a heater probably isn't even necessary most of the time – just rev the engine!) The BTR-50PK, with its closed roof, was often produced by simply welding a roof kit to the superstructure and rearranging the interior.

A later version of the BTR-50PK, introduced in the 1970s, replaced the standard engine with a 300-horsepower UTD-20 diesel engine; at this time, the driver's IR vision block was upgraded, and if radios were carried, they were replaced with newer ones. This is the BTR-50PKM. This engine was also used on the BTR-50PUM series variants.

Other APC-Type Variants

The BTR-50, and particularly the BTR-50PK, was used as the basis of a number of specialist vehicles; in fact, the BTR-50PK was more often used as the basis of several command vehicles than were produced for use as plain vanilla APCs. The BTR-50P was also used as a conventional artillery tractor (where the gun was not carried atop the vehicle) and as a mount for AAA guns (particularly the ZPU-2, ZPU-4, ZSU-23, and ZSU-23-2, and as the basis of an NBC reconnaissance vehicle and a FAC team vehicle.

Along with the introduction of the BTR-50PK in 1958, a small amount of intermediate command versions of the BTR-50PK were built. These were designated BTR-50PN, and the primary external change was the three whip antennas atop the superstructure and rear deck roof. Inside, the interior is rearranged to provide space for a command staff and the sorts of tables, chairs, drawers, map boards, and other supplies and stores for use in command functions. At the time, most BTR-50s did not even have a radio in them, and if they did, it was a rather short-ranged one; the BTR-50PN had such a radio along with a medium-range and long-range radio. The pintle-mounted machinegun was retained in front of the left superstructure roof hatch. The BTR-50PN had seats for eight, four of whom were radio operators and two of which are the BTR-50PN's crew. Only small numbers were produced, as the BTR-50PN was a stop-gap measure pending the introduction of the BTR-50PU.

The BTR-50PU is the definitive command version of the BTR-50PK, and was introduced in 1959. The BTR-50PU seats ten, four of whom are radio operators, two of which are crew, and other four of which are for the commander and his staff. The interior compartment has a folding table plus a second small folding table for the unit commander's use. The pintle mount for a weapon is deleted. Under the low rear area are attachments for two hammocks and racks for equipment storage. The floor of the BTR-50PU has an emergency escape hatch. The entire crew compartment has a layer of insulation that is primarily meant to keep out the cold when the engine is off, but does also keep a small amount of heat out on hot days. (It's basically a thin fiberglass blanket, much like one might find in a thicker form in their attics.) The BTR-50PU has an early form of a navigation system – a gyrocompass aids navigation, and also uses a simple computer that generates map coordinates that the commander can plot on a conventional map. (Later, an early form of inertial navigation system was tried, but considered unreliable; improved forms of inertial navigation were never used on the BTR-50PU in Soviet service, as the vehicle was long out of service by the time those systems were available.) On the rear deck is a 1kW generator in an armored box; most BTR-50PUs have a second 1kW generator (this is included in the stats below), as early Soviet radio equipment proved to be quite power-hungry. Radios included one short-range, one medium-range, and three long-range radios. The rear deck also has a number of armored storage boxes, with only vents for the engine air intakes being uncovered; the exact configuration of these storage boxes could vary from vehicle to vehicle, and may have been jury-rigged or provided as kits from the manufacturer and added by unit maintenance. An 11-meter collapsible mast antenna can be mounted on the roof of the BTR-50PU in special brackets to extend the range of one of the long-range radios when the vehicle is stationary; as the mast must be secured by guy lines running to the ground, it cannot be used while the vehicle is in motion. The BTR-50PU's communications equipment also includes a wireless telegraph. If the BTR-50PU is in a stationary position, the BTR-50PU can be hooked into a field telephone net (whether with other stationary positions or a moving unit that is running wire as they move); in this case, the BTR-50PU also carries a 10-line field telephone switchboard system, along with six field telephones that can be run to other positions using four reels of commo wire that each contain 600 meters of wire.

The BTR-50PU-2 is an improved form of the BTR-50PU, differing primarily in modernized communications equipment (for the time; the BTR-50PU-2 was first issued to Soviet troops in the mid-1960s) and in the fact that the generators atop the rear deck could be dismounted and dug in to reduce their noise signature. The BTR-50PUM is a further modernized version (primarily in the engine and drive train; as the Soviets did not employ the BTR-50 series in front-line roles, the BTR-50PUM was primarily issued to Category II and Category III reserve units and sold to export customers as an upgrade. The BTR-50PUM-1, introduced in 1972, was also issued primarily to Soviet Category II and III units and sold as an upgrade kit to export customers. It mounted the latest Soviet radios in service at the time, and two radio operators were removed in favor of more space for the command staff (the new radios required less oversight, and could be operated by less personnel). The radios of the BTR-50PUM-1 were the same as used in the command variants of the BTR-60 at the time. The BTR-50PUM-1 introduced an inertial navigation system that was actually reliable, though it usually had to be reset when the vehicle was in motion every half an hour; this resetting requires the vehicle to stop for about three minutes while the procedure is taking place, while the vehicle commander cross-checks the gyrocompass and his maps; some export customers had an inertial navigation system installed in the early 1980s or later that did not require this constant resetting. Except for the new inertial navigation system and further updated radios, the later version of the BTR-50PUM-1 is identical to the earlier BTR-

50PUM-1 for game purposes.

The Russians had several versions of their command BTR-50PKs; these primarily differed in internal equipment and what types of radios they carried. FIST and FAC vehicles in particular carried special equipment suited for their role in calling for and coordinating artillery, mortar, and/or air strikes.

The Bulgarian R-82 is an improved version of the BTR-50PU with more modern (for the time) communications equipment (comparable to that of the BTR-50PU-2) and an AZI frame antenna on the rear deck which could be raised, was more stable than the mast antenna of the BTR-50PU series, and allowed the R-82 to move slowly while the antenna is raised. Otherwise, for game purposes, it is identical to the BTR-50PU-2; the potentially most important difference between the R-82 and BTR-50PU-2 for players is that the generators cannot be readily dismounted.

Many BTR-50PUs given to the Egyptian Army by the Soviets were modified by the addition of a bubble cabin atop the superstructure made from bullet-resistant glass over a framework. This allowed for increased observation ability by the command staff, and also made them better vehicles for FAC and FIST teams. They are otherwise identical to the various BTR-50PU variants used by the Egyptians over the years. This wasn't that common a modification.

It is common that BTR-50s in current service mount PKs, M-60s, or MAGs instead of the old SGMB machinegun.

Though the Israelis no longer use the BTR-50PK, when they did, they shifted the pintle mount to the commander's position, where either a single M-60 machinegun was mounted. Other Israeli BTR-50PKs mounted three M-1919A4 machineguns, one at the commander's position and one at the front of each roof hatch. 2000 rounds were typically carried for each gun. They are otherwise the same as standard BTR-50PKs, though the GM should add \$21,443 to the price; in addition, after the 1973 war, Israeli BTR-50PKs were given an engine upgrade by Nimda (to 300 horsepower), making them equivalent to BTR-50PKMs.

Later Modifications

Finland is one of the few Western countries still using any variants of the BTR-50. They use the BTR-50YVI, which is a BTR-50PK converted into a command and staff vehicle by rearrangement of the interior, the replacement of the communications system with the Italian YVI-2 digital communications system (the BTR-50YVI has essentially four radios using a common antenna), an extendible antenna mast, appliqué armor, four smoke grenade launchers on either side of the front hull, and a weapon mount for the commander. The BTR-50YVI began service in 1994. The BTR-50YVIM is the same, but with a UTD-20 engine, and the BTR-50YVIM-1 is the same as the BTR-50YVIM, but uses up-to-date Western communications gear (made by Sweden). These vehicles also typically have a ruggedized laptop computer, a hand-held thermal imager, image intensifier, and laser rangefinder, and one of the radios is data-capable. The driver's night vision block is also brought up to modern standards. The IR Searchlight is deleted.

In 2005, the Serbians began offering an upgrade package for the BTR-50PK, aimed primarily at the export market. Designated the BTR-50S, this package upgrades the engine to a locally-produced 300-horsepower diesel engine with an associated automatic transmission and updated suspension and drive train. Instead of the roof hatches, the turret from the M-80AK IFV with upgraded firepower is mounted atop the superstructure, giving the BTR-50S a significant upgrade in firepower including a 30mm autocannon, coaxial machinegun, a pair of ATGM launchers, and four smoke grenade launchers on each side of the turret. Night vision is improved, and the IR Searchlight is deleted.

Morozov of Ukraine offers four upgrade packages for the BTR-50PK; both resulting vehicles are called the BTR-50M. All replace the old engine with the UTD-20 engine, and both use automatic transmissions, with the driver's compartment having conventional steering yokes, gas pedals, and brake pedals. The first two models mount turrets atop the superstructure with 2A72 30mm autocannons; at the customer's option, the coaxial machineguns can be PKTs or Ukrainian-made KT-7.62 machineguns, which are very similar to PKTs. The third variant replaces the 30mm autocannon with a KPV heavy machinegun. The second BTR-50M variant carries more ammunition for its autocannon and less for its grenade launcher, has better stabilization for the autocannon and coax, and has better night vision equipment; the third BTR-50M variant also has two-axis stabilization like the autocannon of the first version of the BTR-50M. Both the first and second versions of the BTRM have ballistic computers and laser rangefinders for the autocannon and coax. On each side of the turret of the first three versions of the BTR-50M are launchers for AT-5 or Ukrainian-designed R-2 ATGMs; these are reloaded by the small hatch on the superstructure deck to the right and rear of the turret. The fourth version of the BTR-50M is the economy upgrade; it includes a KPV with a smaller coaxial machinegun; like all of the BTR-50M variants, there are three smoke grenade launchers on the front of the turret on each side of the main gun. Unlike the rest of the BTR-50Ms, the turret of the fourth BTR-50M upgrade uses an OHWS-type turret instead of a manned turret, with sights linked by downlinked monitors to the gunner inside the vehicle (though the gunner is still in the turret basket, and rotates with the turret). On the fourth version, there is only a small hatch in the turret roof for the gunner; the commander has the usual BTR-50PK-type commander's station and hatch (though no pintle weapons mount). The IR Searchlight is deleted from these upgrades, as the night vision suite is improved.

The first three variants also have external flexible mounts for an AG-17 grenade launcher; the AG-17 in this mount can be elevated and to an extent traversed separately from the turret armament, up +70 degrees, -5 degrees, and 45 degrees to either side. The AG-17 in this installation is fed by a 100-round magazine at the rear of the mount, and is reloaded by a soldier that uses the small hatch behind the turret to the left (the turret on all versions of the BTR-50M is offset somewhat to the right). The AG-17 is controlled by the gunner; the commander has no auxiliary controls for it, though he does for the rest of the turret weapons. Optional equipment for the BTR-50M (any of them) includes a Kevlar anti-spalling liner (add \$1240 to the price and 1 to the side armor; the weight is negligible), a GPS system (add \$20,000 to the price; the weight is negligible), and an air conditioner (add \$1000 to the cost; the weight again is negligible). The Ukrainians can also add soft-kill-type APS systems to their BTR-50Ms, similar to the Shtora-1 system (see the notes about this system in the BMP-3 entry above). This adds 100 kg to the weight of the vehicle and \$18,055 to the price.

It is obvious from the large number of upgrades available for the BTR-50 that the vehicle is still in active service in many places in the world. The BTR-50 does have a very small advantage over most modern armored vehicle designs – its swimming speed is very quick.

Twilight 2000 Notes: One unusual user in the Twilight War of the BTR-50 was the United States; they had a fair number of captured examples in OPFOR units stationed in Fort Irwin, California and Fort Polk, Louisiana, and these were pressed into use in the later stages of the Mexican invasion. (They were stock versions, mostly of BTR-50PKs, except for their US-made, up-to-date SINCGARS radios and perhaps an overhaul.) Many countries still had BTR-50s in active use during the Twilight War, including Soviet Category III and Mobilization-Only units and some Warsaw Pact reserve units; one could expect to encounter the BTR-50 at almost any time. Most BTR-50s in use during the Twilight War were BTR-50PKs or their derivatives. The versions listed under "Later Modifications," however, were not available for the Twilight War, except for the BTR-50S, which was produced in small numbers by Yugoslavia as an upgrade kit for use by her army.

BTR-50P	\$43,599	D, A	1 ton	14.2 tons	2+20	10	Active IR (D) (Later Passive IR (D)), IR Searchlight (C)	Open
BTR-50PA	\$47,800	D, A	1 ton	14.2 tons	2+20	10	Active IR (D) (Later Passive IR (D)), IR Searchlight (C)	Open
BTR-50PK	\$48,796	D, A	1.3 tons	14.5 tons	2+12	10	Passive IR (D), IR Searchlight	Enclosed
BTR-PKM	\$50,946	D, A	1.3 tons	14.6 tons	2+12	10	Passive IR (D), IR Searchlight	Enclosed
BTR-50PN	\$52,851	D, A	650 kg	14.5 tons	2+6	11	Passive IR (D), IR Searchlight	Enclosed
BTR-50PU	\$61,831	D, A	650 kg	14.4 tons	2+8	12	Passive IR (D), IR Searchlight	Enclosed
BTR-50PU-2	\$81,811	D, A	650 kg	14.4 tons	2+8	12	Passive IR (D), IR Searchlight	Enclosed
BTR-50PUM	\$81,239	D, A	650 kg	14.5 tons	2+8	12	Passive IR (D), IR Searchlight	Enclosed
BTR-50PUM-1	\$91,745	D, A	650 kg	14.4 tons	2+6	12	Passive IR (D), IR Searchlight	Enclosed
BTR-50YVI	\$137,908	D, A	650 kg	14.3 tons	2+6	11	Passive IR (D), IR Searchlight	Enclosed
BTR-50YVIM	\$140,058	D, A	650 kg	14.4 tons	2+6	11	Passive IR (D), IR Searchlight	Enclosed
BTR-50S		D, A	800 kg	16.6 tons	2+10	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed
BTR-50M (Version 1)	\$150,567	D, A	800 kg	16.6 tons	2+10	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed
BTR-50M (Version 2)	\$190,754	D, A	800 kg	16.8 tons	2+10	10	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Enclosed
BTR-50M (Version 3)	\$152,768	D, A	800 kg	16.6 tons	2+10	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed
BTR-50M (Version 4)	\$141,017	D, A	800 kg	16.5 tons	2+10	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed

BTR-50P/PA	131/92	32/20/8	400+180	100	Std	T3	HF3 HS2 HR2
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BTR-50PK/PN	129/90	31/20/8	400+180	102	Std	T3	HF3 HS2 HR2
BTR-50PKM	152/106	37/23/9	400+180	127	Std	T3	HF3 HS2 HR2
BTR-50PU	128/89	31/20/8	400+180	103	Std	T3	HF3 HS2 HR2
BTR-50PUM	154/107	37/23/9	400+180	126	Std	T3	HF3 HS2 HR2
BTR-50PUM-1	156/108	37/23/9	400+180	125	Std	T3	HF3 HS2 HR2
BTR-50YVI	130/91	31/20/8	400+180	103	Std	T3	HF5 HS3 HR2
BTR-50YVIM	156/108	37/23/9	400+180	125	Std	T3	HF5 HS3 HR2
BTR-50S	134/93	33/20/8	400+180	145	Trtd	T3	TF4 TS4 TR4 HF3 HS2 HR2
BTR-50M (Version 1/Version 3)	134/93	33/20/8	400+180	145	Trtd	T3	TF5 TS4 TR3 HF3 HS2 HR2
BTR-50M (Version 2)	133/92	33/20/8	400+180	147	Trtd	T3	TF5 TS4 TR3 HF3 HS2 HR2
BTR-50M (Version 4)	135/94	33/20/8	400+180	144	Trtd	T3	TF3 TS3 TR3 HF3 HS2 HR2

BTR-50 (All Except Listed Below and the BTR-50PU Variants)	None	None	SGMB	1250x7.62mm
BTR-50PA	None	None	KPVT	650x14.5mm
BTR-50YVI/YVIM	None	None	PK (C)	1250x7.62mm
BTR-50S	+2	Fair	30mm Mauser MK-30 Autocannon, PKT, 2xAT-4 ATGM Launchers	1100x30mm, 2000x7.62mm, 4xAT-4 ATGMs
BTR-50M (Version 1)	+3	Fair	30mm 2A72 Autocannon, KT-7.62 or PKT, 2xAT-5 or R-2 ATGM Launchers, AG-17 GL	150x30mm, 2000x7.62mm, 4xAT-5 or R-2 ATGMs, 180x30mm Grenades
BTR-50M (Version 2)	+3	Good	30mm 2A72 Autocannon, KT-7.62 or PKT, 2xAT-5 or R-2 ATGM Launchers, AG-17 GL	350x30mm, 2000x7.62mm, 4xAT-5 or R-2 ATGMs, 116x30mm Grenades
BTR-50M (Version 3)	+2	Good	KPVT, KT-7.62 or PKT, 2xAT-5 or R-2 ATGM, AG-17 AGL	1000x14.5mm, 2000x7.62mm, 4xAT-5 or R-2 ATGMs, 180x30mm Grenades
BTR-50M (Version 4)	+2	Fair	KPVT, KT-7.62 or PKT	3000x14.5mm, 2000x7.62mm

*Belly armor for the most of the BTR-50 series is 2. The floor armor of the BTR-50YVI is 3.

BTR-D

Notes: The BTR-D is the BMD-1, with the turret removed, stretched by 60mm, and essentially turned into a conventional "basic Box" APC. It was first seen by the West during the Soviet invasion of Afghanistan in 1979, and was therefore first had the NATO designation of BMD-1979. The BTR-D actually first entered Soviet service in 1974. The BTR-D was first used as an APC to allow Airborne troops to carry more troops in an armored vehicle, but has since become the basis of several specialized vehicles, including logistics vehicles, ambulances, AAA vehicles, mortar carriers, ARVs, and ATGM vehicles. The BTR-D, however, is showing its age, and may be slated for replacement soon by a version of the BMD-4 (variously referred to as the BTR-MD, BTR-D3, and Rakushka).

The BTR-D retains the firing ports of the BMD-1, as well as the ports for the bow-mounted machineguns. The bow machineguns, however, are replaced by PKD machineguns (instead of the PKTs of the BMD-1) and may be removed from the BMP-1 and used as ground weapons if desired; tripods are also carried on the BTR-D for this purpose. The commander's position also has a pintle mount for a weapon, usually a PK machinegun or an AGS-17 or AGS-30 grenade launcher; a pintle mount for a weapon (usually a PKT) is

installed on each side of the vehicle near the front of the rectangular hatches. The BTR-D is, as stated above, slightly longer than the BMD-1's hull, and has six roadwheels on each side instead of five. Like the BMD-1, traverse for the bow machineguns is limited, allowing 15 degrees up and down and only about 25 degrees from side to side. Lengthening the hull, along with removal of the turret, removal of the ammunition for the turret weapons, and rearrangement of the interior allows the BTR-D to carry six troops, two bow machinegunners, and two crewmembers. The hull is raised and is higher than that of the BMD-1, and the armor is of aluminum instead of the magnesium alloy of the BMD-1. The top of the hull is closed, with a pair of rectangular hatches over the troop compartment opening inwards, a hatch on the center deck near the front, and hatches on the front deck for the driver and left bow machinegunners. The driver has three vision blocks to the front; the left bow machinegunner has vision blocks to his front and left side, and the right bow machinegunner, though he has no hatch, has vision blocks to his front and right side. All three can remove their front vision blocks and replace them with night vision blocks. The three firing ports on each side of the vehicle are retained. There is no rear door, with all troops entering and exiting through the various roof hatches. The commander's position has no night vision, though he does have all-around vision blocks and an IR/white light searchlight, and a traversable periscope. The crew is protected by a collective NBC system.

Propulsion of the BTR-D is identical to that of the BMD-1, using a 270-horsepower 5D-20 diesel engine, the same and transmission as the BMD-1, and the same suspension except for the extra roadwheel. Though the BTR-D uses armor that is heavier in weight than that of the BMD-1, the BTR-D is lighter than the BMD-1 due to the absence of the turret and its ammunition. The BTR-D also has the same amphibious capabilities as the BMD-1, including the very versatile waterjets.

Other BTR-D APC-Type Variants

The BTR-D San is an armored ambulance version of the BTR-D. The BTR-D San can carry two stretcher-borne patients and four seated casualties, and carries a dedicated medic along with a commander and driver who are usually also medics. Armament is deleted, as are the positions for the bow machinegunners and the firing ports. The BTR-D carries a portable defibrillator, one set of oxygen administration gear, and the equivalent of a doctor's medical bag and the equivalent of 15 personal medical kits. Utility of the BTR-D San is limited by the fact that casualties must be loaded into the vehicle by lifting them or assisting them over the top of the vehicle into the roof hatches.

The BTR-DG is a logistics variant; it has a largely open compartment at the rear, and the pair of rear deck roof hatches are enlarged. The BTR-DG has a crane with a capacity of 2 tons to help handle cargo, and troop seats are eliminated. The crane can be folded atop the vehicle and when in use can be traversed through 180 degrees. The vehicle retains the pintle mounts for weapons on each side and for the commander, but the bow machineguns and the side firing ports are deleted.

The NPDU Sterkh is an interesting variant of the BTR-D – it is a base vehicle for the launch and control of a Yak-061 Pchela-1T UAV (a UAV that has the primary role of reconnaissance, but can be used as a radio or radar jammer). In this role, the BTR-D has a launch rail on the left hull deck that extends over the front of the hull, and is raised into position at about a 45-degree angle before the UAV is launched. On the front right hull is a large three-piece cylindrical container which carries “catching” equipment for the UAV when it returns from its mission. Instead of troops, the interior of the NPDU carries equipment for the launch and control of the UAV and for receiving and recording the reconnaissance information from the UAV, and transmitting it to command units or units equipped to receive it. The NPDU can control the Pchela-1T at a range of 60 kilometers. The NPDU Malakite is a version of the NPDU Sterkh with improved interior electronics and equipment that allow it to better interface with the UAV, and control it at double the range. On these vehicles, the bow machineguns, firing ports, and side weapons mounts are all deleted. The NPDU is not amphibious; the large container for the catcher unbalances the NPDU too much to allow for it. (The swimming equipment is still there and could be used if one ditches the catcher and its container.) Sorry, the UAV is *not* included in the price below, but the Load figure does include the weight of the UAV. If not carrying the UAV, triple the Load capability.

The BMD-1KSh Soroka is, despite its designation, actually based on the BTR-D hull. (It is also known variously by the designations BMD-KSh and KShM-D.) The BMD-1KSh does not have bow mounted machineguns and firing ports, and the openings are plated over, but the commander's position has a pintle-mounted weapon and the side pintle mounts are retained. The BMD-1KSh is equipped with a long-range, medium-range, and short-range radio, as well as a folding Clothes Horse antenna which runs around the top of the hull in a rectangular shape, and as two whip antennas. The long-range radio is data-capable, and a ruggedized laptop computer is carried. A hand-held thermal imager, image intensifier, and laser rangefinder are provided for the use of the command crew. The vehicle has an inertial navigation system with a gyrocompass backup, and an AB1 portable 1kW generator is carried to power the electronics when the vehicle is turned off. This generator can be readily dismantled if necessary; this is often done to dig in the generator (i.e., put in an open hole) to dampen noise. The generator is normally carried on the rear roof deck. On the BMD-1KSh, the commander's hatch is offset to the left of its normal position.

The BMD-1R Sinitza is a communications and signals vehicle used at Division level and higher. It is not normally used as a communications vehicle *per se*; instead, its communications equipment is designed to relay and amplify communications signals generated by the Division's command vehicles and other radios and communications equipment. As such, it is equipped with a single R-161A2M radio and radio amplification set and a heavy telescopic mast that is stowed on the left side of the vehicle roof. This mast is used when the vehicle is at a halt only, as it is a very tall mast (up to 20 meters) and must be emplaced with guy wires and a baseplate spiked into the ground. The BMD-1R also has a smaller, telescoping antenna that can be extended from the vehicle and used while the vehicle is on the move or during a short halt. These vehicles are rather rare, as they are employed only at high command levels. The bow machineguns, firing ports, and side pintle mounts are all deleted.

The R-440-ODB Kristall-BDS is a BTR-D converted into a SATCOM communications system vehicle. The Kristall-BDS has special

SATCOM radios and has a roof-mounted AK-12 radio dish that can give its radios a range of up to 15,000 kilometers. The dish antenna is covered with a cage-like structure with a tight mesh during movement. The bow machineguns, firing ports, and side pintle mounts are all deleted.

BTR-D	\$89,073	D, A	1.1 tons	8.5 tons	2+11	6	Passive IR (D, LBG, RBG), WL/IR Searchlight (C)	Shielded
BTR-D San	\$95,989	D, A	900 kg	8.2 tons	*	8	Passive IR (D), WL/IR Searchlight	Shielded
BTR-DG	\$53,615	D, A	1.5 tons	8.2 tons	2	5	Passive IR (D), WL/IR Searchlight	Shielded
NPDU	\$100,384	D, A	300 kg	9 tons	3	9	Passive IR (D)	Shielded
Sterkh								
NPDU	\$112,000	D, A	300 kg	9 tons	3	9	Passive IR (D)	Shielded
Malakite								
BMD-1KSh	\$285,715	D, A	550 kg	8.5 tons	2+4	8	Passive IR (D), WL/IR Searchlight	Shielded
BMD-1R	\$143,614	D, A	550 kg	8.5 tons	2+4	9	Passive IR (D)	Shielded
R-440-ODB	\$298,109	D, A	400 kg	8.5 tons	2+4	10	Passive IR (D)	Shielded

BTR-D/BMD-1KSh/BMD-1R/R-440-ODB	197/138	48/30/12	300	113	Std	T3	HF8 HS4 HR4
BTR-D San/BTR-DG	204/143	50/31/12	300	110	Std	T3	HF8 HS4 HR4
NPDU	185/130	45/28	300	120	Trtd	T3	TF1 TS1 TR1 HF8 HS4 HR4**

BTR-D	None	None	2xPKB (Bow), PKT or AGS-17 (C), 2xPKT or 2xAGS-17 or Combination of the Two	6000x7.62mm or 3000x7.62mm and 500x30mm or Combination of the Two
BTR-D DG/BMD-1KSh	None	None	PKT or AGS-17 (C), 2xPKT or 2xAGS-17 or Combination of the Two	4000x7.62mm or 2000x7.62mm and 300x30mm or Combination of the Two
NPDU/BMD-1R/R-440-ODB	None	None	PKT or AGS-17 (C)	2000x7.62mm or 300x30mm

*See text above for crew capacity.

**The "turret" in this case is the cylinder containing the UAV catcher.

Omsk BTR-T

Notes: The BTR-T grew out of a need for a heavily armored engineer assault vehicle, and to use a number of obsolete T-55s that the Russians had in storage. Originally, the BTR-T was meant to deliver combat engineer squads to their targets, but it now used in general as an HIFV. The BTR-T is sometimes called the BMP-4, but this is an incorrect appellation, as there is already a variant of the BMP-3 called the BMP-4. The T-55s hull is converted to a heavy IFV used primarily for urban warfare. The number of BTR-Ts will necessarily be limited, as the Russians have exported most of their T-55s or converted them to other uses, and scrapped many of them. The remaining T-55s are later versions of the tank, and have somewhat heavier base armor and more powerful engines. From time to time, designs for similar HIFVs based on other obsolete tanks are spoken of (particularly the T-80), but none have come to fruition yet. The Russians say that they can produce such a vehicle from any tank platform, and reportedly India is interested in producing such a vehicle from their Vijayanta tanks. The BTR-T was designed after Russian experience in Chechnya, in the Battle of Grozny, where the Russians experienced horrendous armored vehicle losses. A recent buyer of the BTR-T is Bangladesh.

The BTR-T is a T-55-series hull with a 30mm autocannon elevated over a low-profile one-man turret. The standard T-55 turret is removed, and its ring largely replaced with armor plate and hatches. There is a pintle mount located on the right side of the turret, and is manned by one of the troops carried. This gun can be aimed and fired from within the vehicle. The removal of the original turret

allows the crew and dismounts to be located forward of the engine. The major drawback of the design is that infantrymen can only exit through hatches on the roof. The BTR-T is usually equipped with ERA on the glacis and on the sides. In addition, the armor has been upgraded with appliqué armor. It is a heavy vehicle, which is underpowered and cannot keep up with maneuver forces, so the BTR-T is limited to its specialized roles. The engine installed is the same V-55U engine of the T-62, developing 620 horsepower, and coupled with a semiautomatic transmission that is able to operate in either manual or automatic transmission modes.

On Each side of the hull are clusters of six smoke grenade launchers. In addition, diesel fuel may be injected into the exhaust to produce a thick, oily smokescreen. The main cannon has a laser rangefinder which can double as a laser designator, and the cannon has a modicum of stabilization.

The crew is protected by a fire detection and suppression system, as well as an NBC Overpressure system. The crew also has air conditioning and a heater. The driver is on the front left, and the commander's OHWS/hatch is on the front center. The commander has a remote-controlled weapon to his left, and the missile launchers to his right. A third crewmember (part of the infantry or engineer squad) has a hatch to the right of the missile launcher and is armed with a pintle-mounted medium machinegun. The other crewmembers are in the hull. The BTR-D is equipped with a Russian version of a BMS, as well as GPS.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$796,277	D, A	400 kg	38.5 tons	2+5	26	Passive IR (D), Image Intensification (C), Thermal Imaging (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
121/84	33/23	500 + 400 in rear drums	230	CiH	T6	TF13 TS8 TR6 HF74Sp HS18Sp HR6

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	30mm 2A42 Autocannon, Twin AT-5 ATGM, PKT or NSVT or AGS-17 (C), PKMT	200x30mm, 4xAT-5, 2000x7.62mm or 500x12.7mm or 300x30mm grenades, 2000x7.62mm

*Roof AV is 12; Floor AV is 8Sp.

Kharkov MT-LB

Notes: This vehicle was not originally meant to be an armored personnel carrier; instead, it was designed to be a versatile chassis that could be easily modified for a variety of roles, from artillery tractor to command vehicle, as well as APC in some roles. The MT-LB is an armored variant of the MT-L tracked carrier, and as such was meant to replace the AT-P armored tractor (above) as well as to be the basis of a large number of other specialized vehicles. There are over 40 variants of the MT-LB in service worldwide today, including many APC variants; they are valued in that role due to their size and surefootedness on uneven terrain. They also have a very good heating system, as one of the roles the MT-LB was designed for was to replace several over-the-snow vehicles used in Arctic and Siberian conditions. The MT-LB is used or has been used by some two dozen countries, including the US (who uses a good number of them in its OPFOR units in California and Arkansas). It is also used by a number of civilian relief agencies operating in dangerous areas or rough terrain; numbers have also been bought by news organizations for the same purpose. They are a common sight in war movies set in modern settings. (Civilian versions will be, of course, unarmed, or at best armed with mock or deactivated weapons.) The MT-LB shares a common heritage in the PT-76, though the MT-LB is internally very different and very few parts aside from the engine and transmission will interchange between the three. MT-LB's, therefore, can be found virtually anywhere in the world. The MT-LB first appeared in Soviet units in the late 1960s.

The MT-LB takes the form of a long-low box, with a hatch in the front left for the driver with the commander on the right side of the front; his hatch usually replaced by a small turret mounting a machinegun, but sometimes only a hatch with a pintle mount is present. If there is a turret, the turret uses 360-degree manual traverse, and the machinegun has manual elevation from +30 to -5 degrees. This turret is sometimes replaced with a slightly larger one mounting an NSVT machinegun, at which point the vehicle is called the MT-LBM. If the turret is present, the commander will have a hatch between his position and the driver's; the turret has no hatch. The driver can replace his front vision block with a night vision block, and the commander has a small, short-range WL/IR searchlight with a range of about 40 meters; this is primarily to aid the driver when driving at night. The engine is in the front of the vehicle. A small aisle between the commander and driver gives access to the troop compartment. On the roof of the troop compartment are two large hatches – depending upon which country built the MT-LB in question, the hatches may be round, square, or rectangular. The troop compartment has two large doors in the rear face, and four firing ports, one of which are in each side and one of which is in each rear door.

The engine of the MT-LB is a 240-horsepower YaMZ-238 diesel engine. This engine, while only modest in power for an armored vehicle, generates considerable torque and the MT-LB is capable of towing 6.5 tons. This makes the MT-LB an ideal artillery tractor as well as a good chassis for recovery vehicles or towing other specialist equipment and trailers. The treads can be replaced with tracks almost twice as wide as normal (585mm) for even better performance in snow and swamps; in this guise, the vehicle is referred to as the MT-LBV. Like most Soviet-designed vehicles of the period, the MT-LB's suspension is of conventional torsion bars and has shock absorbers on the first and last set of roadwheels. Construction of the MT-LB is largely of steel and armor is rather thin, especially on the sides and rear.

MT-LB APC Upgrades and APC-Type Versions

As the MT-LB is still being used as an APC by many countries around the world, a number of upgrade packages have been offered and fielded for the MT-LB around the world. These focus on the central deficits of the MT-LB: power, protection, and firepower, providing improvements in some or all of those areas.

An engine upgrade in the early 1990s gave the MT-LB a 290-horsepower engine and an automatic transmission, along with improved driver's controls. Most versions of the MT-LB variants fielded after this point include these improvements, and some older versions were also re-engined.

The MT-LB-6MA, MB, M1B3, and M1B5 are variants of the MT-LB designed after Russian experiences in Chechnya. The Russians needed a sure-footed, stable vehicle with decent firepower for the rubble-choked streets of urban battlegrounds; they also needed an APC which could provide more fire support. To this end, they topped an MT-LB chassis with turret giving the vehicle better firepower; this turret is based on that of the BTR-80A, enlarged as necessary for the M1B3 and M1B5 versions. In addition, appliqué armor was added to the vehicle hull in virtually all places, to varying degrees. The commander's position stays in the same place, but he has a simple hatchway instead of a small turret. Radios and night vision devices are updated. In the case of the M1B3 and M1B5 versions, the AG-17 grenade launchers are on a flexible mount on the turret like those on the BTR-50M versions, and loaded in the same way. These versions are not amphibious. These versions are primarily used by the Russians, though they are offered for export.

The RKhM Kashalot is an NBC reconnaissance version of the MT-LB which does not carry troops, but instead carries a small crew of NBC-trained personnel and equipment to detect and analyze chemical agent contamination and radiological hazards. At the rear of the vehicle is a dispenser that contains 50 small flags to mark contaminated areas. Alarms alert the crew to such hazards, and then they can analyze the contamination. The RKhM does not have the firing ports of the MT-LB, but retains the machinegun turret; it also retains the vision blocks that normally come with the firing ports. The rear of the vehicle has one door at the rear instead of two, and has reinforced seals to ensure that the vehicle is NBC sealed. It also has an NBC overpressure system and extensive radiation shielding. The RKhM has an additional radio (medium-range) which is data-capable. The RKhM-K is a command version of this vehicle; it does not have the chemical analysis equipment, but still has the detectors and contains extra radio equipment, including one long-range, one medium-range, and one short-range radio, with the long range radio being data-capable. The RKhM-K does not have the marker-emplacement system of the RKhM. The RPM is a specialized version of the RKhM, designed only to detect radiological hazards. Its radiological analysis equipment is designed to measure the exact amount of each major type of radiological contamination (gamma rays, neutrons, beta particles, and alpha particles).

The MT-LB San is an armored ambulance version of the MT-LB. In this role, the MT-LB is unarmed and the firing ports are plated over; in place of the turret is a simple commander's hatch. The MT-LB San carries extensive medical equipment, including a refrigerator for medicines and blood products, oxygen gear, a transfusion machine, a defibrillator, and a heating blanket. The equivalent of two doctor's medical bags and 20 personal medical kits are carried. The MT-LB San can carry four stretcher cases and three seated patients, or two stretcher cases and five seated patients.

Russia is marketing an upgrade kit that adds the Kliver turret along with an engine and transmission upgrade and a small amount of appliqué armor. The suspension is also upgraded, as is driver's station. The vehicle has an NBC overpressure system with a collective NBC backup. This gives the MT-LB a substantial performance and firepower upgrade as well as making it a bit more survivable. The turret also has a cluster of four smoke grenade launchers on either side.

Ukraine is also offering a new turret, engine, and armor upgrade package for the MT-LB, though it does not offer the ATGMs that the Russian Kliver upgrade offers. Like the Russian Kliver upgrade, there are four smoke grenade launchers on each side of the turret. Ukraine also calls this upgrade the MT-LBM, though it is not the same as the Soviet/Russian MT-LBM.

Twilight 2000 Notes: The MT-LB was in service throughout the Warsaw Pact (and indeed, virtually the entire world) during the Twilight War; some ex-East German models were also sold to Sweden before and during the war, and some were also pressed into service by Germany. The US also officially had about three dozen of these vehicles in working order during the Twilight War, in the OPFOR units stationed at Fort Irwin in California and Fort Polk, Louisiana. The engine upgrade program started earlier in the Twilight 2000 timeline than in real life, beginning in the late 1980s, and over half the Soviet and Warsaw Pact MT-LBs had this engine upgrade; some 20 other countries had also performed a similar upgrade starting in the 1990s, with some such engine upgrades actually taking place at third-echelon-level maintenance shops during the war. The Russians did not have the Chechen problems in the Twilight 2000 timeline that they had in real life, but some small numbers MT-LB-6MAs and MT-LB-6MBs did make into service for the Twilight War, and some Polish MT-LBs also carried these modifications. The MT-LB with the Kliver turret was not available for the Twilight War, but the Ukrainian MT-LBM variant was available in very small numbers, though it was designated the MT-LBM2 in Soviet service. The "MT-LBM2" arrived late on the scene (around 1997), and was used largely for protection of vehicle convoys and rear-echelon units when it was available.

MT-LB	\$52,763	D, A	2 tons	11.9 tons	2+11	8	Passive IR (D), WL/IR Searchlight (C)	Shielded
MT-LBM	\$55,894	D, A	2 tons	11.9 tons	2+11	8	Passive IR (D), WL/IR Searchlight (C)	Shielded

MT-LB (Engine Upgrade)	\$52,886	D, A	2 tons	11.9 tons	2+11	8	Passive IR (D), WL/IR Searchlight (C)	Shielded
MT-LBM (Engine Upgrade)	\$56,018	D, A	2 tons	11.9 tons	2+11	8	Passive IR (D), WL/IR Searchlight (C)	Shielded
MT-LB-6MA	\$44,848	D, A	1 ton	13.8 tons	3+7	7	Passive IR (D, G, C)	Shielded
MT-LB-6MB	\$57,387	D, A	1 ton	13.8 tons	3+7	7	Passive IR (D, G, C)	Shielded
MT-LB-6M1B3	\$74,825	D, A	900 kg	14 tons	3+6	8	Passive IR (D, G, C)	Shielded
MT-LB-6M1B5	\$83,337	D, A	900 kg	14 tons	3+6	8	Passive IR (D, G, C)	Shielded
RKhM	\$195,013	D, A	700 kg	13 tons	5	11	Passive IR (D), WL/IR Searchlight (C)	Shielded
RKhM-K	\$75,213	D, A	700 kg	13 tons	5	10	Passive IR (D), WL/IR Searchlight (C)	Shielded
RPM	\$115,013	D, A	700 kg	13 tons	5	10	Passive IR (D), WL/IR Searchlight (C)	Shielded
MT-LB San	\$56,985	D, A	1.6 tons	11.4 tons	**	10	Passive IR (D), WL/IR Searchlight (C)	Shielded
MT-LB San (Engine Upgrade)	\$57,108	D, A	1.6 tons	11.4 tons	**	10	Passive IR (D), WL/IR Searchlight (C)	Shielded
MT-LB/Kliver	\$310,382	D, A	1.3 tons	13.3 tons	3+7	9	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded
MT-LBM (Ukrainian)	\$222,482	D, A	1.7 tons	12.5 tons	3+7	9	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G)	Shielded

MT-LB/MT-LBM	148/104	36/23/4	450	100	CiH	T3	TF2 TS2 TR2 HF5 HS2 HR2
MT-LB/MT-LBM (Engine Upgrade)	171/120	42/27/4	450	122			
MT-LB-6MA/MB	147/103	36/23	450	142	CiH	T3	TF4 TS4 TR4 HF8 HS4 HR4*
MT-LB-6M1B3/M1B5	145/102	36/23	450	144	CiH	T3	TF4 TS4 TR4 HF8 HS4 HR4*
RKhM/RKhM-K/RPM	136/96	33/21/3	450	109	CiH	T3	TF2 TS2 TR2 HF5 HS2 HR2
MT-LB San	154/108	37/24/4	450	96	Std	T3	HF5 HS2 HR2
MT-LB San (Engine Upgrade)	179/126	43/28/4	450	117	Std	T3	HF5 HS2 HR2
MT-LB/Kliver	152/108	37/24/4	450	141	Trtd	T3	TF5 TS5 TR5 HF6 HS3 HR3***
MT-LBM (Ukrainian)	162/114	40/26/4	450	128	Trtd	T3	TF4 TS4 TR4 HF6 HS3 HR3***

MT-LB/RKhM/RKhM-K/RPM	None	None			PKT		2500x7.62mm
MT-LBM	None	None			NSVT		1500x12.7mm
MT-LB-6MA	+1	None			KPV, PKT		750x14.5mm, 2000x7.62mm
MT-LB-6MB	+1	None			30mm 2A42 Autocannon, NSVT		350x30mm, 1200x12.7mm
MT-LB-6M1B3	+1	None			2x23mm Gsh-23 Autocannons, NSVT, AG-17 GL		600x23mm, 1200x12.7mm, 200x30mm Grenades
MT-LB-6M1B5	+1	None			2x30mm Gsh-30K Autocannons,		450x30mm, 1200x12.7mm,

MT-LB/Kliver	+3	Good	NSVT, AG-17 GL 30mm 2A72 Autocannon, PKT, up to 4xAT-15 ATGM and/or 4xSA-18 SAM Launchers	200x30mm Grenades 300x30mm, 2000x7.62mm, up to 4xAT-14 ATGM and/or 4xSA-18 SAMs
MT-LBM (Ukrainian)	+3	Good	30mm ZTM-1 or 2A72 Autocannon, KT-7.62 or PKT	300x30mm, 2000x7.62mm

*These versions have a belly armor value of 4, and a deck armor of 3 (except for the turret, which has a deck armor of 2).

**See text above for crew and passenger capacity.

***These versions have a belly armor rating of 3.

Kharkov MT-LBu

Notes: The MT-LBu (also called the ACRV) is a further developed version of the MT-LB; the vehicle is longer with 7 roadwheels per side instead of six, a hull 40 centimeters taller, and a more powerful engine. Many sightings of an "MT-LB" are in fact of an MT-LBu, as other than size, they look the same externally (with the exception of any specialized equipment). Even more so than the MT-LB, the MT-LBu is primarily a platform for specialized vehicles; the MT-LBu is rarely found being used as a simple APC. Let me emphasize that – the MT-LBu is almost never used as a conventional, plain APC, but since it does happen from time to time, I have included stats for such a version below. The first MT-LBu variants appeared in Soviet service in the early 1970s, and is has been used as the basis for almost 70 variants. Steps were taken to make the MT-LBu's basic chassis and hull easier and quicker to manufacture; this not only makes the basic MT-LBu less expensive to make, it also facilitates the production of the myriad of variants by simplifying the basic manufacturing process (the real work in manufacturing is to outfit the variants with their specialized gear). Only "APC-type" variants will be covered in this entry; more specialized versions, such as artillery and artillery support vehicles, fire support vehicles, engineer vehicles, etc., will be covered in other sections of this site.

On the rare occasions that the MT-LBu is used as an APC, the MT-LBu essentially conforms to the form of the MT-LB, except that it is bigger and can carry more cargo and troops. The MT-LBu is also not seen with the small turret found on the MT-LB; instead, there is a dedicated gunner's position behind and slightly to the right of the driver's position with a pintle mount. The driver is in the front left of the MT-LBu, with the commander to the right, and a small aisle between their positions that links to the rear of the vehicle. The driver and commander have hatches on the front face of the vehicle; these are not normally used for ingress and egress from the vehicle, as they open only part way (so that they are standing just slightly above straight out from the front face), and both the commander and driver have normal hatches above their positions. The front hatches are square, while those above their positions are oval; the hatch sometimes used by a gunner is large and circular. The MT-LBu has only two firing ports, one in the front right side of the troop compartment, and the other in the rear door. The rear compartment has a large square hatch on the rear deck which opens to the rear, and the aforementioned hatch sometimes used by a gunner, which is circular. (This hatchway is generally filled by a blanking plate on most versions of the MT-LBu, as most MT-LBu variants are unarmed.) The armor of the MT-LBu is of aluminum instead of the steel of the MT-LB, and provides no better protection than that of the MT-LB. The engine is a YaMZ-238N 300-horsepower diesel which is actually an adapted heavy truck engine. The engine gives the MT-LBu the same 6.5-ton towing capacity as the MT-LB. The MT-LBu has an automatic transmission, and the driver has conventional driving controls – a steering yoke, a gas pedal, and a brake pedal. Like the MT-LB, the MT-LBu is amphibious with a minimal amount of preparation (a trim vane must be erected and bilge pumps turned on), though on the MT-LBu a crewmember must leave the vehicle to erect the trim vane instead of simply climbing out onto the front of the vehicle, so 7 minutes are required for preparation instead of five. The MT-LBu variants are generally equipped with a collective NBC system, though many variants have an NBC overpressure system.

MT-LBu Command Posts

A large number of MT-LBu variants are command-and-control-type vehicles. The 9V514 Beta-3 is used at division level and higher, and has a rear compartment that is for the most part taken up by the PASUV Manyevr command-and-control computer system. This includes an Argon-40 computer (sort of a small, ruggedized mainframe computer) and a smaller T-244 data processing unit. This vehicle gives the division commander very precise knowledge of the locations of friendly units, vehicles, and supply elements, as well as allowing him to keep and update battlefield information and transmit it to both lower and higher-echelon commanders and reconnaissance units, and vice versa. The 9V514 also includes two long-range radios, both of which are data-capable, to assist in the collection and dissemination of such information. A short-range radio for inter-vehicle communication is also carried. The 9V514 usually has several tall whip antennas (at least three), as well as having two mast antennas (one 11 meters tall, one 20 meters) which can be erected on the ground next to the vehicle to extend the range of the radios; the mast for the 11-meter antenna is sectional and can be made taller or shorter in 2-meter increments. The mast for the 20-meter antenna is telescoping and can be raised from a height of 6-20 meters. The 9V514 is equipped with external hookups to allow field telephones to be connected to the division command post. The 9V514 is equipped with an NBC overpressure system with a collective NBC backup. The initial 9V514s were produced from 1980-1990, but the equipment was updated in the late 1990s, with the computers and radios becoming far more capable – it is rumored that some types of hacking attacks can be carried out from an updated 9V514, making it a minor sort of a computer warfare vehicle in addition to its normal functions. This upgraded version is called the MP-95 Beta-4. As the 9V514 does not normally carry its own generator, and energy requirements for the computers and radios is high, the 9V514 is normally found towing a trailer with one or more high-power (5kW or more) generators.

The MP-21 series of MT-LBu-based vehicles are also part of the PASUV Manyevr command-and-control system. The MP-21, also

called the 9S743, is a command and staff vehicle found at division command level; it consists of three variants that are essentially the same except for some details in internal equipment. The primary version, the MP-21M, is the version for the division commander and his staff, the MP-21M-2 is the NBC defense commander and his staff, and the MP-21M-3 is for the division intelligence chief and his staff. Other versions include the MP-22 for the air defense liaison, the MP-23 for the air force liaison, the MP-24 for the field artillery and rocket forces liaisons, and the MP-25, which is used to process incoming air defense, counterbattery, and ground surveillance reports. The MP-21M will be detailed here; the others are, as stated above, basically the same in most details. The MP-21M is well-appointed with radios, having two long-range radios (both of which are data-capable), two medium radios, and one VHF very-long-range radio. To use with these radios, the MP-21M has no less than three whip antennas, a tall antenna that telescopes from the MP-21M's roof, a "Clothes Rail" antenna that extends in an oval shape above the roof of the vehicle, and an 11-meter mast antenna that can be emplaced beside the vehicle at a halt. The commander also has at his disposal a set of two ruggedized computers that give him a complete battlefield management system. The MP-21M has an inertial navigation system with a gyrocompass backup, and includes a computerized mapping system that interfaces with the battlefield management system. Also present are a variety of command post equipment like office supplies, plotting symbols, a map board, and a folding table and folding chairs. A tent can be extended from the rear of the vehicle to double the working space available, and the MP-21M comes with lights that can be strung to light this tent space. External hookups allow for field telephones from various sources to be fed into the vehicle. A 5kW generator is carried on the rear deck to power the radios and electronics when the engine is off. In the late 1990s, the MP-21Ms equipment was updated, to include the addition of a GPS system and the upgrading of the generator to 8kW. The MP-21 series is equipped with an NBC overpressure system with a collective NBC backup.

Another MT-LBu variant normally present in a division command center is the PPRI-5. This is essentially an MT-LBu crammed full of communications gear, including at least three long-range radios (with at least one having data capability), at least one very-long-range VHF radio, one medium-range radio for general communications, and one short range radio for general inter-vehicle communications. The VHF radios have a range of 2000 kilometers. Also present are a switchboard with hookups for 20 field telephones, at least 10 field telephones to use and pass out to other elements of the command center, and equipment to patch radio communications through field telephones and computers in other command units. Some spare parts for communications gear is also carried on the PPRI-5, but most such equipment is carried in a towed trailer. Liberal amounts of comms wire are carried, with more on the trailer. As might be imagined, the PPRI-5 is literally festooned with antennas, some of which are mounted on the roof of the vehicle and some of which are mast antennas which are to be erected outside the vehicle when it is in a fixed position; these include a 10-meter antenna which is telescoped from the roof of the vehicle, and 11-meter and 20-meter mast antennas as described above. A computer ties the communications equipment together and helps the operators make best use of it. As with its counterparts, the PPRI-5 was updated in the late 1990s. The R-161B is similar, but focuses more on the HF and VHF long-range and very-long-range radios, with four long-range and three very-long-range VHF radios; the VHF radios have a 2000-kilometer range as above, while the HF radios have a range of 50 kilometers. More range can be achieved with the radios through the use of the antenna masts in the case of both vehicles. The R-161B also has a standard short-range vehicular radio for general communications. The R-161B was also updated in the late-1990s, producing the R-161BM.

The R-412B (and its updated form, the R-412BM) works in concert with the PPRI-5; its functions are normally tied to the division command center by the PPRI-5. The R-412B is tropospheric relay station, with antennas and equipment used to amplify the signal strength of the PPRI-5s and R-161Bs radios, and to extend the range of those signals four-fold by bouncing the radio signals off of the ionosphere. A computer helps automate these functions, and a 5kW generator helps power these functions when the vehicle's engine is switched off. The R-412B also has standard basic vehicle radios. Finally, the R-439BG is a mobile SATCOM station with a large satellite dish on the roof of the vehicle and providing multiple avenues of communications and data relay; the range of the SATCOM radios in the R-439BG is generally 15,000 kilometers or more, depending upon positioning of communications satellites – potentially, the R-439BG could be used to communicate with any point on the planet. Again, a computer normally automates most functions of the SATCOM system. As with the R-412B, the R-439BG normally routes its communications through a PPRI-5 vehicle, though both it and the R-412B can route communications directly.

Except for the MP-21 series, these vehicles are generally accompanied by trucks, trailers, or MT-LBUs that are essentially unremarkable except that they carry generators to run the specialist MT-LBu's equipment when their engines are switched off. These generators can vary in size from 1 kW to 15 kW. All these vehicles' communications equipment have the highest security measures available to the country using them (which are for the most part the Soviets and Warsaw Pact countries, or later the Russians and Eastern European nations). Other than what is noted above, the primary improvements introduced in the late 1990s are in the areas are in the area of potential range (generally increased by about 20%), communications security (the use of frequency-hopping radios and new encryption modules with the radios, as well as increasing the number of types of radios with which the radios can inter-operate in many cases), power consumption (lowered overall), computing power, and reduced electromagnetic signature (very important; high-level command elements can often be found and identified due to their large electromagnetic signature).

Just an informational note: US, NATO, and most 1st-World Western-based armies have equivalent vehicles, but they are generally modular-type units mounted on heavy and medium trucks instead of dedicated armored vehicles, with equipment tailored for specific functions.

MT-LBu EW Vehicles

A number of electronic warfare and ground-surveillance radar versions of the MT-LBu exist. The R-330B is a mobile jamming system designed primarily to jam ground surveillance radars and radars of low-flying aircraft. Jamming range of the EW equipment on

the R-330B is 15 kilometers, but only 5 kilometers vertically. The jamming system is completely automated, so only a small crew is required, and the vehicle could be literally parked, the jamming equipment turned on, and the vehicle left there unattended. The jamming frequencies are of a relatively wide spectrum, they can be adjusted so as to not interfere with friendly radars. The R-330P is similar, but is a radio jammer, designed to jam in a frequency range of 20-100 MHz. This vehicle's jammers have a range of 25 kilometers, but it is not designed to operate on the frequencies that most aircraft communications use. The R-378B is another similar radio jammer, but designed to jam HF frequencies in a wide spectrum and having a range of 50 kilometers. The R-934B is another radio jammer, tuned to jam aircraft radios in a wide spectrum operating in the VHF and UHF bands, and having a range of 25 kilometers. The R-330-series, R-378B, and R-934B do not carry any special communications equipment, only basic vehicle radios.

The R-381T Taran series are vehicles with SIGINT (signals intelligence) equipment. They normally operate in concert with each other in military intelligence units at brigade level and above. The R-381T1 Taran-1 is designed to listen in on enemy radio broadcasts; it has two radio signal interception units, each of which can analyze a mid-sized band of frequencies and use an integrated computer to home in on and attempt to decrypt their broadcasts. They also automatically record the broadcasts they intercept, with enough recording space to record up to 5 hours of broadcasts, and with the system automatically erasing the oldest set of intercepted signals in order to record newer broadcasts. The R-381T1 operates closely with the R-381T2 Taran-2, which is a radio direction finder designed to locate enemy radio broadcasts, even if they are broadcasting in a tight directional beam. The R-381T2 has four radio direction finder units, and when they detect the radio broadcasts they attempt to determine the location range, signal strength, and radio frequency. R-381T2 can detect such broadcasts within a range of 30 kilometers. The R-381T3 Taran-3 is a control vehicle for the R-381T1 and R-381T2; it primarily carries computers designed to recognize certain patterns (such as repeated words and call signs) in order to facilitate CEOI analysis and decoding of code words, attempt to determine the language used in the broadcasts, analyze intercepted frequencies discovered by the R-381T2, and in general tie together the capabilities of the R-381T1 and R-381T2 and convert their findings into more useful intelligence. As such, the R-381T3 primarily carries computers used in signals intelligence work and various aids to the signals intelligence process, along with radios to relay the gathered signals intelligence to other units. The R-381T1 and R-381T2 carry only basic radio equipment for communicating with other friendly vehicles; the R-381T3 carries such radios in addition to two long-range radios which are data capable, for use in transmitting their findings to other units.

As with most other MT-LBu-based vehicles, these EW vehicles were updated in the late-1990s, giving them up-to-date electronics and computers. All of these EW vehicles have NBC overpressure systems with a collective NBC backup. All are normally found towing trailers with generators that have a capacity of 5-8kW, or by trucks that are carrying those generators.

Chemical Detection/Analysis Vehicle

The KDKhR-1N Dal is a vehicle with long-range chemical detection and analysis equipment. The system is quite advanced, using an optical chemical "sniffer" that lasers fired into an area suspected of chemical contamination combined with sophisticated computers to determine levels of contamination and the type of chemical that is contaminating the area. This system has a range of 7 kilometers and is not only able to detect and analyze chemical warfare agents, but other possible hazardous buildups of chemical agents such as the composition of smoke clouds from debris, oil wells that have been set on fire, and noxious gasses which are not normally chemical warfare agents. The KDKhR-1N also carries equipment for more direct, more detailed collection of samples and analysis, including valves to suck in air samples and manipulator arms used to pick up and test possible contaminated objects and small animals. Vision blocks and TV cameras are provided to aid in this process, and the TV system can be used at longer ranges for observation as well. This TV system is equipped with a separate image intensifier to allow observation at extended ranges as well as giving it low-light capability. The KDKhR-1N is also equipped with more conventional alarms to tell the crew that they are entering an area contaminated by chemical agents, noxious chemicals, or radiation. The KDKhR-1N, however, does not have the ability to detect radiological hazards until the vehicle is already in the radiologically-contaminated area, nor can it measure radiation types or levels except for the basic radiation level measurement provided by a Geiger counter. As the vehicle is a chemical warfare reconnaissance vehicle, it is equipped with an inertial navigation system which has a gyrocompass backup and a small computer to generate mapping information for the commander to mark on his maps. The KDKhR-1N is generally equipped with one short-range and one long-range radio; the long-range radio is data-capable. The KDKhR-1N was updated to the KDKhR-1NM standard in the late 1990s; these updates concentrated on the computers and added a GPS system with a computer that provides a computerized mapping system that displays maps on an LCD screen in the commander's cupola and allows the commander to note contaminated areas, friendly units, and transmit and receive such information from other units equipped with battlefield management systems. As the KDKhR-1N is a reconnaissance vehicle that is expected to operate in forward battlefield areas, it is armed, unlike most MT-LBu variants. Needless to say, the KDKhR-1N has an NBC overpressure system with a collective NBC backup.

Twilight 2000 Notes: The updates done in the late-1990s are not available in the Twilight 2000 timeline.

MT-LBu	\$37,171	D, A	2.3 tons	15.5 tons	3+13	12	Passive IR (D), WL/IR Searchlight (C)	Shielded
9V514	\$622,901	D, A	450 kg	15.9 tons	5	16	Passive IR (D), WL/IR Searchlight (C)	Shielded
MP-95	\$916,451	D, A	450 kg	15.9 tons	5	16	Passive IR (D), WL/IR Searchlight (C)	Shielded
MP-21	\$168,200	D, A	950 kg	15.7 tons	2+5	13	Passive IR (D), WL/IR	Shielded

MP-21 (Updated)	\$249,398	D, A	950 kg	15.7 tons	2+5	13	Searchlight (C) Passive IR (D), WL/IR	Shielded
PPRI-5	\$72,661	D, A	450 kg	15.7 tons	5	15	Searchlight (C) Passive IR (D), WL/IR	Shielded
PPRI-5M	\$87,972	D, A	450 kg	15.7 tons	5	15	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-161B	\$74,130	D, A	450 kg	15.8 tons	5	15	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-161BM	\$89,441	D, A	450 kg	15.8 tons	5	15	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-412B	\$167,092	D, A	450 kg	15.8 tons	5	15	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-412BM	\$132,497	D, A	450 kg	15.8 tons	5	15	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-439BG	\$565,237	D, A	450 kg	16 tons	5	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-439BGM	\$332,642	D, A	450 kg	16 tons	5	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-330B	\$287,982	D, A	450 kg	15.7 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-330BM	\$200,752	D, A	450 kg	15.7 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-330P	\$68,438	D, A	450 kg	15.6 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-330PM	\$83,343	D, A	450 kg	15.6 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-378B	\$68,989	D, A	450 kg	15.6 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-378BM	\$83,894	D, A	450 kg	15.6 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-934B	\$68,485	D, A	450 kg	15.6 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-934BM	\$83,390	D, A	450 kg	15.6 tons	4	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-381T1	\$112,642	D, A	450 kg	15.7 tons	5	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-381T1M	\$149,547	D, A	450 kg	15.7 tons	5	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-381T2	\$70,292	D, A	450 kg	15.7 tons	5	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-381T2M	\$85,197	D, A	450 kg	15.7 tons	5	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-381T3	\$245,302	D, A	450 kg	15.8 tons	6	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
R-381T3M	\$348,207	D, A	450 kg	15.8 tons	6	16	Searchlight (C) Passive IR (D), WL/IR	Shielded
KDKhR-1N	\$345,864	D, A	600 kg	15.9 tons	2+4	16	Searchlight (C) Passive IR (D, C), Image Intensification (C, TV), WL/IR	Shielded
KDKhR-1NM	\$405,319	D, A	600 kg	15.9 tons	2+4	16	Searchlight (C) Passive IR (D, C), Image Intensification (C, TV), WL/IR	Shielded

MT-LBu	133/93	32/21/3	540	127	Std	T3	HF5 HS2 HR2
9V514/MP-95/KDKhR-1N	129/90	31/20/3	540	131	Std	T3	HF5 HS2 HR2
MP-	132/92	32/21/3	540	128	Std	T3	HF5 HS2 HR2

21/PPRI- 5/R- 330B/R- 330P/R- 378B/R- 934B/R- 381T1/R- 381T2								
R-161B/R- 412B/R- 382T3	130/91	31/21/3	540	130	Std	T3	HF5 HS2 HR2	
R-439BG	129/90	31/20/3	540	131	Std	T3	HF5 HS2 HR2	

MT- LBU/KDKhR- 1N	None	None		NSVT			1500x12.7mm
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Mastranza M-114 APC

Notes: This vehicle is an El Salvadoran modification of the M-114 Lynx – sort of. In 1978, El Salvador took delivery of 27 used Woodmaster tractors – essentially M-114s stripped of their armor and rebuilt as agricultural tractors. Mastranza in El Salvador immediately got to work on them, re-plating them and otherwise trying to get into working order. One of the vehicles produced from these Woodmaster tractors became an M-114, with a raised roofline and topped with an armored cupola mounting an M-2HB. To help augment the skimpy armor protection, the Salvadoran M-114 APC variant has wire mesh covering the front and sides of the vehicle; this is basically chain-link fence with a tighter mesh to it. This mesh is used to pre-detonate HE-type rounds (primarily meant as a defense against HEAT rounds). However, this is not as effective as true spaced armor or even the type of bar/slat armor used on vehicles like the Stryker, and stops only 1D6 of penetration damage instead of the normal 2D6 of damage. Egress for the troops is through a large circular door in the rear face.

The biggest problem that Mastranza had was the engines. The Woodmaster does not have the same engine as the M-114 – it uses a different engine, a Chevy V-8 gasoline engine that produces 160 horsepower. The gasoline engines were limited in range, unreliable, prone to breakdowns, and tended to overheat when used in their new role in armored vehicles. Within a year, Mastranza replaced those engines with 134-horsepower LDT-4651C V-6 multi-fuel engines (normally run on diesel by the Salvadorans) adapted from M-35A2 2.5-ton trucks. Though the range was improved, speed was decreased, the engines are considerably heavier than the gas engines, and the engines still regularly overheat; this limits the M-114 APC variant's utility as an APC, as it often cannot keep up with the convoys it is supposed to be protecting and could easily break down at the wrong moment during an assault.

Some sources I have consulted say that the Salvadoran M-114 APCs have been withdrawn entirely from service, some others say that they are still used, but only infrequently, and some say they are still in regular service. I'm not sure which one is right. One thing's for sure – it really is a strange sort of Frankenvehicle.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-114 APC (Gas Engine)	\$25,462	D, A	550 kg	9.9 tons	2+8	6	Headlights	Enclosed
M-114 APC (Diesel Engine)	\$25,399	D, G, AvG, A	550 kg	10.4 tons	2+8	8	Headlights	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor					
M-114 APC (Gas Engine)	124/87	30/19	303	85	CiH	T2	TF3	TS3	TR3	HF5Sp*	HS3Sp*	HR2
M-114 APC (Diesel Engine)	106/74	26/16	303	53	CiH	T2	TF3	TS3	TR3	HF5Sp*	HS3Sp*	HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-114 APC	None	None	M-2HB (C)	500x.50

*This primitive version of spaced armor stops only 1D6 of penetration damage.

Bionix

Notes: The Bionix was originally designed to replace Singapore's aging M-113 fleet completely, but it appears that, in the near-term, will simply supplement Singapore's M-113s (most of which will also be upgraded). The Bionix is, in essence, a radically-upgraded M-113. The Bionix entered Singaporean service in 1997 and is also being offered for export, though no *known* export customers have materialized so far. (Several countries are believed to have trialed the Bionix or plan to do so in the near future.) The Bionix is meant to be a smaller, less expensive alternative to vehicles such as the Bradley and Warrior; though the Bionix cannot match those vehicles in armor protection, armament, fire control, or night vision systems, the Bionix is a much more affordable IFV for those countries who simply want a more modern vehicle but simply cannot pull off a more expensive vehicle purchase. The Bionix is also attractive to countries who, due to political reasons, cannot buy vehicles from the more usual arms companies. Though inferior to most Western AFV designs, it is plenty for those countries that are likely to use the Bionix. In 2000, a version of the Bionix (the Bionix ICV) was even tested by the US Army, though that contest was eventually won by the Stryker family of vehicles.

There are currently three variants of the Bionix IFV; the first two are in use by the Singaporean military, and the third should be entering service soon. (A fourth version, the Bionix ICV, which used an OHWS in lieu of a turret, was cancelled soon after the US trials; only the two prototypes that were sent to the US for trials were built.) In addition, there are ARV, AVLB, Counter-Mine, and SP Howitzer versions of the Bionix (not covered in this entry); the Bionix was designed to be a modular system which can be used as a base for a family of AFVs. All use essentially the same hull, which has a sharply-raked glacis plate of spaced armor. The hull, especially the suspension, shows its M-113 heritage, with the tracks, roadwheels, drive sprockets, and final drives all being obviously derivative of the M-113 series. The sides of the Bionix have spaced armor, including armored side skirts covering the top of the tracks just above the roadwheels. The extra armor applied to the Bionix is of steel. The rear of the vehicle is essentially the same as on the M-113, with a powered ramp at the rear that has a door in it; it is also obviously taken from the M-113 series. The Bionix has no firing ports and no vision blocks for the troops in the rear. Despite its M-113 heritage, the Bionix is not readily amphibious; to swim, a special kit must be attached which includes Styrofoam-filled metal blocks to the sides, the extension of a trim vane at the front, the attachment of balloon-like floats to each of the roadwheels, and the switching on of a bilge pump. Note that none of these requirements for amphibious operations are supplied with a standard Bionix; the standard Bionix is not amphibious. As the Bionix is much heavier than an M-113, the engine has been replaced with a license-produced 475-horsepower Detroit Diesel DDC-6V-92TA supercharged diesel engine, along with an HMPT-500EC automatic transmission (a modified form of the transmission found in the M-2 Bradley) and a driver's compartment that has a conventional steering yoke, gas pedal, and brake pedal. The driver's position remains in the front right of the vehicle; the driver has three vision blocks to his front, the center of which can be replaced with a night vision block.

The Bionix 25 is the base IFV version. It is topped with a two-man turret armed with an ATK M-242 25mm autocannon (a license-produced version of the M-242 Bushmaster) and a coaxial machinegun. (It should be noted that STK license-produces the ammunition for this weapon and the Bionix II's weapon from Oerlikon.) The turret is located in roughly the center of the vehicle, and is of all-steel construction. The commander also has a pintle-mounted weapon, and a third machinegun is found in a remote overhead mount atop the troop compartment. This remote installation provides a day/night periscope with magnification, and is manned by one of the troops in the rear. Three smoke grenade launchers are found on each side of the turret. The turret has modern night vision and the fire control equipment includes a ballistic computer; magnification for the sights are x8 by day and night. The commander has no night vision equipment or magnified day sights of his own, but can access the gunner's sights, and has auxiliary controls for the autocannon and coaxial machinegun. The commander's cupola has vision blocks to the sides and front (a total of five); the gunner has three vision blocks, to the right and rear. The troops in the rear are seated three per side, with the seventh (normally the squad leader) being at the front of the troop compartment facing to the rear; the rearmost soldier on the left side mans the remote machinegun. The troops and crew have a collective NBC system.

For the most part, the Bionix 40/50 is similar to the Bionix 25, but the turret mounts an automatic grenade launcher with a coaxial .50-caliber machinegun. The turret on this model is a one-man turret, and there is no commander's station; as the turret is smaller, more troops are carried. The rear overhead mount for a machinegun remains over the left rear troop compartment. The Bionix is designed to act as a counterpart to the Bionix 25; the Bionix acts primarily in the IFV role, while the Bionix 40/50 is optimized for counterinsurgency and, to an extent, anti-riot work.

The Bionix II is produced both as new-build vehicles and as an upgrade kit for the Bionix 25. The Bionix II is a modern IFV, featuring a battlefield management system (in conjunction with IFF receivers that are being mounted on most Singaporean vehicles and in many units, as well as being offered for export). This BMS gives the commander two LCD screens that display information about friendly and enemy units, receives updated intelligence and allows the commander to send updated reports, and displays precise information about the state of his vehicle. The BMS also allows the commander to interface with UAV cameras and information from UAV sensors can be displayed on one of the commander's LCD screens. The Bionix II is armed with the ATK Mk 44 ChainGun (a license-produced version of the US M-230 Bushmaster II). Fire control for the main armament and coaxial machinegun is improved with the addition of a laser rangefinder and dual-axis stabilization. The commander retains his pintle-mounted machinegun and the left rear-mounted overhead machinegun is also retained. The commander still has no magnified day vision or night vision devices of his own, but has the ability to access the gunner's sights as well as having auxiliary controls for the autocannon and coaxial machinegun. Armor overall is beefed up, with extra attention being paid to the floor of the vehicle for mine protection. Other additions include an air conditioner.

Twilight 2000 Notes: The Bionix 25 and Bionix 40/50 were put through an accelerated development program before the Twilight War; however, only 10 of each were actually available for the start of hostilities. Though it was not substantiated, some export sales

may have been made to South Africa. The Thais were known to have about 8 Bionix 40/50s on hand for the war, and the Cambodians were believed to have four. Some reports state that the Indonesians bought five Bionix 25s, and used them against the Australians.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Bionix 25	\$165,502	D, A	1 ton	23 tons	3+7	16	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Bionix 40/50	\$172,987	D, A	1 ton	21.5 tons	2+9	14	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Bionix II	\$378,725	D, A	1 ton	24.8 tons	3+7	18	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor					
Bionix 25	134/94	33/20	527	236	Trtd	T3	TF13Sp	TS7Sp	TR7	HF16Sp	HS7Sp	HR4*
Bionix 40/50	143/101	35/21	527	221	Trtd	T3	TF13Sp	TS7Sp	TR7	HF16Sp	HS7Sp	HR4*
Bionix II	125/87	31/19	527	255	Trtd	T3	TF14Sp	TS8Sp	TR8	HF17Sp	HS8Sp	HR5*

Vehicle	Fire Control	Stabilization	Armament		Ammunition
Bionix 25	+2	Fair	25mm ATK M-242 ChainGun, MAG, MAG (C), MAG (R)		630x25mm, 2800x7.62mm
Bionix 40/50	+2	Fair	CIS 40AGL, CIS 50, MAG (R)		350x40mm Grenades, 850x.50, 1500x7.62mm
Bionix II	+3	Good	30mm ATK Mk 44 ChainGun, MAG, MAG (C), MAG (R)		525x30mm, 2800x7.62mm

*Belly armor for the Bionix 25 and Bionix 40/50 is 3.

**Belly armor for the Bionix II is 5.

M-113A3 Ultra

Notes: STK of Singapore offers a number of upgrade possibilities and modifications for the M-113 series of APCs, including modifications to turn the M-113 into a variety of specialist vehicles and to turn the M-113 into a variety of ICVs and IFVs. The M-113 Ultra is the part of the M-113 upgrade program that deals with the IFV-type modifications to the M-113. The M-113 Ultra program began as a program specifically to upgrade Singapore's M-113 fleet, but was soon offered on the international arms market. Singapore employs a large number of M-113 Ultra-upgraded vehicles, as acquisition of the Bionix has not gone as fast as desired by the Singaporean Army. I have called the various possible upgrades below as Ultra 1-5, though these are **not official designations**.

The Ultra modification starts with the upgrade of the basic M-113 chassis to the M-113A3 standard, including the replacement of the engine with a license-produced version of the Detroit Diesel 6V53T 275-horsepower supercharged diesel engine. The suspension is also greatly-improved, primarily to cope with the additional weight of the Ultra upgrades. The chassis is topped with a turret, with three possible turrets being applied. The primary version used by Singapore uses a turret that is essentially a heavily-armored cupola with overhead protection, and armed with an automatic grenade launcher and .50-caliber machinegun. A second variant uses an OHWS turret designed by Rafael of Israel, armed with a 25mm autocannon and coaxial machinegun, and with the weapons sights and external sensors being downlinked to the gunner's station inside the hull. This turret has a small hatch in the roof. The third turret, not used by Singapore but offered for export, uses the Rafael OHWS, but with the addition of a single launcher for a TOW II ATGM. The launcher is reloaded from the large hatch which, like most M-113-based vehicles, is present on the rear deck. Due to the space taken up by the turret and ammunition storage, the troop complement is reduced substantially. The electrical system of the M-113 chassis is beefed up to cope with the demands of the turret. In each case, there are three smoke grenade launchers on each side of the turret. The M-113 Ultra series is not designed to be amphibious, though STK states that such a capability could be added in a similar manner to the kits proposed for the Bionix.

The hull layout remains essentially the same as the M-113, except for the presence of the turret, and the resulting absence of the commander's station. There is a large hatch on the rear deck, and primary access to the interior of the vehicle is through a powered

ramp in the rear face which also has a door in it. The driver remains in his position in the right front of the hull. Firing ports have been added, with four being on each side of the troop compartment and one in the rear door. An interesting crew-comfort feature has been added: a special seatbelt can be snapped on, which pumps chilled water through the seatbelt to help cool off the soldier. This, combined with the addition of air conditioning, makes the M-113 Ultra potentially an unusually comfortable vehicle for the soldier. A collective NBC system has been installed. The vehicle's armor has been increased through the use of appliqué armor – but unlike most appliqué armor, which comes in the form of steel or aluminum plates, the Ultra upgrade uses advanced ceramics sandwiched in a spaced fashion inside thin steel walls. This makes the appliqué armor lighter than most appliqué armor upgrades, but just as effective. This approach was taken because the Ultra modifications already make the resulting vehicle heavy, and standard appliqué armor would have made the Ultra unacceptably heavy. As the Ultra appliqué armor modifications were also designed with urban warfare in mind, the hull floor and deck have also received such armor upgrades.

STK also offers the ceramic appliqué armor package by itself on the international arms market for use as a general M-113 armor upgrade.

Singapore is contemplating a further upgrade to the Ultra in the near future, replacing the engine with a Caterpillar 3126B turbocharged diesel that develops 330 horsepower, or a variant of the 3126B engine that develops 350 horsepower. STK also is also offering an upgrade for the OHWS turret with a 30mm autocannon.

Twilight 2000 Notes: The Ultra-upgraded M-113 was more common than the Bionix in the Twilight 2000 timeline, though not with the 330 or 350-horsepower engines or the 30mm autocannon.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Ultra 1 (275hp Engine)	\$132,981	D, A	800 kg	16 tons	2+9	8	Passive IR (D, G), Image Intensification (G)	Shielded
Ultra 1 (330hp Engine)	\$133,187	D, A	800 kg	16 tons	2+9	8	Passive IR (D, G), Image Intensification (G)	Shielded
Ultra 1 (350hp Engine)	\$133,262	D, A	800 kg	16 tons	2+9	8	Passive IR (D, G), Image Intensification (G)	Shielded
Ultra 2 (275hp Engine)	\$161,416	D, A	800 kg	15.7 tons	2+9	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 2 (330hp Engine)	\$161,622	D, A	800 kg	15.7 tons	2+9	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 2 (350hp Engine)	\$161,697	D, A	800 kg	15.7 tons	2+9	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 3 (275hp Engine)	\$182,416	D, A	800 kg	16.1 tons	2+9	9	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 3 (330hp Engine)	\$182,622	D, A	800 kg	16.1 tons	2+9	9	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 3 (350hp Engine)	\$182,697	D, A	800 kg	16.1 tons	2+9	9	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 4 (275hp Engine)	\$164,489	D, A	800 kg	15.7 tons	2+9	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 4 (330hp Engine)	\$164,695	D, A	800 kg	15.7 tons	2+9	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 4 (350hp Engine)	\$164,770	D, A	800 kg	15.7 tons	2+9	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 5 (275hp Engine)	\$185,489	D, A	800 kg	16.1 tons	2+9	9	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
Ultra 5 (330hp)	\$185,695	D, A	800 kg	16.1 tons	2+9	9	Passive IR (D, G), Image Intensification (G), Thermal Imaging	Shielded

Engine) Ultra 5 (350hp Engine)	\$185,770	D, A	800 kg	16.1 tons	2+9	9	(G) Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Ultra 1 (275hp Engine)	109/76	27/16	360	125	Trtd	T2	TF6 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 1 (330hp Engine)	129/90	32/19	360	156	Trtd	T2	TF6 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 1 (350hp Engine)	136/95	34/20	360	167	Trtd	T2	TF6 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 2/4 (275hp Engine)	111/78	28/16	360	123	CiH	T2	TF4 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 2/4 (330hp Engine)	131/92	33/19	360	153	CiH	T2	TF4 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 2/4 (350hp Engine)	139/98	35/20	360	164	CiH	T2	TF4 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 3/5 (275hp Engine)	108/75	27/16	360	127	CiH	T2	TF4 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 3/5 (330hp Engine)	127/89	32/19	360	158	CiH	T2	TF4 TS4 TR4 HF10Sp HS6Sp HR6
Ultra 3/5 (350hp Engine)	135/94	34/20	360	169	CiH	T2	TF4 TS4 TR4 HF10Sp HS6Sp HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Ultra 1	+2	Fair	CIS 40AGL, CIS 50	350x40mm Grenades, 850x.50
Ultra 2	+3	Fair	25mm ATK M-242 ChainGun, MAG	630x25mm, 1500x7.62mm
Ultra 3	+3	Fair	25mm ATK M-242 ChainGun, MAG, TOW II ATGM Launcher	600x25mm, 1500x7.62mm, 4xTOW II ATGMs
Ultra 4	+3	Fair	30mm ATK Mk 44 ChainGun, MAG	525x30mm, 1500x7.62mm
Ultra 5	+3	Fair	30mm ATK Mk 44 ChainGun, MAG, TOW II ATGM Launcher	525x30mm, 1500x7.62mm, 4xTOW II ATGMs

*Hull floor armor for the M-113 Ultra series is 5; hull deck armor is 4.

Daewoo (Doosan) Korean Infantry Fighting Vehicle (KIFV)

Notes: The ROK Army first issued a request for a new IFV in 1981; the initial design work was done directly by the South Korean Agency for Defense Development, but then the final design work and actual production order was passed on to Daewoo Heavy Industries' Land Systems division. (Most people in the US have heard of Daewoo as a maker of inexpensive automobiles, but in South Korea, they make just about *anything* you can think of, from Walkman-type music players and civilian cars and trucks to assault rifles and most of South Korea's domestically-produced military vehicles.) The first member of the KIFV family, the K-200 APC, entered service in 1985; a command post version, the K-277, followed closely behind along with an armored ambulance version, and soon thereafter several other non-APC-type vehicles based on the same chassis went into production, including a pair of mortar carriers, three anti-aircraft vehicles, and an ARV. In addition, four IFV-type vehicles were produced in prototype form; these were extensively field-tested, but ultimately did not enter production. These IFV designs were also briefly offered for sale on the international market, but no one showed any interest and the two designs were completely withdrawn from production and the Daewoo catalog. (I actually got to see the KAFV 30 during Team Spirit 1988; it surprised me at first, because the KAFV 30 can be mistaken at first glance for a Bradley from some angles, including the one I first saw it from, and I knew there were no Bradleys in South Korea at the time.) Other turret possibilities were presented to both the ROK Army and the international market by Daewoo, but these designs also did not enter production. The latest version is the K-216A1 NBC reconnaissance version – currently the only tracked NBC reconnaissance vehicle being employed in the world. The KIFV draws upon Daewoo's experience with maintenance and refurbishing work done on ROK M-113s, as well as assistance from countries using the AIFV – the KIFV's basic similarity to the AIFV is obvious.

In addition to its use by the ROK Army, the KIFV is also used by the Malaysian Army. Malaysia received their first batch of KIFVs in 1993, and almost all of that first batch were immediately put into action in Kosovo, used by the Malaysian contingent of KFOR (one of the few non-NATO countries to take part in KFOR). The Malaysians received 42 KIFVs of various types in that first batch; they bought 22 more in a second batch in 1994, and 47 more in a third batch in 1995. South Korea herself uses about 1890 KIFV variants, most of which had been brought up to A1 standard by 1996.

In 2005, Daewoo was acquired by the Doosan Group, a large, multinational, South Korean-based conglomerate that includes among its many departments defense industries in several countries. Doosan Infracore therefore became the prime contractor for KIFV maintenance, upgrades, and any possible future modifications.

The K-200 APC

The base vehicle of the KIFV range is the K-200. In the case of the K-200, "KIFV" is a misnomer, as the K-200 is *not* an IFV – it is an APC, armed only with a heavy machinegun on a pintle mount at the gunner's cupola. The gunner's cupola is surrounded with heavy (AV2) gun shields, but the cupola is manually traversed and is open-topped. The shields, however, are high and the front of the shield has a slit for the machinegun that is wide enough to allow the gunner to give a reasonable, if limited, field of view if he crouches completely below the level of the gun shields or lowers his seat below that level. The gunner's hatch, inside the gun shields, opens to the rear and locks open vertically; when locked open, the gunner effectively has an additional AV2 to his rear. To the right and rear of the gunner's cupola is a hatchway for the commander, who has all-around vision blocks but no vehicular armament. The driver is seated directly in front of the commander, and has a conventional steering yoke with a brake and gas pedal. The driver has three vision blocks to his front and one to the right; the center front vision block be removed and replaced by a night vision block. A bank of six smoke grenade launchers is found on the center front hull, just below above the trim vane when it is in its stowed position. Armor is decent (better than its AIFV counterparts), and better than the M-113s that the ROK Army was using or the AIFV from which the hull was derived. The K-200's armor is essentially the same as that of the AIFV, but updated and a bit more advanced in design. There is a shallow track skirt of sorts, but this is of thin metal and is there to enhance floatation instead of being used to protect the suspension. The K-200 uses a Daewoo D-2848 280-horsepower turbocharged engine (derived from a MAN design); initially, this engine was designed to run only on diesel fuel, but later, the capability to use JP-8 jet fuel was added. (This was done for purposes of interoperability; in the mid-1990s, the US Army began converting its vehicles and virtually all of its fuel-powered equipment to burn JP-8 in order to simplify logistics.) The engine is coupled in an integrated power pack to the Daewoo T-300 automatic transmission, an improved derivative of the Alvis TN-15 transmission. The powerpack is separated from the crew and troop compartments by a thick firewall; both the engine/transmission compartment and the crew/troop compartment have an automatic fire detection and suppression system. The high horsepower-to-weight ratio gives the K-200 outstanding speed and agility. The K-200 is amphibious with little preparation, requiring that the large trim vane be extended to the front and bilge pumps turned on, and requiring 4 minutes to prepare. Propulsion in the water is, like most amphibious tracked vehicles, by track motion. The K-200 has two firing ports in each side of the hull, one in the rear door (on the left side of the ramp), and another in the ramp to the right of the door; these firing ports can take the M-231, CAR-15, MP-5, M-16 series, M-4 series, K-2, K-1A1, M-249 SAW, or K-3 SAW. The rear door is part of a powered ramp, and the troop compartment also has a large hatch on the rear deck, opening to the rear. The troops are seated four on each side of the troop compartment, with a ninth soldier (normally the squad leader) being in a seat at the front of the compartment facing the rear.

In 1994, South Korea began to upgrade their K-200s to the K-200A1 standard. The primary difference involved in this upgrade is the replacement of the engine by the more powerful D-2848T 350-horsepower engine, which is, as the previous engine, a turbocharged engine able to burn diesel or JP-8 jet fuel. As with the previous engine, the D-2848T is a design licensed from MAN for production by Daewoo. Along with the engine, the transmission was replaced with the more efficient Allison X200-5K automatic transmission, which was produced by Daewoo (and later Doosan) under license. Other modifications include the addition of a medium machinegun to the cupola armament, a slight increase in armor protection (including belly protection), a beefed up suspension that

gives a smoother ride over rough terrain, and increased drive train and suspension tolerance to temperature extremes. The powerpack is even more tightly integrated, with powerpack changes requiring reduced time, even in field conditions; in addition, the powerpack and suspension are improved in reliability. In 2000, Malaysia began to apply the A1 upgrades to their KIFV fleet; however, only 57 members of their total KIFV fleet were upgraded to the A1 standard.

For service in Kosovo, some Malaysian K-200s had their M-2HB's removed and replaced by Mk 19 automatic grenade launchers. An estimated one-quarter of their total deployed force (about 10 vehicles) were so modified. These vehicles had their Mk 19s replaced by M-2HBs again after their return from Kosovo.

The K-277 and K-277 Ambulance

Both of these are based on a common chassis, which is a modified K-200 chassis with the roofline raised a little over a meter over most of the vehicle, except for the driver's compartment, and engine compartment. At the front of the raised section is a projection housing a 5kW generator to run the vehicle's equipment when the engine is switched off. All in all, this makes the K-277 look very close to the M-577 version of the M-113 series. The sides and rear of the K-277 do not have firing ports, and the side armor is not made of the same spaced laminate as the K-200, being simple slab sides. The K-277 retains the front-mounted smoke grenade launchers. As with the M-577, the K-277 carries four short/medium-range radios (usually SINCGARS radios with attached encryption modules to further increase COMSEC), one medium-range AM radio, and one long-range AM radio (also with encryption modules). Unlike the M-577, the generator on the K-277 is not designed to be removed from the vehicle and ground-mounted. The K-277 has mounts for four whip antennas and a davit for use with a long-range mast antenna. A tent can be extended from the rear to increase the working area. A ruggedized laptop computer is carried, and the medium-range AM radio and one of the short/medium-range radios are data-capable. As with the M-577, the K-277 has internal racks for weapons at the rear on the roofline above the ramp; however, the K-277's commander's hatch *does* have a pintle-mounted weapon (but no gun shields). Other equipment normally carried includes an optical chemical sniffer, a Geiger counter, a map board, various supplies for the plotting of troop positions, and various office-type supplies. In 1994, South Korean K-277s were also upgraded to the A1 standard, but this did not involve an increase in armament, and these upgrades were done to Malaysian K-277s starting in 2000.

The K-277 chassis is also used as a basis for an armored ambulance. It can carry four stretcher-borne patients or two stretcher-borne patients and three seated patients. The crew is increased by one member, a medic; the commander and driver are also normally medics. The ambulance version carries the equivalent of 20 personal medical kits and two doctor's medical bags, two sets of oxygen-administration kits, a portable defibrillator, a small refrigerator for the storage of perishable medical supplies, and two complete sets of splints. It was also upgraded to the A1 standard starting in 1994. The ambulance version of the K-277 is not armed, and no provision for the mounting of a pintle is made. The ambulance version retains the K-277's 5kW generator.

The K-216A1 NBC Reconnaissance Vehicle

Based on the K-200 chassis, the K-216A1 entered service after the 1994 A1 upgrades, and a "plain" K-216 version does not exist. Externally, the most obvious difference is the lack of gun shields around the gunner's position. However, the K-216A1 is internally far different than the K-200, carrying a smaller crew of technicians trained to operate the NBC detection and analysis equipment. This includes small airlocks to take in external air samples, an optical chemical sniffer, a Geiger counter and dosimeter, and equipment to analyze the exact nature of chemical contamination. The K-216A1's radiological equipment can determine not only the radiation levels of a contaminated area, but also the exact nature of the radiation (alpha particles, beta particles, neutrons, and residual emission of gamma rays). In addition to the small airlocks, samples can be scooped from the ground and manipulator arms can sample vegetation and dead animals. The K-216A1 is also equipped with a mass spectrometer and weather observation equipment.

The Unused Variants

The KAFV versions of the KIFV are also somewhat of a misnomer, as they *are* in fact IFVs. They unfortunately never entered production except in prototype form; they also never had a chance to receive the A1 upgrades. The larger turrets take up more space that is normally used to carry troops, but those turrets also carry heavier weapons and give the KAFV better night vision capability. The KAFV 40/50 is armed with an automatic grenade launcher and heavy machinegun, which are stabilized in the vertical axis and equipped with a fire control computer. The KAFV 30A is armed with a 30mm M-230 ChainGun and a coaxial machinegun; in addition, the gun is stabilized in two planes and equipped with a laser rangefinder. The KAFV 30M is identical, except that the autocannon used is the Mauser Mk 30. The KAFV 25 is also identical, but the autocannon used is a 25mm M-242 ChainGun. Other details of the hull design are identical, except that the commander's hatch is deleted and the commander is relocated to the turret. The commander has auxiliary controls for the main armament in all KAFV versions and has access to the gunner's sights.

Twilight 2000 Notes: The A1 upgrades did not take place in the Twilight 2000 timeline, and the K-261A1 never left the drawing board. The KAFV 40/50 was in limited numbers, though the KAFV 30M was not produced. Though in the Twilight 2000 timeline South Korea originally started production of the KAFV 30A and intended to build them in favor of the KAFV 25, production quickly switched to the KAFV 25 to allow ammunition interchangeability with American M-2 and M-3 Bradleys to improve the logistical situation.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
K-200	\$42,037	D, AvG, A	1.4 tons	12.9 tons	3+9	8	Passive IR (D)	Shielded
K-200 (w/Mk 19)	\$64,824	D, AvG, A	1.4 tons	13 tons	3+9	8	Passive IR (D)	Shielded

K-200A1	\$40,798	D, AvG, A	1.4 tons	13.2 tons	3+9	8	Passive IR (D)	Shielded
K-277	\$99,210	D, AvG, A	900 kg	15.4 tons	2+6	9	Passive IR (D)	Shielded
K-277A1	\$113,950	D, AvG, A	900 kg	15.7 tons	2+6	9	Passive IR (D)	Shielded
K-277	\$48,343	D, AvG, A	700 kg	13.4 tons	***	9	Passive IR (D)	Shielded
Ambulance K-277A1	\$46,918	D, AvG, A	700 kg	13.7 tons	***	9	Passive IR (D)	Shielded
Ambulance K-216A1	\$144,000	D, AvG, A	500 kg	13.8 tons	4	11	Passive IR (D)	Shielded
KAFV 40/50	\$153,902	D, AvG, A	1.1 tons	13.9 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
KAFV 30A	\$225,946	D, AvG, A	1 ton	14 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded
KAFV 30M	\$228,206	D, AvG, A	1 ton	14.1 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded
KAFV 25	\$322,906	D, AvG, A	1 ton	14 tons	3+7	8	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
K-200	157/110	39/23/4	400	147	Trtd	T3	TF2 TS2 TR2 HF11Sp HS7Sp HR4*
K-200 (w/Mk 19)	156/110	39/23/4	400	148	Trtd	T3	TF2 TS2 TR2 HF11Sp HS7Sp HR4*
K-200A1	185/129	46/27/5	400	186	Trtd	T3	TF2 TS2 TR2 HF12Sp HS8Sp HR4**
K-277	132/92	33/19/3	400	175	Stnd	T3	HF11Sp HS7 HR4*
K-277A1	155/108	39/23/4	400	221	Stnd	T3	HF12Sp HS8 HR4**
K-277	151/106	37/22/4	400	153	Stnd	T3	HF11Sp HS7 HR4*
Ambulance K-277A1	178/124	44/26/4	400	193	Stnd	T3	HF12Sp HS8 HR4**
Ambulance K-216A1	176/123	44/26/4	400	195	Stnd	T3	HF12Sp HS8Sp HR4**
KAFV 40/50	146/102	36/21/4	400	159	Trtd	T3	TF5Sp TS5Sp TR4 HF11Sp HS7Sp HR4*
KAFV 30A/KAFV 30M/KAFV 25	144/101	36/21/4	400	160	Trtd	T3	TF9Sp TS8Sp TR6 HS11Sp HS7Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
K-200/K- 216A1	None	None	M-2HB	2000x.50
K-200 (w/Mk 19)	None	None	Mk 19 Grenade Launcher	635x40mm Grenades
K-200A1	None	None	M-2HB, M-60D	1000x.50, 1600x7.62mm
K-277/K- 277A1	None	None	M-2HB	1000x.50
KAFV 40/50	+2	Fair	40mm Mk 19 Grenade Launcher, M- 2HB	300x40mm Grenades, 1500x.50
KAFV 30A	+2	Good	30mm M-230 ChainGun, M-60D	330x30mm, 3300x7.62mm
KAFV 30M	+2	Good	30mm Mauser Mk 30, M-60D	330x30mm, 3300x7.62mm
KAFV 25	+3	Good	25mm M-242 ChainGun, M-60D	400x25mm, 3300x7.62mm

*Belly and deck armor for these vehicles is 3.

**Belly armor for these vehicles is 5; deck armor is 3.

***See above for crew and passenger capacity.

Doosan K-21

Notes: The K-21 (though it was type-standardized in 2008, it is still referred to by some sources as the XK-21 or the KNIFV, or

Korean Next Infantry Fighting Vehicle; early in development, a final type-designation of K-300 was also considered) was designed to replace the K-200A1 in South Korean service. No plans have appeared as yet for export sales, and though the K-21 has been referred to by Doosan as a series, no variants of the K-21 other than the PIP have as yet been announced. Low-rate initial production began in 2008 to allow for extended field trials, and first issue to ROK Army units began in 2009 in small numbers. Full production and issue is set for late 2010. The K-21 is designed to use the most advanced vehicle construction and design methods, and is innovative in many ways, particularly in the design of its hull. The vehicle's armor suite was designed specifically with the Russian 2A42 autocannon in mind (or other weapons in its class) -- this is a weapon that is coming into increasing use in North Korea, and as 30mm-class weapons are also common throughout the world, this is something that will be important should the K-21 receive export sales. The main armament is also capable of punching through the armor of most APCs and IFVs, as well as some tanks from the rear or even the side in some cases. The K-21's design and parts are 85% Doosan design, and much of the rest is license-produced in South Korea. The ROK Army plans to field 466 K-21s, and Doosan expects that the K-21 will attract considerable interest from other countries.

The K-21

The heavy armor resulting from the design philosophy presented Doosan with a problem -- it would normally require the K-21 to be a heavy vehicle in general. With normal IFV construction, this meant that the chassis and hull would also necessarily be heavy, and as a result, the engine would have to be powerful and heavy. The suspension would have to be beefy to carry all this weight. Doosan got around this problem with an innovative solution -- they built the chassis and much of the basic, inner hull of the K-21 out of advanced, high-strength, fiberglass composites. This greatly reduces the weight of the K-21, allowing the vehicle to carry the heavy armor and heavy weapons it is armed with while making still making the K-21 a relatively light vehicle -- though armor is in the class of the German Marder 1A3, and better than the US M-2A3, the K-21's combat weight is only 25 tons. Nonetheless, Doosan chose to put an engine in the K-21 with power on par with many last-generation main battle tanks, and this makes the K-21 a very quick and agile vehicle despite its size. The high power-to-weight ratio also means that the K-21 is able to carry a high payload (though, as with most IFVs these days, interior room is still at a premium, the size of the infantry squad inside is larger than most IFV). The exterior of the K-21 has numerous tie-down points to carry equipment, to take advantage of this.

Turret armament consists of a 40mm dual-feed autocannon that, while of Doosan build, is essentially a license-produced version of the Swedish L/70 gun. This firepower is supplemented by a coaxial machinegun and a twin ATGM launcher. The ATGM launcher is contained in a box mounted on the right side of the turret and deploys similar to TOW launcher on a Bradley -- but the ATGMs are Doosan versions of the Israeli Spike ATGM. The turret armament is coupled to an advanced fire control suite on par with that found on many modern main battle tanks, and the main armament (though not the ATGM launcher) is fully stabilized in both axis. The ATGM system can be used against ground targets and against slow, low-flying aircraft. The launchers are reloaded via the hatch above the troop compartment on the rear deck. Night vision is comprehensive, including long-range thermal imaging and a hunter/killer capability for the commander and gunner. The sights are essentially interchangeable; the commander and gunner can make full use of each other sighting and night vision systems, giving both of them a backup in case of damage to either sets of sights and night vision equipment. The sights are designed not only for the engagement of ground targets, but also low-flying helicopters. The fire control suite also includes an advanced ballistic computer and laser rangefinder, and is designed by the Korean division of Britain's Thales. The turret has a cluster of four smoke grenade launchers on the forward part of each side of the turret.

Another refinement present in the K-21 is a Battlefield Management System. As with most such systems, the K-21's BMS consists of a computer, data-capable radio, and LCD displays that give the commander a comprehensive view of the battlefield situation, including the location of friendly and known enemy positions, logistics points, and other vital dispositions of the battlefield situation. The commander can also access information about the exact condition of his vehicle, from fuel available to ammunition state to battle damage sustained. The BMS is essentially constantly sending and receiving reports from and to other friendly units equipped with the same system, and the commander can also use the system to update information for other friendly units and to navigate around the battlefield. To this end, the K-21 is equipped with a GPS system and also has an IFF transmitter/receiver. The system also has an external CCD camera tied to it, and is able to transmit video to other BMS-equipped units.

The driver is located on the right front of the vehicle. He has five vision blocks to his front and right side; the center front block can be removed and replaced with a night vision block. He has a conventional steering yoke with a brake and gas pedal. The K-21's engine is a Doosan D-2840LXE 740-horsepower turbocharged diesel engine which is also able to burn JP-8 jet fuel; this is coupled to a fully-automatic and computer-assisted transmission. The suspension is a variant of the semi-active ISU (In-arm Suspension Unit) suspension found on the K-2 main battle tank, though the K-21's suspension is not variable in height like that of the K-2. The K-21 is amphibious, but it takes a novel sort of preparation -- a trim vane is extended and bilge pumps turned on, like most such vehicles, but a rubber pontoon system is also deployed. These pontoons, one on each side, are located under the track skirts and inflated using air compressors. When inflated, each pontoon is over two feet wide, and the K-21 is then propelled in the water by its tracks. After swimming, the pontoons have the air sucked out of them by the same air compressors, operating in reverse, and then stow automatically under the track skirts again. Therefore, despite the amount of preparation, the K-21 requires only 7 minutes to prepare for swimming operations.

The rear troop compartment is accessed from the rear through a large powered ramp which also has a door in it. There is also a large hatch on the rear deck which opens to the rear. The K-21 does not use firing ports, though the troops do have vision blocks on the roof of the troop compartment. The crew and troops have an NBC overpressure system with a collective NBC backup, and are also protected by automatic fire detection and suppression systems in the crew compartments, troop compartment, and engine

compartment. The fuel tanks are armored and self-sealing. The armor of the K-21 is still a closely-guarded secret, but the fiberglass composite chassis and hull are believed to be encased in high-strength aluminum alloy, and the armor itself is believed to be a layered system of aluminum alloy plates, glass fiber layers, and ceramics. The armor is layered not only over most of the external arcs of the K-21, but also on the hull floor and the deck of the turret and hull. The fiberglass composite of the hull and chassis actually works as a plus, as it is not only less likely to burn upon a hit, it also functions as an anti-spalling liner. The armor is good at stopping incoming rounds from most angles, it is especially effective against explosions from artillery shells – a 152mm round can explode within 10 meters of the K-21 and not only the fragments will be stopped, but the concussion will not harm the crew or troops inside (though it will ring their bells quite a bit). The armor is modular, and can be repaired or panels can be replaced in the field; it also means that possible future armor upgrades can be easily performed. Lugs for ERA are found on the glacis, hull sides, turret sides, and turret front; the K-2's NERA technology will also be available to the K-21. The K-21 also has a soft-kill-type active defense system, which has detectors for targeting lasers and jammers for ATGM guidance systems (on a roll of 12+ on a d20, the difficulty to the ATGM gunner's difficulty is increased by one level; outstanding success indicates that the incoming missile pre-detonates before it can hit the K-21). A rotating IRCM emitter atop the turret on a low post emit pulsed IR beams to decoy IR-guided munitions; their effectiveness is the same as listed for the electro-optical jammer above, and both have a 360-degree range of protection, as well as 180-degrees upwards. The detectors also can automatically fire the smoke grenade launchers, which may use conventional smoke, WP smoke, or IR-obscuring smoke (the most common type of grenade expected to be used in the K-21's launchers).

The K-21 PIP

Doosan is not resting on its laurels with the K-21 – they are already working on an upgrade package, currently called the K-21 PIP (Product-Improvement Program), which might be fielded as early as 2012. Though small improvements will be carried out in several areas of the K-21, the primary upgrades involve the replacement of the engine with an improved version of the D-2840LXE which has an output of 840 horsepower, an improved ballistic computer, and the addition of a hard-kill APS system. This system, the AWiSS, is a version of the same as used on the K-2 PIP. The system developed by the South Koreans launches special rounds in the path of the missile that quickly break up into a cloud of tungsten pellets, destroying the missile before it can hit the tank. 16 of these rounds are available, and they are 75% likely to destroy the incoming missile about 10 meters from the K-21. This system protects the K-21 against attacks from any angle. Unlike currently-employed hard-kill active defenses, the South Korean system has a small chance of protecting the K-21 against large-caliber rounds (small rounds like autocannon rounds, Skeet-type EFPs, or cluster bomb submunitions are too small to be reliably detected). The chance that the system will be able to counter such a round is only 5%. The hard-kill system uses millimeter radar and an upgrade to the K-21's BMS computer; the hard-kill rounds are employed in a ring around the turret, with the radar on a short pole on the roof of the turret. The AWiSS system is incorporated into a layered defense with the soft-kill system mentioned for the standard K-21 above.

Twilight 2000 Notes: The K-21 is not available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
K-21	\$460,050	D, AvG, A	2 tons	25 tons	3+9	20	Passive IR (D, G, C), Image Intensification (G, C), 2 nd -Generation Thermal Imaging (G, C)	Shielded
K-21 PIP	\$509,454	D, AvG, A	2 tons	26 tons	3+9	21	Passive IR (D, G, C), Image Intensification (G, C), 2 nd -Generation Thermal Imaging (G, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
K-21	157/110	39/23/6	600	314	Trtd	T3	TF14Cp TS11Sp TR7 HF18Cp HS9Sp HR6
K-21 PIP	171/120	42/25/6	600	364	Trtd	T3	TF14Cp TS11Sp TR7 HF18Cp HS9Sp HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
K-21	+4	Good	40mm Bofors (Doosan) L/70 Autocannon, MAG, 2xSpike ATGM Launchers	200x40mm, 3000x7.62mm, 4xSpike ATGM
K-21 PIP	+5	Good	40mm Bofors (Doosan) L/70 Autocannon, MAG, 2xSpike ATGM Launchers	200x40mm, 3000x7.62mm, 4xSpike ATGM

*Hull deck armor for the K-21 is 4Sp; hull floor armor is 6Sp.

Hagglunds Bv-206S

Notes: The Bv-206S is an armored version of the Bv-206 tracked rough terrain/over-the-snow vehicle. Like the Bv-206, the Bv-206S is designed for all types of difficult terrain, ranging from Arctic ice to snow to jungle swamps. Though its heavier weight makes it slightly less suitable for these types of rough terrain, it is a compromise between protection and mobility, and its light weight and wide tracks still allows it to negotiate most terrain that a tracked vehicle cannot negotiate. Since its introduction, the Bv-206S, the Bv-206S has been ordered by France, Germany, Spain, Italy, Britain (mostly by the Royal Marines), Netherlands, Norway, Canada, Sweden, Spain, and the US (who designated it the M-973A2 SUSV), and some civilian relief organizations and news agencies operating in difficult terrain and potentially hostile fire. Several other countries are evaluating the Bv-206S. Some other users include Chile, China, Pakistan, and Singapore, all of whom use only small numbers of the Bv-206S. Some 480 have been built so far. Several specialist versions exist, including logistics vehicles, armored ambulances, command vehicles, mortar carriers, ATGM vehicles, AAA vehicles, FDC vehicles, and even an ARV. Only the APC-type variants will be covered in this entry. Several countries have deployed the Bv-206S to Afghanistan, usually with appliqué armor fitted; they have excellent agility on Afghanistan's rough, mountainous terrain, but have proven to be very vulnerable to mines, IEDs, and RPGs; even heavy machineguns like the DShK and NSV can make Swiss cheese out a Bv-206S.

In 1997, Hagglunds was acquired by the British company of Alvis, which was subsequently renamed Vickers Defence, and in 2005, bought by BAE. Currently, the Bv-206S is therefore built by a British consortium, though the actual vehicles are still built in Sweden by the Land Systems Hagglunds division of BAE. The Bv-206S is also license-produced in Germany by Rheinmetall.

The Bv-206S APC

The Bv-206S takes the form of articulated front and rear sections, with the front section carrying the engine, driver, commander, and three troops, and the rear section being the primary area for the carrying of troops and cargo, but there is no direct troop access between the front and rear sections. Of the Bv-206's cargo capacity, one-third is carried in the front section and two-thirds in the rear section. The Bv-206's front section is rather roomy, but the rear section is generally as cramped as most APCs. The rear section can have windows in the sides or rear, or they can be omitted; most countries appear to have omitted these windows, though large hatches are provided on the roof of the rear section and there are two doors on the rear face, as well as hatches on the deck of the rear section for the troops to stand and fight. Smaller armored glass vision blocks are also an option for the Bv-206S. The standard commander's station has an overhead hatch with a simple pintle-mounted weapon. Behind the seats for the driver and commander is a bench seat for three passengers. The other nine troops are carried in the rear section. The armored hull is constructed of all-welded steel, except for the large windows up front and to the sides of the driver and commander, which use bullet and blast-resistant glass that provides protection equal to the Bv-206S's armor. Armor is necessarily light to keep the weight of the vehicle down, though an appliqué armor kit is available that increases armor to all faces except the rear and the deck of the front and rear sections. Most versions of the Bv-206S retain the basic hull and form of the standard Bv-206S APC, differing only in internal details. The Bv-206S is equipped with an air conditioner and heater for both sections as well as an automatic fire detection and extinguishing system. Hagglunds offers a collective NBC system and an NBC overpressure system as options. (The Germans are known to have taken these options.) Another option is a cluster of three smoke grenade launchers on each side of the front of the vehicle; this seems to be an option that most countries have taken.

Some French versions use a small turret equipped with an M-2HB machinegun over the commander's station. This turret is the same as is mounted on some versions of the Panhard VBL scout car, and is a small turret which, though it has a rather small hatch in the roof, is primarily designed to be operated by the standing commander from inside the Bv-206S. This turret has a cluster of three smoke grenade launchers on each side of the turret.

The engine used by the Bv-206S is a Steyr M16 diesel engine providing 174 horsepower, coupled to a Mercedes-Benz W5A-580 automatic transmission. The engine and transmission are linked to the rear section's suspension and tracks so that both sections provide drive power via a small articulated tunnel between the two sections. The controls are conventional with a steering wheel, a gas pedal, and brake pedal. The Bv-206S can turn rather tightly, being able to accomplish a 180-degree turn in only 16 meters. The Bv-206S can negotiate steeper grades and side slopes than most tracked vehicles. The Bv-206S is also amphibious, requiring only the extension of a trim vane and the turning on of bilge pumps, requiring 4 minutes of preparation. The Bv-206S is propelled in the water by its tracks. The standard tracks are rather wide at 600mm, and wider ones can be fitted if necessary. The Bv-206S is compact and can be slung beneath helicopters, carried by large helicopters or in numbers by aircraft (you can stuff ten into a C-5 Galaxy transport), and even air-dropped.

Other Bv-206S Versions

The command version of the Bv-206S primarily carried its command station in the rear section, and the front of the vehicle typically has the passenger seats removed and the resulting open space used to carry cargo. The rear section carries several radios (generally one short-range, one medium-range with data capability, and one long-range), a ruggedized laptop computer, a map board and plotting equipment for the battle situation, and folding tables and chairs for use outside if the situation permits. Also carried are various office-type supplies, and the Bv-206S command version has a collection of drawers to store supplies and extra maps. Also carried are a hand-held thermal imager, image intensifier, and laser rangefinder. Command versions are typically NBC-sealed, having an NBC overpressure system with a collective NBC Backup.

The ambulance version can take two stretcher-borne patients and three seated patients, as well as a medic. Again, the rear section is the primary medical section, though it carries the likely equipment necessary for immediate treatment, like an oxygen

administering set, a portable defibrillator, two splint sets, and about half of the medical equipment (a total of the equivalent of 20 personal medical kits and two doctor's medical bags between the two sections). The front section generally has the passenger seats removed, and the resulting space used for personal equipment and a small refrigerator for perishable medical supplies. The ambulance version is generally unarmed.

The logistics carrier uses a rear cargo section which is squared off (the normal section has rounded corners) and has no windows in the rear section. This rear section is a little lower than used on the other variants. The floor of this rear section has rollers to facilitate the loading and off-loading of cargo, and has numerous tie-down and lock-down points. The exterior of the rear section also has numerous tie-down points for out-sized cargoes. This variant also has the rear passenger seats taken out of the front section, with the resulting space being used for personal equipment and more cargo. A flatbed version of the logistics carrier is also available, with the rear section having no top and being essentially an articulated trailer on motorized tracks; the sides are just high enough to retain the Bv-206S's amphibious capability. The flatbed version has a small crane (capacity 2 tons) to assist in the loading and off-loading of cargo. If appliqué armor is applied to this version, it applies only to the front section and the belly armor of the rear flatbed. A hit on the flatbed logistics version from the rear is 80% likely to hit the rear of the front section, with the rest of hits hitting the trailer, which has an AV of 1. The flatbed carrier, due to the nature of its rear section, is not amphibious.

Norway is modifying some of its BV-206S APCs and logistic carriers to the P6 standard, which involves the installation of anti-capsizing bars on the front section, replacement of the standard engine with a 260-horsepower Cummins 6CTA8 diesel engine (with a corresponding increase in cargo capacity), and a hydrostatic transmission. Some other upgrades are done to the drive train, electrical system, and drive train. The weight does increase somewhat, but the large increase in power more than makes up for that. The logistics carrier version is based on the closed-rear section version of the Bv-206S Logistics Carrier, and is designated the P6-300M. The modification process is proceeding slowly; prototypes first appeared in 1997, but the upgrading process is still underway at a low speed. Other versions based on the P6 upgrades are possible in the future. The P6 can use the appliqué armor designed for the Bv-206S; in addition, Norwegian Bv-206S's routinely use a bar/slat armor kit with anti-RPG mesh in conjunction with the appliqué armor kit. The combination of bar/slat armor and the mesh screens pre-detonate HE-type rounds and effectively act as spaced armor in game terms, but every hit on a face protected by bar/slat/RPG mesh combination will destroy 5% of the bar/Slat/RPG mesh. Thus, a skilled enemy gunner can exploit this damage in an attempt to hit a hole in the armor, and if hit enough, the bar/slat/RPG mesh can become useless. The P6 remains amphibious despite the increase in weight.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Bv-206S APC	\$19,579	D, A	1.7 tons	7 tons	2+10	4	Headlights	Enclosed
Bv-206S APC	\$20,690	D, A	1.3 tons	7.8 tons	2+10	4	Headlights	Enclosed
w/Appliqué Bv-206S APC	\$24,414	D, A	1.6 tons	7.2 tons	2+10	4	Headlights	Enclosed
(French Version) Bv-206S APC	\$25,711	D, A	1.2 tons	8 tons	2+10	4	Headlights	Enclosed
(French Version) w/Appliqué Bv-206S Command	\$261,876	D, A	600 kg	7.4 tons	2+5	5	Headlights	Enclosed
Bv-206S Command	\$262,985	D, A	490 kg	8.2 tons	2+5	5	Headlights	Enclosed
w/Appliqué Bv-206S Ambulance	\$22,516	D, A	850 kg	7.3 tons	*	5	Headlights	Enclosed
Bv-206S Ambulance	\$23,794	D, A	650 kg	8.1 tons	*	5	Headlights	Enclosed
w/Appliqué Bv-206 Logistics Carrier	\$16,643	D, A	2.5 tons	6.4 tons	2	4	Headlights	Enclosed
Bv-206 Logistics Carrier	\$17,754	D, A	2.1 tons	7.2 tons	2	4	Headlights	Enclosed
w/Appliqué								

Swedish Tracked APCs

Bv-206S Flatbed Logistics Carrier	\$13,510	D, A	3.8 tons	5.8 tons	2	4	Headlights	Enclosed
Bv-206S Flatbed Logistics Carrier	\$14,066	D, A	3.6 tons	6.2 tons	2	4	Headlights	Enclosed
w/Appliqué P6	\$19,702	D, A	3.2 tons	7.8 tons	2+10	4	Headlights	Enclosed
P6 w/Appliqué Armor Kit	\$23,662	D, A	2.7 tons	8.8 tons	2+10	5	Headlights	Enclosed
P6-300M	\$16,748	D, A	4.7 tons	7.1 tons	2	4	Headlights	Enclosed
P6-300M w/Appliqué Armor Kit	\$20,708	D, A	4.2 tons	8.1 tons	2	5	Headlights	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Bv-206S APC	170/119	42/25/4	360	71	Std	T2	HF3 HS2 HR2
Bv-206S APC	157/110	39/23/4	360	77	Std	T2	HF5 HS4 HR2**
w/Appliqué Bv-206S (French Version)	166/116	41/25/4	360	72	CiH	T2	TF2 TS2 TR2 HF3 HS2 HR2
Bv-206S (French Version)	154/108	38/23/3	360	79	CiH	T2	TF2 TS2 TR2 HF5 HS4 HR2**
w/Appliqué Bv-206S Command	162/114	40/24/4	360	78	Std	T2	HF3 HS2 HR2
Bv-206S Command	149/105	37/22/3	360	84	Std	T2	HF5 HS4 HR2**
w/Appliqué Bv-206S Ambulance	163/114	40/23/4	360	74	Std	T2	HF3 HS2 HR2
Bv-206S w/Appliqué	150/105	37/21/3	360	80	Std	T2	HF5 HS4 HR2**
Bv-206S Logistics Carrier	180/126	45/27/4	360	67	Std	T2	HF3 HS2 HR2
Bv-206S Logistics Carrier	166/116	41/35/4	360	73	Std	T2	HF5 HS4 HR2**
w/Appliqué Bv-206S Flatbed Logistics Carrier	204/143	50/30	360	59	Std	T2	HF3 HS2 HR2***
Bv-206S Flatbed Logistics Carrier	188/132	46/28	360	64	Std	T2	HF5 HS4 HR2****
w/Appliqué P6	215/150	53/32/5	360	107	Std	T2	HF3 HS2 HR2
P6	195/136	48/29/4	360	118	Std	T2	HF5Sp HS4Sp HR2**

w/Appliqué Armor Kit								
P6-300M	237/165	58/35/5	360	97	Std	T2	HF3 HS2 HR2	
P6-300M	215/150	53/32/5	360	107	Std	T2	HF5Sp HS4Sp HR2**	
w/Appliqué Armor Kit								

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Bv-206S APC/Command Vehicle/Logistics Carrier/P6/P6- 300M	None	None	MAG (C) or M-2HB (C) or Mk19 (C)	2000x7.62mm or 1000x.50 or 250x40mm Grenades
Bv-206S APC (French Version)	+1	Fair	M-2HB	1500x.50

*See above for crew and passenger capacity.

**Belly armor with the appliqué armor kit is 4.

***The armor value of the rear flatbed section is 1. 80% of hits on this vehicle will be on the rear of the front section; 20% will be to the rear section.

****The armor value of the rear flatbed section is 1, except for the belly section, which is 4. 80% of hits on this vehicle will be on the rear of the front section; 20% will be to the rear section.

Hagglunds BvS-10

Notes: The BvS-10 (called the Viking by the British and some other countries) is a further development of the Bv-206S. Design work started in 2001, with development and extensive field trials lasting until 2004; the first field trials took place in Oman in 2001. As Hagglunds was by then owned by BAE and the BvS-10 was designed with the Royal Marines in mind, the primary design work was done in Britain and the Royal Marines played an integral part in the design process. Actual production is done in Sweden. Britain's Royal Marines were the first to employ the BvS-10, receiving their first BvS-10s in 2005 and deploying them to Afghanistan in 2006; they did have some LRIP-built BvS-10s as early as 2003, as they were conducting the field trials for the vehicle. The British remain the largest users of the BvS-10, with about 200 on hand, though starting in 2009, the British began a slow withdrawal of the BvS-10 from service and replacement by Singapore's STK Bronco (called the Warthog by the British; the Bronco is essentially an improved variant of the BvS-10). The BvS-10 has proven to be quite vulnerable to some mines (though the BvS-10's low ground pressure makes triggering less-sensitive antitank mines less likely), IEDs, and RPGs due to the relatively thin armor and flat, thinly-armored floors. Nonetheless, Britain still operates a considerable number of BvS-10s, generally with lots of appliqué armor as well as bar/slat-type armor and even anti-RPG mesh screens. As with the Bv-209S, the BvS-10 can be loaded in large numbers in several types of aircraft, and can be airdropped.

In addition to Britain, the Dutch Marines have ordered 74 BvS-10s; most of them have already been delivered and some have been deployed to Chad as part of the EUFOR peacekeeping force there. In addition, some Dutch BvS-10s have been deployed to Afghanistan; as with the British, the Dutch have heavily increased the armor on their BvS-10s in Afghanistan. The French ordered 129 BvS-10s in December of 2009, and they are in the process of being delivered. Dutch experience in Chad and Afghanistan led to them and other users starting a replacement program for the BvS-10s drive shafts, which experienced several failures in use. Norway is a recent customer of the BvS-10.

Despite its shortcomings in the armor department, BvS-10 crews highly praise the vehicle for its exceptional agility over rough terrain and high speed. Another name for the BvS-10, again particularly in British service, is the ATV(P), which stands for All-Terrain Vehicle (Protected). The Load capability of the front section is 35% of the total load, with the rest carried in the rear.

The BvS-10 APC

The BvS-10 is similar in its basic design to the Bv-206S, but it is much larger and has generally more rounded lines that helps reduce its radar signature (though appliqué armor tends to negate this advantage). The APC version is designated the TCV (Troop-Carrying Variant). The BvS-10 is a modular design, and components of the variants of the BvS-10 can be quickly interchanged to produce the different variants. The rear sections, in particular, can be uncoupled and replaced with different specialist rear sections. The BvS-10 uses a much more powerful 250-horsepower turbocharged Cummins 5.9 diesel engine, with a greatly-improved transmission that operates much more smoothly than that of the Bv-206S. The driving controls are also improved over the Bv-206S, as is the suspension, which offers a very smooth ride over even rough terrain; the suspension improvement means that the BvS-10 can turn around in a 14-meter space. The BvS-10 is therefore able to carry more weight, which is good considering that it usually operates with considerable add-on protection. The interior of both the front and rear sections is noted for being a bit cramped; the British are actually issuing their BvS-10-borne troops the SA-80A2K carbine version of the L-85A2. The front section carries the driver, commander, and three other troops in the front section and eight troops in the rear section. The troops in the front and rear sections are connected by an intercom system. Both the front and rear sections have heaters and air conditioners. Above the commander's

station is a manually-rotating cupola with a pintle mount for a weapon; the cupola is usually surrounded by AV2 gun shields that incorporate bullet-resistant glass to the front and sides. The front section has doors on each side of the rear part of the cab as well as doors on the front part of the cab. The rear section has a large door at the rear of the section. On the front of the vehicle above the windshield on either side are clusters of three smoke grenade launchers. Even with appliqué armor and bar/slat armor kits fitted, the BvS-10 is fully amphibious, requiring only that a trim vane be extended and bilge pumps turned on (requiring 4 minutes). The tracks used on the BvS-10 are of Canadian design and are 620mm wide, giving the BvS-10 a low ground pressure; this not only gives the BvS-10 excellent off-road capability and the ability to operate effectively over snow and in swamps, but also means that the BvS-10 has a 25% chance that it will not trigger an antitank mine that requires a pressure of 200 kilograms or more to detonate. An NBC overpressure system and/or a collective NBC system is an option. The front and rear sections both have an automatic fire detection and suppression system. Of course, the weak point of the BvS-10 is its relative lack of protection. The armor is of all-welded steel and is better than on the Bv-206S, and some additional attention was paid to mine protection, but its still nothing to write home about. Thus, the BvS-10 is typically equipped with bolt-on steel appliqué armor plates as well as bar/slat armor, and often anti-RPG mesh screens. The appliqué armor kit includes heavy anti-mine plates for the floor of the vehicle. The combination of bar/slat armor and the mesh screens pre-detonate HE-type rounds and effectively act as spaced armor in game terms, but every hit on a face protected by bar/slat/RPG mesh combination will destroy 5% of the bar/slat/RPG mesh. Thus, a skilled enemy gunner can exploit this damage in an attempt to hit a hole in the armor, and if hit enough, the bar/slat/RPG mesh can become useless.

In late 2009, the BvS-10 Mk II was introduced (resulting in the original BvS-10 being renamed the BvS-10 Mk I), and is currently being employed by British Royal Marines in Afghanistan. The BvS-10 Mk II features improved base armor levels and upgraded drive train components, as well as a more powerful Cummins 5.9L 275-horsepower engine. It also has a wire cutter on a post in front of the vehicle to keep the commander from being injured by wires strung across a road, a common guerilla tactic. The BvS-10 Mk II has a camera in the rear section to help the driver when he is backing up; to a limited extent, this can also be used for general observation. It can also carry a 100-liter reserve fuel tank to extend its range. The Mk II modifications are also available to BvS-10 variants.

BvS-10 Variants

Though due to the modular nature of the BvS-10 the vehicle can be adapted to serve in a wide variety of roles, there are some distinct variants. The APC-type variants include the BvS-10 CV (Command variant), which is used not only for command purposes; with minor changes in equipment, it can be used as a digital communications platform or a communications node. The CV generally carries two short-range, two medium-range, and one long-range radio (which is data-capable), a ruggedized laptop, a map board, and various materials for the plotting of battlefield positions and conditions. The CV is equipped with a battlefield management system (BMS), which primarily enables it to receive and sent digital reports and keep track of friendly and enemy positions (vehicle management is not included in the BvS-10 CV's BMS suite). Various office-type supplies are carried, as well as a folding table and three folding chairs for use outside the vehicle if the tactical situation permits it. A hand-held thermal imager, image intensifier, laser rangefinder, and several pairs of binoculars are provided. The BvS-10 CV carries two crewmembers and six command and staff personnel, three of which normally ride in the front section and three in the rear section, though there is room for all six command and staff personnel in the rear section.

The BvS-10 MV (Medical Vehicle) is a tracked armored ambulance. Like most such vehicles, it has an oxygen administering set, a portable defibrillator, two splint sets, and about half of the medical equipment (a total of the equivalent of 20 personal medical kits and two doctor's medical bags between the two sections). The front section generally has the passenger seats removed, and the resulting space used for personal equipment and a small refrigerator for perishable medical supplies. The rear section is the primary medical section of the vehicle, and most of the medical equipment and supplies are carried in the rear section; in the front section, the rear seats are generally removed and the space used to carry personal equipment and further medical equipment. The MV version is generally unarmed. The MV can carry four stretcher patients or two stretcher patients and four seated patients, along with the crew up front and a medic in the back.

The BvS-10 LV (Logistics Vehicle) is similar in concept to the Bv-206S Logistics Vehicle, but as the BvS-10 is larger and more powerful, the BvS-10 LV can carry more cargo. As with the Bv-206S, the BvS-10's rear section's floor has rollers to facilitate the loading and off-loading of cargo, and has numerous tie-down and lock-down points. The exterior of the rear section also has numerous tie-down points for out-sized cargoes. This variant also has the rear passenger seats taken out of the front section, with the resulting space being used for personal equipment and more cargo.

In addition to APC-type variants, there are repair and recovery versions and mortar carrier variants of the BvS-10.

Twilight 2000 Notes: This vehicle was slated to replace the Bv-206 and Bv-206S in several countries' militaries as the Twilight War commenced, but deliveries had just begun at the outset of the war, and only about 300 total of these vehicles had been delivered at the war's outset, to Britain, the Netherlands, Sweden, and Norway.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BvS-10 Mk I TC	\$21,251	D, A	3.9 tons	10.6 tons	2+10	6	Headlights	Shielded
BvS-10 Mk I TC w/Appliqué	\$22,166	D, A	3.1 tons	12.1 tons	2+10	7	Headlights	Shielded

Swedish Tracked APCs

BvS-10 Mk II TC	\$21,326	D, A	5.8 tons	10.9 tons	2+10	6	Headlights	Shielded
BvS-10 Mk II TC	\$22,241	D, A	5 tons	12.4 tons	2+10	7	Headlights	Shielded
w/Appliqué BvS-10 Mk I CV	\$469,599	D, A	2 tons	11.3 tons	2+6	7	Headlights	Shielded
BvS-10 Mk I CV	\$470,614	D, A	1.6 tons	12.8 tons	2+6	9	Headlights	Shielded
w/Appliqué BvS-10 Mk II CV	\$469,674	D, A	2.9 tons	11.6 tons	2+6	7	Headlights	Shielded
BvS-10 Mk II CV	\$470,589	D, A	2.5 tons	13.1 tons	2+6	9	Headlights	Shielded
w/Appliqué BvS-10 Mk I MV	\$24,324	D, A	2 tons	11 tons	***	7	Headlights	Shielded
BvS-10 Mk I MV	\$25,491	D, A	1.6 tons	12.5 tons	***	8	Headlights	Shielded
w/Appliqué BvS-10 Mk II MV	\$24,525	D, A	2.9 tons	11.3 tons	***	7	Headlights	Shielded
BvS-10 Mk II MV	\$25,578	D, A	2.5 tons	12.8 tons	***	8	Headlights	Shielded
w/Appliqué BvS-10 Mk I LV	\$18,064	D, A	5.9 tons	8.8 tons	2	6	Headlights	Shielded
BvS-10 Mk I LV	\$18,979	D, A	5.1 tons	10.3 tons	2	7	Headlights	Shielded
w/Appliqué BvS-10 Mk II LV	\$18,139	D, A	7.8 tons	9.1 tons	2	6	Headlights	Shielded
BvS-10 Mk II LV	\$19,054	D, A	7 tons	10.6 tons	2	7	Headlights	Shielded
w/Appliqué								

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
BvS-10 Mk I TC	169/118	42/25/3	500	133	Std	T2	HF5 HS4 HR3*
BvS-10 Mk I TC	153/107	38/23/3	500	147	Std	T2	HF7Sp HS6Sp HR3**
w/Appliqué BvS-10 Mk II TC	176/123	44/26/4	500+100	145	Std	T2	HF5 HS5 HR4*
BvS-10 Mk II TC	160/112	40/24/3	500+100	160	Std	T2	HF7Sp HS7Sp HR4**
w/Appliqué BvS-10 Mk I CV	159/111	39/24/3	500	142	Std	T2	HF5 HS4 HR3*
BvS-10 Mk I CV	144/101	36/22/3	500	157	Std	T2	HF7Sp HS6Sp HR3**
w/Appliqué BvS-10 Mk II CV	165/116	41/24/3	500+100	155	Std	T2	HF5 HS5 HR4*
BvS-10 Mk II CV	150/105	38/23/3	500+100	171	Std	T2	HF7Sp HS7Sp HR4**
w/Appliqué BvS-10 Mk I MV	162/113	40/24/3	500	138	Std	T2	HF5 HS5 HR4*
BvS-10 Mk I MV	147/103	36/22/3	500	153	Std	T2	HF7Sp HS7Sp HR4**

I MV w/Appliqué	BvS-10 Mk	169/118	42/25/3	500+100	151	Std	T2	HF5 HS5 HR4*
II MV	BvS-10 Mk	154/108	38/23/3	500+100	163	Std	T2	HF7Sp HS7Sp HR4**
II MV w/Appliqué	BvS-10 Mk	203/142	50/30/4	500	111	Std	T2	HF5 HS5 HR4*
I LV	BvS-10 Mk	184/128	46/28/4	500	122	Std	T2	HF7Sp HS7Sp HR4**
I LV w/Appliqué	BvS-10 Mk	211/148	53/31/4	500+100	120	Std	T2	HF5 HS5 HR4*
II LV	BvS-10 Mk	192/134	48/29/4	500+100	133	Std	T2	HF7Sp HS7Sp HR4**
II LV w/Appliqué								

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BvS-10 TC/CV/LV	None	None	MAG (C) or M-2HB (C) or Mk19 (C)	2000x7.62mm or 1000x.50 or 250x40mm Grenades

*Hull deck armor is 3; hull floor armor is 4.

**Hull deck armor is 3; hull floor armor is 6Sp.

***See notes above for crew and passenger capacity.

Hagglunds CV-90

Notes: Development of the CV-9040 version of the CV-90, known to the Swedish as Stridsfordon 90, started in 1984 when Hagglunds was still a wholly-Swedish company, as well as by Saab, who designed the turret. The CV-9040 was designed to be a heavily-armed tracked carrier which would be fast and agile, be armed with a conventional (i.e., non-ATGM) weapon that had some minor-antitank capability and be able to handle lighter armored vehicles and low-flying aircraft, and still be to an extent airmobile. Development was long and involved, and proceeded in stops and starts due to funding difficulties at various times, periodic incorporation of new technology and concepts, and lengthy field trials. Production of the CV-9040 version for the Swedish Army began in 1993 and continued through 2002; other versions of the CV-90 series remain in production for export customers. As of June 2010, the CV-90 series is in use by Sweden, Norway, Switzerland, Finland, the Netherlands, Switzerland, and Denmark; the British are testing a modified form of the CV-9040 under its FRES-SV program to find a new scout vehicle. Canada has recently selected the CV-9030 for its Close Combat Vehicle (CCV) to operate in conjunction with its Leopard 2A4 tanks, with first deliveries starting in mid-2011. Several subtypes have been produced, using different armament, armor levels, and various bells and whistles; in addition, upgrade packages have been devised. The CV-90 has seen combat service in Afghanistan with the Swedish and Norwegians, where they have proven quite valuable, particularly since versions posted to Afghanistan have been fitted with heavy add-on armor. Sweden have also deployed the CV-9040 to Liberia as part of Sweden's contingent to the UN peacekeeping force. The Danish plan to have their CV-9035s in Afghanistan soon.

The Original Version: The CV-9040

The CV-90 hull is designed with a high level of base armor (for an IFV) made of all-welded steel, meant to offer protection for against up to 30mm rounds from the front, and an appliqué armor package was also devised from the outset. Other armor upgrade packages have been designed since then, as well as a lug system for ERA; this includes simple bolt-on steel plates, the MEXAS ceramic spaced armor package, and bar/slat/anti-RPG mesh cages. The design of the CV-90 has a low, generally rounded silhouette which reduces the radar signature, as well as dampeners for the exhaust system and engine heat in general which lower its IR signature (-2 deficit for detection by both methods). The sound signature is also relatively low; under some circumstances, the CV-90 cannot be heard by the enemy until the CV-90 is almost on top of them. The CV-90 is equipped with separate automatic fire detection and prevention systems for the turret, engine and driver's compartment, troop compartment, and fuel tanks. The crew and passengers are protected by an MBC overpressure system with a collective NBC backup system, as well as a chemical agent and radiation detector. The CV-90 is not designed to be amphibious.

The turret of the CV-9040 is armed with the proven Bofors 40mm L/70 autocannon. (Initial models were to be armed with the 25mm Bushmaster ChainGun, but this was discarded in favor of the L/70.) The L/70 mounted on the CV-90 is a modified version which has a triple-feed mechanism, and is fed by three magazines with 24 rounds in each magazine; the rest are primarily carried in the hull with the rest being in the Hull just forward of the turret. In addition to a coaxial machinegun, the CV-9040 is armed with two Lyran 71mm mortars on the rear of the turret behind the commander's station which can fire smoke or illumination rounds to an extended range, and four smoke grenade launchers on each side of the turret. A later addition was a pintle mount at the

commander's station for a SAW-type weapon or a light machinegun. Both the Lyran mortars and the smoke grenade launchers can be fired when buttoned up from the commander's station. The turret carries the commander on the right side of the turret and the gunner on the left. The sighting system on the CV-9040 incorporates a ballistic computer and laser rangefinder, and the night vision system is comprehensive.

The driver is in the front left; he has three vision blocks to the front, and can replace the middle vision block with a night vision block. The driver has a conventional steering yoke with a gas and brake pedal. The troop compartment has a large door in the rear for entry and exit, but the CV-90 has no firing ports or vision blocks for the troops, as tactical doctrine for all countries involved so far call for troops to dismount in all cases and not fight from the vehicle. There are two overhead hatches on the rear deck for standing troops, and hatches on the turret deck for the commander and gunner. The CV-9040 has heating and air conditioning systems for crew comfort, as well as an NBC overpressure system with a collective NBC backup system.

The suspension of the CV-90 is particularly noted for its smooth ride and large lack of the squeaks and creaks that tend to go along with most tracked vehicles, and this contributes greatly to its ability to move on enemy positions without being noticed until it's too late. The engine noise is also effectively dampened out by insulation and exhaust baffles that also reduces its IR signature and gives the engine good protection from burning fuel being poured into the engine compartment. The engine used is a Scania DSI-14 550 turbocharged diesel; coupled to an automatic transmission. The engine, transmission, and part of the drive train are part of an integrated power pack that can be removed from the vehicle in one piece, quickening and simplifying maintenance and allowing a complete powerpack change in as little as 15 minutes. Other parts of the vehicle are also designed for easy access. The troop compartment is designed for eight, but putting eight fully-equipped troops in the troop compartment leaves them very cramped.

Upgrades started in 2001 gave the CV-9040 a Scania DI-16 600-horsepower engine and matching transmission, general suspension and drive train improvements, and electrical system updates, as well as a fully-stabilized main gun and coaxial machinegun. A US-designed FLIR system was also fitted as well as an improved ballistic computer. A laser warning system was added to the defensive suite, and a commander's independent sight system was installed to give the CV-9040 a hunter/killer capability. After this first set of improvements, the resulting vehicle was dubbed the CV-9040B. Between 2005 and 2008, some CV-9040s were equipped with a battlefield management system, though the resulting vehicle was still called the CV-90409B. The CV-9040C version was designed for use in Afghanistan, and have these improvements as well as bolt-on spaced appliqué steel armor modules for the hull and turret, bar/slat/anti-RPG mesh and improved hull floor, hull deck, and turret deck armor as well. Thickened Kevlar anti-spalling liners have been added to the interior. Every hit on a face protected by bar/slat/RPG mesh combination will destroy 5% of the bar/slat/RPG mesh. Thus, a skilled enemy gunner can exploit this damage in an attempt to hit a hole in the armor, and if hit enough, the bar/slat/RPG mesh can become useless. (This is true in general of any type of bar/slat/anti-RPG mesh appliqué).

The CV-9030

The Norwegians were the first export customers for the CV-90; however, like every other country using the CV-90, they did not feel that a heavy autocannon like the 40mm L/70 was warranted, opting to go with an ATK 30mm M-230 Bushmaster II autocannon instead. The coaxial machinegun is an MG-3 instead of the Ksp m/39. The Lyran mortar system is not fitted to the CV-9030N. Deliveries of the resulting vehicle, the CV-9030N, began in 1995, with 104 delivered by the time production stopped in 2001. The CV-9030N is also known by the BAE/Hagglunds company designation of CV-9030 Mk I. Though the hull and its systems are built in Sweden by Hagglunds, the turret of the CV-9030N was built in Norway under license by Kvaerner Eureka (which has since closed down). The CV-9030N is typically armored for combat with the MEXAS layered ceramic armor kit as well as a bar/slat/anti-RPG mesh cage designed by the German company RUAG; appliqué armor is virtually the standard for Norwegian CV-9030Ns. Most of the other features of the CV-9040 are included, and has the same drive train, hull, turret, and general layout. The CV-9030N retains the large rear hatch; however, the CV-9030N also has a power-operated rear ramp. The CV-9030N's main armament was fully stabilized from the outset; the fire control suite is otherwise the same as that on the CV-9040, suitably modified for use with the 30mm autocannon. The CV-9030 was also equipped with the Scania DI-16 600 turbocharged diesel and its matching transmission as part of its original design. Though the CV-9030 does have room for the same eight troops as on the CV-9040, the Norwegians normally use a troop complement of only 7 in recognition that the troop compartment is very cramped. The Norwegians intend to upgrade their CV-9030Ns to the CV-9030S standard, which includes additional hull floor armor, a more compact air conditioner, and a camera for use by the driver when backing up, as well as the add-on armor kit described above.

The Swiss version of the CV-9030, the CV-9030CH (known as the CV-9030CH in its company designation, and sometimes in the Swiss Army as the Grenadier Tank 2000), is also the same in basic form as the CV-9030N, but as the Swiss Army has not deployed its CV-9030s yet, the Swiss Army has not yet added any armor its vehicles. However, they don't need to, since the standard armor for the glacis and turret front is a layered mix of hardened steel, ceramics, and Kevlar, and turret and hull sides use spaced steel/ceramic armor. The hull and turret decks and hull floor also have additional armor. The Swiss Army had planned to have 186 CV-9030CHs by 2005, but procurement has been slowed due to budgetary problems and questions by the Swiss government about the necessity of such a vehicle. The coaxial machinegun used is the M-86 version of the M-51. 186 CV-90CHs were delivered between 2002 and 2005. The CV-9030CH is armed with a version of the M-230 called the Mk 44, which, while the standard installation is a 30mm autocannon, can be modified into a 40mm weapon firing case-telescoped ammunition at a later date if desired. (There are currently no plans by the Swiss Army to do so.) The armament is fully stabilized and includes a ballistic computer and laser rangefinder. The commander does not have an independent sight, but can access the gunner's sights and he has auxiliary controls for the main armament. The engine is an updated version of the DI-16 called the DS-14 which has an output of 670 horsepower. The rear troop

compartment's roof has been raised 14 centimeters, and a powered ramp is installed at the rear, which also retains its large hatch. The CV-9040CH has screens which can display the vehicle state, the amount of ammunition, and navigation information such as compass heading and maps. This system is called the VIS (Vehicle Information System). The fire control system includes a special digital sight for antiaircraft use as well as the standard sights for ground targets, and the Hagglunds Vehicle Control System (HCVS). This system includes screens at each crew position that can display a CCD camera view of the exterior of the vehicle (with the CCD being located at the front of the turret), a built in diagnostics self-tests for the CV-9030CH's systems and the HADS (Hagglunds Defensive Aids Suite), which is essentially a soft-kill APS system. The HADS includes IR emitters that emit coded, pulsed IR beams to decoy IR-guided munitions (on a roll of 12+ on a d20, the difficulty to the ATGM gunner is increased by one level; outstanding success indicates that the incoming missile pre-detonates before it can hit the CV-9030CH). They can also temporarily blind IR sights and image intensifiers; this is successful on a roll of 8 on a d20 for IR sights and 5 for image intensifiers. An electro-optical jamming system is included to jam wire-guided and radio-guided ATGMs (on a roll of 12+ on a d20, the difficulty to the ATGM gunner is increased by one level; outstanding success indicates that the incoming missile pre-detonates before it can hit the CV-9030CH). A laser warning system is also included with the HADS; when the CV-90 is being lased by a laser designator, an alarm sounds inside the CV-90, and a pair of smoke grenades are automatically launched to help obscure the CV-90 to the laser beam. The laser warning system and the smoke grenades can also be triggered manually by the commander. The smoke grenades can also be triggered by the gunner manually if he feels it is necessary. As with the CV-9040, the CV-9030CH has four smoke grenade launchers on each side of the turret, but it not fitted with the Lyran mortar system. The CV-9030CH is equipped with a 1kW APU to run the vehicle's systems while the engine is switched off. Though the hull parts of the CV-9040CH are built in Sweden, they are assembled in Switzerland by RUAG; RUAG also builds the turret of the CV-9040CH.

A version of the CV-9030CH is used by Finland, where it is designated the CV-9030FIN. Deliveries of the first batch of 57 started in 2002 and ended in 2005; a second batch of 45 was delivered from 2006 to 2007. Finland eventually hopes to have 150 CV-9030FINs. Differences between the CV-9030FIN and CV-9030CH includes the use of a PKT as a coaxial machinegun instead of the M-86. The suspension of the CV-9030FIN has been upgraded and the vehicle uses wider tracks in recognition of the difficult terrain in Finland. The engine is an uprated version of the DI-16 called the DI-16 40A 01 which has an output of 620 horsepower. The special armor used on the CV-9030CH is not installed on the CV-9030FIN, though simple bolt-on appliqué armor is fitted as standard to the turret, hull, hull and turret deck, and hull floor. The CV-9030FIN has a version of the HADS suite which, though domestically produced, is identical to the HADS suite for game purposes.

It has been proposed that the turret of the CV-9030CH could be fitted to the South African Rooikat light armored vehicle and the MOWAG ACV 10x10 wheeled LAV, as well as the BMP-1 and BMP-2. This could be with or without the HADS suite.

Switzerland and Finland also use the CV-9030 COM, which is a command version of the CV-9030CH or CV-9030FIN. These are both like the CV-9030s of their respective countries, but the troop compartment is modified to carry a battlefield management system, two short-range, two medium-range, and one long-range data-capable radios. A ruggedized laptop computer is also carried, as well as a hand-held thermal imager for the commander and several pairs of binoculars. Drawers and compartments for maps and office-type supplies are installed, but the CV-9030 COM does not have a large map board like most command vehicles. The troop compartment carries four command and staff members in individual seats facing the radios and equipment instead of the bench seats down each side of the vehicle for troops.

The British is evaluating a heavily-modified version of the CV-9030 (along with several other vehicles) for its FRES-SV (Future Rapid Effect System Specialist Vehicles) requirement. This will be an IFV modified for the scout/reconnaissance role, with a special day/night vision system, extra communications equipment, and special equipment to allow it to be used to control artillery and air strikes. The program is still very much ongoing and the final vehicle used as a base for the FRES-SV and the exact configuration are still under development, though the main armament will likely a 40mm case-telescoped ammunition-firing weapon.

The CV-9035

The Dutch use a version of the CV-90 called the CV-9035NL (also known by its company designation of CV-9035 Mk III). The Dutch signed the contract for their vehicles in late 2004, and design work began at this time, though for the most part all that needed to be worked on was the new turret. The CV-9035 officially entered service with the Dutch Army in 2008, though small numbers were issued to units in 2007. The initial order of 184 CV-9035DKs was delivered from 2007 to 2009; recently, the Dutch ordered another 8 CV-9035DKs, which are to be delivered in 2010. (The original number desired by the Dutch Army was 200.) The basic hull is still built in Sweden, but the new armor kit is added by Halteren Metall of the Netherlands and the turret is built by the same company. The Dutch version is armed with the ATK 35mm Bushmaster III ChainGun, which can be upgraded to fire 50mm if the Dutch Army desires this at a later date. The CV-9035 uses the MAG as its coaxial weapon as well as the commander's weapon. The CV-9035 is equipped with a RUAG add-on armor package which includes frontal armor and bar/slat/anti-RPG mesh armor similar in design to the CV-9030N above, but includes a different type of appliqué armor for the sides of the vehicle. The appliqué armor uses a distinctive ripple shape on the vehicle sides where the ripples have a pronounced V-shape; though this appliqué armor is also provided by RUAG, it clearly is influenced by the appliqué armor applied to the Zelda version of Israeli M-113s and US AAVP-7A1 APCs. The add-on armor also pays particular attention to mine protection, with the floor armor being greatly increased (the CV-9035 has the most floor armor of all the CV-90 series); deck armor for the turret and hull is also increased. (This makes the CV-9035NL and CV-9035DK the best protected member of the CV-90 series – but it pays for that protection in weight.) The CV-9035 is equipped with the latest generation of the Swedish UTAAS fire control system, which includes a ballistic computer, laser rangefinder, and a special antiaircraft sight which takes full advantage of the UTAAS suite's capabilities. (The difference between the CV-9035's fire control system and the CV-

9040B/C is unfortunately not quantifiable in game terms.) The CV-9035 uses an independent day/night vision system as well as an independent fire control system (though it uses the same ballistic computer as the gunner), which gives the CV-9035 complete hunter/killer capability. The commander has full auxiliary controls for the main armament, and the commander has the ability to feed target information directly to the gunner's computer and have the main armament switch automatically to the new target so that the gunner can engage it, requiring only the push of a button by the gunner or commander. The CV-9035 is equipped with the HADS suite to increase its protection. The CV-9035s are driven by the Scania DI-16 600-horsepower turbocharged diesel engine. The CV-9035NL is also equipped with a full BMS system that includes the VIS system detailed above.

Denmark also uses the CV-9035 (designated the CV-9035DK), which is configured to the CV-9035NL standard but the night vision suite is upgraded to use the British Thales MT-DNGS commander's sight/night vision system, which includes an updated Claire thermal imager, and the Catherine XP FLIR night vision system with the UTAAS fire control system. They do not have the BMS of the CV-9030NL, though they do have the VIS. The Danish use the MG-3 as their coaxial and commander's weapons. These vehicles were delivered from 2007-2009. Assembly and the upgrades are performed by in Hydrema Export in Denmark. The CV-9035DK has seen combat experience in Afghanistan, though they did not deploy to Afghanistan until early 2010. The Danish employ 45 CV-9035DKs. The CV-9035DKs will replace most of their M-113 G3 DKs and some M-92s.

The Canadians have recently selected the CV-9035 as their new IFV after a lengthy trial period and much (sometimes heated) debate between the Canadian Army and the Canadian government. The Canadian Army feels that such a vehicle is necessary for the increasingly-deadly conflict in Afghanistan, but it took a lot of convincing the Canadian government to agree to foot the bill. The size of their order is not yet known, but the Canadian CV-9035s are likely to be a version of the CV-9035NL, with assembly being carried out in Canada and some components (such as the fire control package and night vision suite) being of Canadian design instead of using foreign components. The Swiss are also considering a version of the CV-9035 to supplement their CV-9030CHs, using the armor suite, engine, fire control and night vision suite, and APU of the CV-9030CH.

The Dutch also use a command version, the CV-9035NL CV, which is the CV-9035NL configured in a manner similar to the CV-9030CH COM and CV-9030FIN COM above, though a separate hand-held thermal imager, image intensifier, and laser rangefinder is not supplied, and they do not have the 1kW APUs. The Danish do not employ a version of the CV-9035NL CV, though a few of their CV-9035DKs are fitted with additional radios (a total of one short-range, one medium-range, and one long-range), a GPS system, and carry a ruggedized laptop computer for use as command vehicles or scout vehicles. Troop capacity is reduced to allow room for the extra equipment.

The Stripbv-90

The Stripbv-90 (also called simply the CV-90 Forward Command Vehicle) is a command version of the CV-9040, designed not only to provide extensive command and communications functions, but also to be able to keep up with and operate with other primary combat vehicles. So far only the Swedish Army uses the Stripbv-90; production and first issue began in 1995 and production has long since been completed, though Hagglunds remains willing to re-open the production lines if other countries decide to buy their own versions of the Stripbv-90. The basic hull remains the same as that of the CV-9040, though the interior details are greatly different. The turret differs greatly from the CV-9040, as it contains more communications and sighting gear and eliminates the heavy armament of the CV-9040; it is therefore also a bit smaller. The armament of the turret is limited to a single machinegun, though the gunsights of the coaxial machinegun of the CV-9040, laser rangefinder, and ballistic computer are retained, as are the smoke grenade launchers and Lyran 71mm launchers. The primary use of the turret is for training of the night vision equipment, laser rangefinders (the Stripbv-90 has one for sighting the machinegun and one for finding the range to targets in general to help plot artillery and air strikes), and general observation gear. The hull is heavily rearranged, accommodating one short-range, two medium-range, and two long-range radios (including one which is data-capable); in addition, there are screens and controls which feed from the sensors and observation devices in the turret. The Stripbv-90 has a GPS system and a BMS. In addition, the Stripbv-90 is equipped with a pair of ruggedized laptop computers and an extra external hard drive system, bench tables and seats, for the radio/computer operators and command/staff crews, a map board, and plotting and office-type supplies that are normally present on a command vehicle. The hull of the Stripbv-90 can take the same appliqué armor as the CV-9040, though it cannot use the CV-9040's turret appliqué armor; therefore, a special appliqué armor package was devised for the Stripbv-90's turret which offers the same protection.

Twilight 2000 Notes: Sweden and Norway were the only countries to field the CV-90 series in the Twilight War. All of Sweden's CV-90 fleet were CV-9040s, though some were given additional protection using bolt-on spaced steel armor modules for the turret and part of the hull, as well as plating for the hull and turret deck and hull floor. (This is the "w/Appliqué" version listed below.) Soviet and Pact soldiers tended to look out in dismay when Norwegian CV-9030s showed up, especially if they were equipped with add-on armor.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
CV-9040	\$233,726	D, A	1 ton	22.8 tons	3+8	14	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded
CV-9040 w/Appliqué	\$239,963	D, A	750 kg	24.5 tons	3+8	14	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded
CV-9040B	\$343,838	D, A	1 ton	22.8	3+8	15	Passive IR (D, G, C), Image	Shielded

					tons					
CV-9040B w/BMS	\$517,289	D, A	1 ton	22.9 tons	3+8	16	Intensification (G, C), FLIR (G), Thermal Imaging (C)	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Shielded	
CV-9040C	\$315,739	D, A	750 kg	25.8 tons	3+8	15	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Shielded	
CV-9040C w/BMS	\$519,790	D, A	750 kg	25.9 tons	3+8	16	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Shielded	
CV-9030N	\$207,340	D, A	1 ton	22.8 tons	3+8	12	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded	
CV-9030N w/Appliqué	\$216,086	D, A	750 kg	25.2 tons	3+8	12	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded	
CV-9030S	\$220,086	D, A	750 kg	25.7 tons	3+8	13	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded	
CV-9030CH	\$241,974	D, A	700 kg	28.4 tons	3+8	15	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded	
CV-9030FIN	\$210,486	D, A	750 kg	27.5 tons	3+8	14	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded	
CV-9030CH COM	\$309,322	D, A	500 kg	28.5 tons	3+4	17	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded	
CV-9030FIN COM	\$237,850	D, A	500 kg	27.6 tons	3+4	16	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded	
CV-9035NL	\$275,659	D, A	650 kg	29.4 tons	3+8	14	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded	
CV-9035DK	\$343,639	D, A	650 kg	29.3 tons	3+8	13	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), 2 nd Gen Thermal Imaging (C)	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), 2 nd Gen Thermal Imaging (C)	Shielded	
CV-9035NL CV	\$529,270	D, A	500 kg	29.5 tons	3+4	15	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded	
CV-9035DK CV	\$550,103	D, A	600 kg	29.3 tons	3+6	14	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), 2 nd Gen Thermal Imaging (C)	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), 2 nd Gen Thermal Imaging (C)	Shielded	
Stripbv-90	\$836,860	D, A	500 kg	22.25 tons	3+6	17	Passive IR (D, G, Crew), Image Intensification (G, Crew), 2 nd Gen Thermal Imaging (Crew), Thermal Imaging (G)	Passive IR (D, G, Crew), Image Intensification (G, Crew), 2 nd Gen Thermal Imaging (Crew), Thermal Imaging (G)	Shielded	
Stripbv-90 w/Appliqué	\$855,159	D, A	400 kg	23.95 tons	3+6	17	Passive IR (D, G, Crew), Image Intensification (G, Crew), 2 nd Gen Thermal Imaging (Crew), Thermal Imaging (G)	Passive IR (D, G, Crew), Image Intensification (G, Crew), 2 nd Gen Thermal Imaging (Crew), Thermal Imaging (G)	Shielded	

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
CV-9040/CV-9030N	141/98	35/21	525	249	Trtd	T4	TF14 TS8 TR6 HF18 HS7 HR4
CV-9040 w/Appliqué	131/91	33/20	525	266	Trtd	T4	TF17Sp TS10Sp TR7 HF21Sp HS9Sp HR4*

CV-9040B	163/114	41/24	525	300	Trtd	T4	TF14 TS8 TR6 HF18 HS7 HR4
CV-9040B w/BMS	161/113	41/24	525	303	Trtd	T4	TF14 TS8 TR6 HF18 HS7 HR4
CV-9040C	143/100	36/21	525	339	Trtd	T4	TF18Sp TS11Sp TR8 HF23Sp HS11Sp HR5**
CV-9040C w/BMS	143/100	36/21	525	342	Trtd	T4	TF18Sp TS11Sp TR8 HF23Sp HS11Sp HR5**
CV-9030N w/Appliqué	147/103	37/22	525	333	Trtd	T4	TF17Cp TS10Sp TR7 HF23Cp HS10Sp HR4**
CV-9030S	144/101	36/22	525	340	Trtd	T4	TF17Cp TS10Sp TR7 HF23Cp HS10Sp HR4***
CV-9030CH	149/104	37/22	525	333	Trtd	T4	TF17Cp TS9Sp TR7 HF22Cp HS9Sp HR5****
CV-9030FIN	145/101	36/22	525	312	Trtd	T4	TF17 TS10 TR7 HF22 HS8 HR5****
CV-9030CH/CV-9030CH COM	149/104	37/22	525	333	Trtd	T4	TF17Cp TS9Sp TR7 HF22Cp HS9Sp HR5****
CV-9030FIN/CV-9030FIN COM	145/101	36/22	525	312	Trtd	T4	TF17 TS10 TR7 HF22 HS8 HR5****
CV-9035NL	127/89	32/19	525	384	Trtd	T4	TF18Cp TS11Sp TR8 HF23Cp HS11Sp HR5*****
CV-9035DK/CV-9035DK CV	127/89	32/19	525	383	Trtd	T4	TF18Cp TS11Sp TR8 HF23Cp HS11Sp HR5*****
CV-9035NL CV	126/88	32/18	525	385	Trtd	T4	TF18Cp TS11Sp TR8 HF23Cp HS11Sp HR5*****
Stripbv-90	144/100	36/22	525	243	Trtd	T4	TF14 TS8 TR6 HF18 HS7 HR4
Stripbv-90 w/Appliqué	134/93	33/20	525	261	Trtd	T4	TF17Sp TS10Sp TR7 HF21Sp HS9Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
CV-9040	+3	Fair	40mm L/70 Autocannon, Ksp m/39, Ksp m/39 or Minimi (C), 2x71mm Lyran Launchers	240x40mm, 3000x7.62mm, 1500x7.62mm or 2000x5.56mm, 8x71mm Shells
CV-9040B/CV-9040C	+4	Good	40mm L/70 Autocannon, Ksp m/39, Ksp m/39 or Minimi (C), 2x71mm Lyran Launchers	240x40mm, 3000x7.62mm, 1500x7.62mm or 2000x5.56mm, 8x71mm Shells
CV-9030N/CV-9030S	+3	Good	30mm M-230 Bushmaster II ChainGun, MG-3, MG-3 (C)	400x30mm, 5300x7.62mm
CV-9030CH	+4	Good	30/40mm Mk 44 ChainGun, M-86, M-51 (C)	400x30mm, 5300x7.62mm
CV-9030FIN	+4	Good	30/40mm Mk 44 ChainGun, PKT, PKM (C)	400x30mm, 5300x7.62mm
CV-9035NL/CV-9035NL CV	+4	Good	35/50mm Bushmaster III ChainGun, MAG, MAG (C)	340x35mm, 4500x7.62mm
CV-9035DK/CV-9035DK CV	+4	Good	35/50mm Bushmaster III ChainGun, MG-3, MG-3 (C)	340x35mm, 4500x7.62mm
Stripbv-90	+3	Fair	Ksp m/39, Ksp m/39 or Minimi (C), 2x71mm Lyran Launchers	3000x7.62mm, 1500x7.62mm or 2000x5.56mm, 8x71mm Shells

*This version has a hull and turret deck AV of 3, and a hull floor AV of 4.

**The CV-9040C and the CV-9030N with its appliqué armor kit have a hull and turret deck AV of 3, and a hull floor AV of 5Sp.

***The CV-9030S has a hull and turret roof AV of 3 and a hull floor AV of 7Sp.

****The CV-9030CH and CV-9030FIN have a hull and turret deck AV 4, and a hull floor AV of 5.

****The CV-9035NL and CV-9035DK have a hull and turret deck AV of 4, and a floor AV 6Sp.

Hagglunds Pbv-302

Notes: The Pbv-302 is an older Swedish APC which replaced the interim-solution Pbv-301 (which was a rebuilt and heavily-modified Strv m/41, a Swedish version of the pre-World War 2 Czech TNH light tank). Design work on the Pbv-302 began in 1961, but full production and first issue did not begin until 1966, with production continuing until 1971. Though the Pbv-302 has been almost totally replaced in service by the CV-9040 and Swedish versions of the BMP-1 and MT-LB, small amounts of the Pbv-302 are still in service as APCs and more are still in use as specialist vehicles. The APC version (in a modified form) has seen combat service as recently as the UN KFOR deployment in Kosovo. The Pbv-302 is basically in the same class as early-1960s APCs like the M-113 and FV-432, but its heavier armament gives it an edge in firepower and the relatively powerful engine gives it an edge in speed and agility. Some 650 Pbv-302s of all versions were built; a great deal of them have met a sad end on gunnery ranges, though some that are not still in Swedish Army service are now in museums or the hands of private collectors. Hagglunds offered the Pbv-302 for export, but had no takers. The Pbv-302 shares some components with the Ikv-91 tank destroyer.

The Basic Pbv-302

The standard APC version is designated the Pbv-302A. The Pbv-302 is basically an armored box on tracks, and has a large boxy hull with a gently-sloping glacis. The driver is in the front center of the hull; he has a conventional steering yoke in addition to pedals for the gas, brakes, and clutch. The driver has three vision blocks to his front; the center block can be removed and replaced with night vision block. Behind and to the right of him is the commander's hatch, which is ringed by vision blocks, but has no provision for a weapon. Atop the rear deck are two long, narrow hatches which allow the troops inside to stand and fight from the vehicle; these hatches are hydraulically-assisted and require only a light touch to swing open. They are a bit of a tight squeeze. They open to the center, just enough for the hatch cover to stand straight up. Two large hatches are found in the rear of the vehicle for troop entry and exit. The arrangement of the troop compartment is a little unusual: at the front of the compartment at the center is a single seat facing towards the rear doors (normally occupied by the squad leader), three troops are seated on each side of the compartment on folding bench seats, occupying most of the center of the compartment, and the remaining two members of the infantry squad are seated next to the rear doors on folding seats and facing back-to-back towards the outsides of the vehicle. (Operationally, the Swedes sometimes squeeze in a tenth infantryman, though he sits on the floor.) There are no firing ports or vision blocks for the troops in the rear.

Behind the driver and to his left is the Pbv-302's small turret; this is the same turret which is found on the Bgbv-82 ARV, the Swiss Schutzenpanzer 63/73 version of the M-113A1, and some versions of the Brazilian EE-11 Urutu wheeled APC. The turret has three vision blocks to the front and one to the rear. The turret armament is a license-built version of the Swiss Hispano-Suiza HS-804 20mm autocannon (designated the m/47D); most of these autocannons were taken off of the obsolete Saab J-29 Tunnan fighter, and modified them for use in the Pbv-302. (For much of its time in the Swedish Army, the manuals issued for use and maintenance of the autocannon were actually tech manuals for the J-29 Tunnan's autocannon installation.) The Swedish Army at first used the HS-404 in the Pbv-302 as designed, firing primarily HE ammunition from a 135-round belt and loading a 10-round AP belt when necessary (the HS-404 is not a dual-feed weapon), but the Pbv-302's autocannon was later changed to feed from 30-round magazines (usually firing multipurpose ammunition) that could be changed much more quickly. The gunner has no night vision devices, but does have an x8 magnification sight which can be used against ground and also has a separate channel for aerial targets. (Originally, the gunsights were magnified only for use against ground targets, and a simple reticle was used against aerial targets.) In peacetime, a Ksp m/58 machinegun is mounted on a pintle in front of the gunner's hatch; however, this is normally used during training only to simulate cannon fire, since there are no blank adapters, ammunition, or laser training emitters for the HS-804 autocannon. Originally, neither the machinegun nor the pintle mount were to be used when the Pbv-302 is deployed for real-world missions. The turret has a small hatch which opens to the rear. Two clusters of three smoke grenade launchers are found on the upper glacis on either side of the vehicle, and two Lyran 71mm reloadable flare launchers are found on the rear of the turret.

Hull armor is of steel; it is a bit on the thin side, and an appliqué armor kit was quickly devised as a result. The engine and transmission are combined in a unitary powerpack, something which was unusual at the time of its development. The engine used is a Volvo-Penta THD-100B diesel with an output of an amazing 280 horsepower. The engine is coupled to a manual transmission which is also designed by Volvo. The suspension uses conventional torsion bars with shock absorbers on the first and last set of roadwheels, so it may be surmised that the ride can be a bit rough sometimes. Tracks are wide and help the Pbv-302 stay mobile in snowy or swampy terrain. The Pbv-302 is amphibious; preparation consists only of switching on bilge pumps and extending a trim vane, requiring only 4 minutes. The double-skinned nature of the lower hull above the tracks aids in floatation.

In the 1990s, a modified form of the Pbv-302, designated the Pbv-302C, was introduced for use with the Swedish contingent to KFOR. This version uses an upgraded form of the basic appliqué armor kit, makes the pintle-mounted machinegun on the turret standard, and uses a Volvo-Penta THD-100C 310-horsepower diesel to cope with the increased weight, along with a beefed-up suspension. Additional buoyancy aids are carried. The external machinegun mount on the turret, normally used only for training, is standard equipment on the Pbv-302C. An air conditioner was also added.

The Stripbv-3021 CPV

This is the command post carrier version of the Pbv-302, analogous to the M-577 version of the M-113, though the Stripbv-3021 does not have a raised roof. The Stripbv-3021 normally carries one short-range, two medium-range, and two long-range radios, as well as a map board and office and plotting supplies. A ruggedized laptop computer is normally added these days as a part of its fit. The

interior is rearranged for its role as a command vehicle, but externally the vehicle looks the same (except for extra antennas) and it retains its armament. The Stripbv-3021 carries a hand-held thermal imager, image intensifier, and a laser rangefinder for use by the command crew. As the Pbv-3021 is a little heavier and the center of gravity is different, it has additional buoyancy aids. These vehicles have largely been phased out in favor of the Stripbv-90.

Twilight 2000 Notes: The Pbv-302 and its variants are still in wide use in the Twilight War.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Pbv-302A	\$51,241	D, A	1 ton	13.5 tons	3+9	10	Passive IR (D)	Shielded
Pbv-302C	\$59,523	D, A	725 kg	14.6 tons	3+9	8	Passive IR (D)	Shielded
Stripbv-3021	\$362,941	D, A	500 kg	13.7 tons	2+6	11	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor			
Pbv-302	152/107	38/23/4	285	118	CiH	T2	TF2	TS2	TR2	HF6 HS3 HR3
Pbv-302C	155/109	39/23/4	285	131	CiH	T2	TF3	TS3	TR3	HF8 HS5 HR4*
Stripbv-3021	150/106	38/23/4	285	119	CiH	T2	TF2	TS2	TR2	HF6 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Pbv-302A/Stripbv-3021	+2	None	20mm m/47D	505x20mm
Pbv-302C	+2	None	20mm m/47D, Ksp m/58	505x20mm, 1000x7.62mm

*This version has a hull floor AV of 4.

Spz-63

Notes: Until the advent of the CV-9030CH, the primary APC of the Swiss Army was the Schutzenpanzer (Spz) 61, which is their designation for the M-113A1. The Swiss Army still employs a good number of these vehicles, as CV-9030CH acquisition has not been as rapid as hoped, and the numbers to be eventually acquired will not be enough to fully supplant the Spz-63 series. The basic Spz-61 is essentially identical to the M-113A1, though some sport some additional appliqué armor. The front appliqué is a simple steel plate, while the side appliqué is ribbed steel plates providing the equivalent of spaced armor. The stats of the basic M-113A1 will be reproduced below for convenience. In addition to some other APC versions of the Spz-63/M-113A1, the Swiss use several specialist versions of the Spz-63. Swiss Spz-63s typically have banks of three smoke grenade launchers above the headlight frames on the front of the hull.

One of the first variants of the Spz-63 produced was the Spz-63/79. This version is similar to the Spz-63 externally, but instead of the standard commander's station, the Spz-63/79 is equipped with the same turret as found on the Swedish Pbv-302. This turret is armed with a 20mm HS-804 autocannon; the turret has a (rather small) hatch atop it. (In Swiss service, the autocannon is designated the Kan 48/73.) The Swiss Army uses the HS-804 in the same manner as later versions the way it is used in Swedish use -- fed from 30-round magazines (usually firing multipurpose ammunition) that could be changed quickly. The gunner has no night vision devices, but does have an x8 magnification sight which can be used against ground and also has a separate channel for aerial targets. The frontal trim vane is modified for additional flotation capability, allowing the Spz-63/79 to retain its amphibious capability. Some have appliqué armor applied. In 1989, a further upgrade of the Spz-63/79 was made, the Spz-63/89; this version is equipped with the RISE power pack, the drive train of the M-113A2, fuel tanks moved to the rear of the vehicle, as well as standard appliqué armor.

The Swiss use two command versions of the Spz-63. The Kpz-63 is essentially a standard Spz-63, with the interior rearranged to give more room for radios and other command equipment. Typical equipment includes one short-range, one medium-range, and two long range radios, a small map board, and various plotting and office supplies. Later (in the 1990s), a ruggedized laptop computer and a second medium-range radio were added; one of the long-range radios were made data-capable. The Kpz-63/89 is the same as the Kpz-63, but retains the autocannon turret of the Spz-63/79. As with the Spz-63 series, the Kpz-63s are often found with appliqué armor.

The Gpz-63 is essentially the same as the Spz-63, but is equipped with a dozer blade at the front of the vehicle. This blade is one meter high and as wide as the vehicle. Frontal hits are 50% likely to hit the blade, which has an armor value of 10Sp. The blade unbalances the vehicle and interferes with the trim vane, robbing the vehicle of its amphibious capability.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Spz-63	\$74,419	D, A	1.61 tons	10.92 tons	2+11	6	Passive IR (D)	Shielded
Spz-63	\$79,051	D, A	1.49 tons	11.42 tons	2+11	6	Passive IR (D)	Shielded
w/Appliqué								
Spz-63/79	\$72,848	D, A	840 kg	12.21 tons	2+9	6	Passive IR (D)	Shielded
Spz-63/79	\$77,401	D, A	720 kg	12.71 tons	2+9	6	Passive IR (D)	Shielded
w/Appliqué								
Spz-63/89	\$76,869	D, A	620 kg	12.92 tons	2+9	8	Passive IR (D)	Shielded
Kpz-63	\$82,054	D, A	805 kg	11.5 tons	2+4	7	Passive IR (D)	Shielded
Kpz-63	\$87,068	D, A	745 kg	12 tons	2+4	7	Passive IR (D)	Shielded
w/Appliqué								
Kpz-63/89	\$80,078	D, A	630 kg	12.79 tons	2+4	9	Passive IR (D)	Shielded
Kpz-63/89	\$84,217	D, A	540 kg	13.29 tons	2+4	9	Passive IR (D)	Shielded
w/Appliqué								
Kpz-63	\$180,007	D, A	805 kg	11.5 tons	2+4	8	Passive IR (D)	Shielded
(Upgraded)								
Kpz-63	\$188,688	D, A	745 kg	12 tons	2+4	8	Passive IR (D)	Shielded
w/Appliqué								
(Upgraded)								
Kpz-63/89	\$179,435	D, A	630 kg	12.79 tons	2+4	9	Passive IR (D)	Shielded
(Upgraded)								
Kpz-63/89		D, A	540 kg	13.29 tons	2+4	9	Passive IR (D)	Shielded
w/Appliqué								
(Upgraded)								
Gpz-63	\$80,417	D, A	1.2 tons	11.5 tons	2+11	8	Passive IR (D)	Shielded
GPz-63	\$84,669	D, A	1.08 tons	12 tons	2+11	8	Passive IR (D)	Shielded
w/Appliqué								

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Spz-63	150/105	30/18/3	360	124	Std	T2	HF6 HS4 HR4
Spz-63	145/102	29/17/3	360	130	Std	T2	HF8 HS6Sp HR4
w/Appliqué							

Spz-63/79	139/97	28/17/3	360	139	CiH	T2	TF2 TS2 TR2 HF6 HS4 HR4
Spz-63/79 w/Appliqué	135/94	27/16/3	360	144	CiH	T2	TF2 TS2 TR2 HF8 HS6Sp HR4
Spz-63/89	161/113	32/19/3	360	152	CiH	T2	TF2 TS2 TR2 HF8 HS6Sp HR4
Kpz-63	144/101	29/17/3	360	131	Stnd	T2	HF6 HS4 HR4
Kpz-63 w/Appliqué	140/98	28/17/3	360	136	Stnd	T2	HF8 HS6Sp HR4
Kpz-63/89	134/93	27/16/3	360	145	CiH	T2	TF2 TS2 TR2 HF6 HS4 HR4
Kpz-63/89 w/Appliqué	130/91	26/16/3	360	151	CiH	T2	TF2 TS2 TR2 HF8 HS6Sp HR4
Gpz-63	144/101	29/17/3	360	131	Stnd	T2	HF6 (16Sp) HS4 HR4*
Gpz-63 w/Appliqué	140/98	28/17/3	360	136	Stnd	T2	HF8 (18Sp) HS6Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Spz-63/Kpz-63/Gpz-63	None	None	M-2HB (C)	2000x.50
Spz-63/79, Spz-63/89, & Kpz-63/89	+2	None	Kan 48/73 (C)	450x20mm

*50% of all frontal hits against the Gpz-63 will hit the dozer blade, which provides additional protection of 10Sp. Every such hit which penetrates the plow, however, has a 1% chance per 2 points of penetration of damaging the plow to the point that the vehicle becomes immobile until the plow is removed.

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FNSS ACV-15 (TIFV, ACV-300)

Notes: The ACV-15, also known as the TIFV (Turkish Infantry Fighting Vehicle), entered service in the early 1990s. The ACV-15 is based on the European AIFV, and is the same in many details as that vehicle. It is not, in the strictest sense, an Infantry Fighting Vehicle, despite its name, as it has neither heavy caliber armament nor antitank missiles. The ACV-15 is being partially replaced/supplemented by the ACV-S; this process started in the late 1990s. In addition to Turkey, the ACV-15 is used by the UAE (the ACV-S version only), Malaysia, and the Philippines. Several APC-type version exist as well as a mortar vehicle and an ATGM carrier as an ARV. Virtually all components of the ACV-15 are license-produced in Turkey (or in Malaysia, in the case of Malaysian vehicles; they are built by Pekan). The Turkish have nearly 1700 of these in service, plus 665 ACV-Ss; the UAE have 136, and Malaysia has 211 (in a bewildering array of variants). The Filipinos have only seven. The Jordanians have ordered the ACV-S, but have are not due to receive their first until late 2010. ACV-15s and ACV-Ss have seen combat service in Somalia, Bosnia and Kosovo with UN peacekeeping forces fielded by Turkey, and in Turkey (and possibly Northern Iraq) against Kurdish rebels.

The ACV-15

The ACV-15, in general, uses a hull similar to the AIFV, though the armor is a bit better than the AIFV, and some additional attention is paid to belly armor. The hull front and sides incorporate spaced armament with ceramic sandwich panels. The engine remains a Detroit Diesel 6V-53T developing 300 horsepower, along with a fully automatic transmission along with a conventional driver's station. The ACV-15 is fully amphibious, propelled in water by its tracks. The sides of the hull have two firing ports each, and the rear has two firing ports. The seats for the troops extend down the center of the vehicle facing outwards, and the two rear seats are facing towards the rear of the vehicles. The rear of the vehicle has a powered ramp with a door in it.

The primary differences in the different members of the ACV-15 family are primary in the turrets (or the lack thereof), and to some extent the internal equipment resulting from these differences. The basic, and most numerous in the Turkish forces, APC version is the ACV-15 AAPC (Advanced Armored Personnel Carrier). This version uses a light 1-man turret armed with an M-2HB heavy machinegun as primary armament and a coaxial MAG machinegun. This turret supplies the commander/gunner with basic night vision equipment, fire control equipment including a ballistic computer, and one-plane stabilization. The turret has a cluster of three smoke grenade launchers on each side. Two the left of the turret is a hatch for the vehicle commander; he has no weapon and no night vision devices, but his hatch has vision blocks to the front, right, and rear. The driver is in the front left, in front of the commander's position. The Malaysians use a version of this vehicle which is equipped only with the M-2HB and a greater ammunition supply for the M-2HB. The Malaysians also employ a version of this vehicle armed with a Mk 19 AGL instead of an M-2HB.

The ACV-300 AIFV is similar to the European AIFV, but is equipped with a one-man turret mounting a 25mm autocannon. The commander's position remains. Early Turkish versions used the French Giat M-811 autocannon in a turret almost identical to that of the AIFV, but later versions use the BAE-designed Sharpshooter turret equipped with the M-242 Bushmaster ChainGun and having a slightly-lower, more angular profile incorporating spaced armor similar to that used in the hull. The Sharpshooter turret also adds a laser rangefinder and gives two-plane stabilization for the main gun and coaxial machinegun. The turret has a cluster of four smoke grenade launchers on each side. Turkish versions have by 2010 all been upgraded to use the Sharpshooter turret, but are still designated the ACV-15. The Turkish, Malaysians, UAE, and Filipinos all use this version, though the Filipinos have only six of them (along with one ARV version).

The ACV-15 – Additional APC-type Variants

The ACV-15 CPV is the command version of the ACV-15; externally, it is an ACV-15 AAPC or AIFV with the turret removed and replaced with a commander's cupola that is armed with an M-2HB, sometimes surrounded with AV2 gun shields. The interior is quite different, with the sorts of things one might expect to find in a CPV – one short-range, two medium-range, and two long-range radios, one of which is data-capable. The ACV-15 has a ruggedized laptop computer as well as a battlefield management system (though not with the vehicle state system), with a linked GPS system with an inertial navigation backup. It also has a map board, various plotting and office-type supplies, and various storage drawers. The side firing ports are sealed off, though the rear firing ports remain. The CPV has four seats for the radio operators and command crew, and a folding table with three folding chairs. An attached tent can be unfolded at the rear to increase working space. In an armored box atop the vehicle is a 5kW APU to power the equipment when the engine is turned off. This generator can be removed and dug in to dampen noise, attached to the vehicle with a slave cable. The commander's station of the CPV has a periscopic sight which includes an image intensifier and a thermal imager, as well as a laser rangefinder. (They're not useable, however, as aiming devices for his machinegun.) The CPV's smoke grenade launchers are on either side of the upper glacis plate, in clusters of three each.

The ACV-15 AMV is an armored ambulance version. As such, it has space in the rear for a medic and two stretcher cases plus four seated patients. It also has a small refrigerator for perishable medical supplies, a defibrillator, two sets of oxygen administration kits, splint kits, and the equivalent of 20 personal medical kits and two doctor's medical bags. Like the CPV, the AMV's smoke grenade launchers are on either side of the upper glacis plate, in clusters of three each. The AMV is normally unarmed.

Big Brother – The ACV-S

The ACV-S ("S" for Stretched) was at first called the ACV-NG (New Generation). The ACV-S is, as the name suggests, an ACV-15 with an extra roadwheel at the end of the hull, making it about a meter longer; it is also a little wider than the ACV-15. This increases available internal volume by 25%, and with the increased engine power, the cargo carrying capability is also dramatically increased. The layout of the vehicle is largely the same, but the new hull size and configuration allows for a wider possible selection of turrets and

armament. There are three firing ports in the sides instead of two, though there are still at the rear. All troop seats are down the center and face outwards. The interior of the ACV-S is air conditioned, and it has a collective NBC system for the troops and crew to hook up to when they are on board. The driver remains in his front left position; whether there is a commander's position depends upon the turret configuration. Armor is in general slightly bumped up from the ACV-15 version. The powerpack is likewise upgraded, with the engine being an upgraded version of the 6V-53T developing 350 horsepower. (Turkey, Malaysia, the UAE, and Jordan are reportedly already considering a further upgraded engine developing 400 horsepower; as this engine is also a 6V-53T version, this would be a simple drop-in upgrade.) The suspension is also upgraded, both for the increased weight and increased engine power. The vehicle's larger size allows for larger fuel tanks. An automatic fire detection and suppression system is standard.

Several versions of the ACV-S are projected, ranging from several APC/IFV variants, ATGM vehicles, SAM and AAA carriers, and specialist vehicles. So far, only the version with the Sharpshooter turret has been ordered by any country's military forces (by Turkey, Malaysia, UAE, and Jordan). As the exact designations of the various APC/IFV versions has not been reported, I have labeled them below as "AFV 1," "AFV 2," "AFV 3," etc.

The current standard ACV-S version is topped with the Sharpshooter turret, as mounted on the ACV-15 AIFV above. The vehicle's larger size allows the vehicle to carry more ammunition as well as a larger infantry squad, and these are the primary differences from the ACV-15 other than those listed above. The commander's position, as for the ACV-15 AIFV, is retained on this version, which I have labeled "AFV 1" below. Variants of this version include two with a two-man turret; this turret is a little lower and wider, giving it a flat, saucer-shaped appearance. These versions eliminate the separate commander's hatch and put the commander in the turret. This version may be armed with the M-242 ChainGun or its 30mm variant, the M-230. There is a slight increase in ammunition stowage. These are labeled AFV 2 and AFV 3 below.

Simpler variants include the version I have labeled AFV 4, which has a version of the British-made SWARM OHWS equipped with an M-2HB; this version, though not as heavily-armed, has better night vision equipment. The gunner sits in the hull with a downlinked monitor and controls for the gun, and the gun can be aimed, fired, and reloaded from within the vehicle. There is no hatch in the small turret. The "AFV 5" version has a small turret (though larger than the SWARM turret) with conventional night vision and a small hatch in the turret roof. Both these versions have the commander's station to the left of the turret. The AFV 4 version uses a cluster of three smoke grenade launchers on either side of the glacis plate near the top; the AFV 5 version has these clusters on either side of the turret.

Perhaps the most fantastic idea for the ACV-S has been the mounting of the entire Bachka turret on the ACV-S hull – the same turret as used on the BMP-4, with the exception of a MAG coaxial being mounted instead of a PKT. This version is called the ACV-SW. Though it has had no takers as of yet, it does show how far the ACV-S platform could be taken. Of course, the use of this turret substantially reduces the size of the infantry squad which can be carried, and greatly increases the weight of the vehicle.

Twilight 2000 Notes: Being a new vehicle to Turkish service at the time of the Twilight War, the ACV-15 was not fielded in as large numbers that they were fielded in real life – the Turkish Army had about 800 of all variants in service at the start of the War, with some 100 more being produced during the War. The Turkish Army also managed to get about 100 ACV-Ss. The Turkish Army opted to produce more of the heavier-armed versions with the 25mm autocannons; some 70% of the total of ACV-15s were APC/IFV variants, with some three-quarters being AIFV variants (only 10% being the early versions with the Giat autocannons). Most of the ACV-S were of the AFV 3 variant (about 50 of the total), with the rest being AFV 2 versions and a few ATGM carrier versions. No other country got the ACV-15 or ACV-S during the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ACV-15 AAPC	\$110,593	D, A	1.15 tons	13.5 tons	3+8	6	Passive IR (D, C), Image Intensification (C), WL/IR Searchlight (C)	Shielded
ACV-300 AAPC (Malaysian 1)	\$105,819	D, A	1.15 tons	13.5 tons	3+8	6	Passive IR (D, C), Image Intensification (C), WL/IR Searchlight (C)	Shielded
ACV-300 AAPC (Malaysian 2)	\$122,640	D, A	1.15 tons	13.5 tons	3+8	6	Passive IR (D, C), Image Intensification (C), WL/IR Searchlight (C)	Shielded
ACV-15 AIFV (Early)	\$136,567	D, A	1 ton	14 tons	3+8	6	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-15 AIFV (Late)	\$148,885	D, A	1 ton	14 tons	3+8	6	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-15 CPV	\$517,429	D, A	860 kg	12.6 tons	3+5	9	Passive IR (D), Thermal Imaging (C), Image Intensification (C), WL/IR Searchlight (C)	Shielded

ACV-15 AMV	\$53,514	D, A	860 kg	12.5 tons	**	7	Passive IR (D), WL/IR Searchlight (C)	Shielded
ACV-S AFV 1 (350 hp)	\$161,812	D, A	1.7 tons	20 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 1 (400 hp)	\$162,003	D, A	1.7 tons	20 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 2 (350 hp)	\$163,001	D, A	1.6 tons	20.3 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 2 (400 hp)	\$163,192	D, A	1.6 tons	20.3 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 3 (350 hp)	\$166,183	D, A	1.6 tons	20.3 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 3 (400 hp)	\$166,373	D, A	1.6 tons	20.3 tons	3+10	10	Passive IR (D, G, C), Image Intensification (G, C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 4 (350 hp)	\$163,277	D, A	2 tons	19.5 tons	3+10	8	Passive IR (D, C), Image Intensification (C), Thermal Imaging (C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 4 (400 hp)	\$163,465	D, A	2 tons	19.5 tons	3+10	8	Passive IR (D, C), Image Intensification (C), Thermal Imaging (C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 5 (350 hp)	\$121,895	D, A	1.9 tons	19.6 tons	3+10	8	Passive IR (D, C), Image Intensification (C), WL/IR Searchlight (C)	Shielded
ACV-S AFV 5 (400 hp)	\$122,083	D, A	1.9 tons	19.6 tons	3+10	8	Passive IR (D, C), Image Intensification (C), WL/IR Searchlight (C)	Shielded
ACV-SW (350 hp)	\$367,011	D, A	800 kg	22.2 tons	3+6	10	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded
ACV-SW (400 hp)	\$367,199	D, A	800 kg	22.2 tons	3+6	10	Passive IR (D, G, C), Image Intensification (G), Thermal Imaging (G), IR Searchlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
ACV-15 AAPC	147/103	31/23/3	416	140	Trtd	T2	TF6 TS5 TR4 HF10Sp HS7Sp HR6*
ACV-15 AIFV (Early)	143/100	30/22/3	416	145	Trtd	T2	TF6 TS5 TR4 HF10Sp HS7Sp HR6*
ACV-15 AIFV (Late)	143/100	30/22/3	416	145	Trtd	T2	TF6Sp TS5Sp TR4 HF10Sp HS7Sp HR6*
ACV-15 CPV/AMV	157/110	33/25/3	416	130	Stnd	T2	HF10Sp HS7Sp HR6*
ACV-S AFV 1 (350 hp)	126/88	27/20/3	501	166	Trtd	T3	TF6Sp TS5Sp TR4 HF12Sp HS9Sp HR7***
ACV-S AFV 1 (400 hp)	140/98	29/22/3	501	194	Trtd	T3	TF6Sp TS5Sp TR4 HF12Sp HS9Sp HR7***
ACV-S AFV 2/3 (350 hp)	125/87	26/20/3	501	169	Trtd	T3	TF6Sp TS5Sp TR4 HF12Sp HS9Sp HR7***
ACV-S AFV 2/3 (400 hp)	138/97	29/22/3	501	197	Trtd	T3	TF6Sp TS5Sp TR4 HF12Sp HS9Sp HR7***
ACV-S AFV 4 (350 hp)	129/90	28/21/3	501	162	CiH	T3	TF2 TS2 TR2 HF12Sp HS9Sp HR7***

ACV-S AFV 4 (400 hp)	144/101	30/23/3	501	189	CiH	T3	TF2 TS2 TR2 HF12Sp HS9Sp HR7***
ACV-S AFV 5 (350 hp)	129/90	28/21/3	501	163	Trtd	T3	TF3 TS3 TR3 HF12Sp HS9Sp HR7***
ACV-S AFV 5 (400 hp)	143/100	30/22/3	501	190	Trtd	T3	TF3 TS3 TR3 HF12Sp HS9Sp HR7***
ACV-SW (350 hp)	113/79	24/18/2	501	184	Trtd	T3	TF11 TS4 TR4 HF12Sp HS9Sp HR7***
ACV-SW (400 hp)	126/88	26/20/3	501	215	Trtd	T3	TF11 TS4 TR4 HF12Sp HS9Sp HR7***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
ACV-15 AAPC	+2	Fair	M-2HB, MAG	1000x.50, 1840x7.62mm
ACV-300 AAPC (Malaysian 1)	+2	Fair	M-2HB	2100x.50
ACV-300 AAPC (Malaysian 2)	+2	Fair	Mk 19	650x40mm
ACV-15 AIFV (Early)	+2	Fair	25mm Giat M-811 Autocannon, MAG	325x25mm, 1840x7.62mm
ACV-15 AIFV (Late)	+3	Good	25mm M-242 ChainGun, MAG	325x25mm, 1840x7.62mm
ACV-15 CPV	None	None	M-2HB (C)	1100x.50
ACV-S AFV 1	+3	Good	25mm M-242 ChainGun, MAG	500x25mm, 2760x7.62mm
ACV-S AFV 2	+3	Good	25mm M-242 ChainGun, MAG	550x25mm, 3050x7.62mm
ACV-S AFV 3	+3	Good	30mm M-230 ChainGun, MAG	460x30mm, 3050x7.62mm
ACV-S AFV 4	+3	Fair	M-2HB	1625x.50
ACV-S AFV 5	+2	Fair	M-2HB	1800x.50
ACV-SW	+3	Good	100mm 2A70 Gun, 2A72 30mm Autocannon, MAG	30x100mm, 6xAT-10 ATGM, 375x30mm, 4500x7.62mm

*Belly armor is 4.

**See above for Crew rating.

***Belly armor is 5, except under the driver and turret (and commander if separate), where it is 6.

BMT-72/BTMP-84

Notes: These two highly-unusual vehicles are both HIFVs (Heavy Infantry Fighting Vehicles); however, while most HIFVs merely use a tank chassis and hull modified into a heavy APC with perhaps a new turret armed with IFV-type armament, the BMT-72 and BTMP-84 go much further than this. These two vehicles meld together a tank and an HIFV, carrying a small infantry squad and yet still retaining a modified form of the turrets of their parent tanks, and carrying a reduced load of standard tank main gun ammunition. While this means that the space for the infantry squad is very cramped, and the squad carried is rather under-strength, the resulting vehicle has the virtue of being able to deliver a small squad of troops to assault a fortified position while having very heavy fire support. The BMT-72 is based on a Ukrainian-built T-72M1 tank, while the BTMP-84 is based on the T-84 tank. In both cases, the hull is lengthened by adding another roadwheel and lengthening the rear of the hull accordingly. The turret, though it appears to be more forward on the resulting vehicle, is therefore actually in the same place as on the tank upon which it is based. There are three hatches behind the turret, one which opens to the left, one to the right, and the center one, which opens against the turret. Each has two vision blocks in them, which allow the troops inside to do little more than peek outside for a narrow-angle view. The turret cannot rotate with the hatches open, and the hatches can be opened only when the turret is rotated forward. Worse yet, the tank crew has no way to close these hatches from their position; if the infantry squad leaves them open, a crewmember must get out of the tank go to the rear deck, and close them to rotate the turret. The engine remains in the rear of the vehicle, and there are no firing ports or even a rear hatchway. Steps are added to the rear fenders, and various hand and foot-holds are added to the rear and sides of the rear of the hull. These two vehicles are born of observation of the Russian experiences in Chechnya; they have been fielded by Ukraine only in small numbers, though they are offered for export (with no takers so far).

The crew positions remain unchanged from their parent tank designs. The infantry squad compartment is horribly cramped; along with the necessary equipment for the squad, five folding seats are squeezed in, two towards the turret bulkhead and facing away from it, and three on the opposite wall and facing toward the turret. The troops are literally knocking knees with each other. Most of the space in this compartment is taken up with space for their weapons, ammunition, gear such as radios, and perhaps some (very) small personal items. The infantry squad can at least take heart in that they are probably the best-protected infantry squad in the world when they are in those vehicles. Night vision is not available to the troops other than what they are carrying. However, a long road march must be nightmarish. The compartment is also air conditioned and heated (as is the rest of the vehicle), and the compartment has an NBC overpressure system with a collective NBC backup. In both cases, room has also been made for a 5kW APU to run the vehicle's systems while the engine is off. Auxiliary fuel tanks are not carried – they are too big a risk to the infantry squad.

The tank portion of the BMT-72 retains most of the features of the T-72M1, though as was mentioned before, the quantity of ammunition is reduced; essentially, the amount of main gun ammunition carried is only what is in the autoloader carousel, plus a few more stowed – 22 in the carousel and eight more stowed. The BMT-72 also adds a few other features that the T-72M1 does not have, such as the ability to aim and fire the commander's NSVT machinegun from inside the vehicle when it is buttoned up. Six smoke grenade launchers are found on each side of the turret. Thermal imaging for the gunner has been added. The power pack of the BMT-72 is the same as used on the T-84 instead of using the T-72M1's power pack; this is a smaller engine which, along with the lengthening of the hull, makes the addition of the infantry squad compartment possible, and provides 1200 horsepower. Like the T-72M1, the BMT-72 has lugs for ERA on the turret sides and front, glacis, hull sides, and the forward third of the turret roof. An inertial navigation system has been added; a BMS with GPS can be added upon customer request.

The BTMP-84 is essentially a long T-84 with the addition of an infantry squad compartment; however, owing to the generally larger size of the base T-84 tank, the infantry compartment is a bit larger, and the rear deck is a little higher than on the standard T-84 as well. Though this gives the infantry squad a little more breathing room, the primary use of the larger compartment is to carry more weapons, particularly things like breaching charges and more ammunition. It otherwise conforms to the same general principles as the BMT-72, but in T-84 form. 30 rounds are in the carousel, with six more stowed.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BMT-72	\$530,127	D, A	815 kg	50 tons	3+5	22	Passive IR (D, G, C), Thermal Imaging (G), WL/IR Searchlight	Shielded
BTMP-84	\$660,867	D, A	980 kg	48.6 tons	3+5	26	Thermal Imaging (G, C), Image Intensification (G, C), Passive IR (D)	Shielded
BMT-72 w/BMS	\$678,177	D, A	765 kg	50.2 tons	3+5	25	Passive IR (D, G, C), Thermal Imaging (G), WL/IR Searchlight	Shielded
BTMP-84 w/BMS	\$869,017	D, A	930 kg	48.8 tons	3+5	27	Thermal Imaging (G, C), Image Intensification (G, C), Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
BMT-72	159/112	36/24	1000	854	Trtd	T6	TF112Cp TS24Sp TR19 HF138Cp HS20Sp HR12
BTMP-84	161/113	36/24	1140	630	Trtd	T6	TF135Cp TS32Sp TR25 HF168Cp HS24Sp HR16*

Vehicle	Fire Control	Stabilization	Armament	Ammunition

Ukrainian Tracked APCs

BMT-72	+2	Fair	125mm 2A46M gun, PKT or KT-7.62, NSVT or KT-12.7 (C)	30x125mm, 2000x7.62mm, 450x12.7mm
BTMP-84	+4	Good	125mm KBA-3 gun, PKT or KT-7.62, NSVT or KT-12.7 (C)	31x125mm, 5xAT-11 ATGM, 1250x7.62mm, 450x12.7mm

* Turret roof armor and hull floor armor are 10Sp.

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BAE MTVL

Notes: The MTVL (Mobile Tactical Vehicle Light) is a concept originally devised by United Defense, and later taken over by BAE. The MTVL, sometimes called the M-113A3+ or M-113A4, is a stretched version of the M-113A3. The MTVL can be distinguished by its extra set of roadwheels (six pairs instead of five) and the additional armor on the hull. United Defense marketed them to the US Army as replacements for existing M-113s, but found no takers; however several countries, most notably Canada, have taken the MTVL as an addition or improvement to their armored vehicle fleet which is less expensive than IFVs.

The MTVL has a more powerful engine to cope with the increased weight, a new high-mobility suspension, and a hull armored with stronger 5083 aluminum alloy armor. Appliqué armor is also available for the MTVL, and lugs for ERA can be added. The appliqué consists of titanium/steel alloy panels for the glacis and front sides of the hull, steel plates for the sides, and a spaced laminate/steel plate for the hull floor, giving a lightweight yet strong armor increase. The MTVL has six roadwheels on each side instead of five, and is nearly a meter longer. The driver's station is similar to that of the M-113A3, being a conventional steering yoke with a brake pedal and gas pedal. The driver can remove his front vision block and replace it with an image intensifier or thermal imager. The engine is replaced with a 400-horsepower 6V-53TIA turbocharged diesel engine, and the transmission is replaced with an Allison X-200 transmission to match. The engine and transmission are electronically controlled for greater efficiency. MTVL can use the standard tracks of the M-113 (though a longer set) or wider tracks for soft terrain. The suspension itself is higher, as is roadwheel travel. The MTVL remains amphibious, though additional buoyant panels must be attached to the sides (they are composed of Styrofoam encased in aluminum – not enough to contribute to armor) and the trim vane is larger. The fuel tanks are larger than those of the M-113; they are normally at the rear of the vehicle, though Canadian MTVLs (generally called M-113A4s) have the fuel tanks in the floor of the vehicle, as experience in Afghanistan has shown that the rear-mounted fuel tanks are vulnerable to enemy fire due to their relatively light armor, and that diesel fuel is not as likely to ignite as other fuels when hit by a mine or IED. Overall layout is virtually identical to the M-113A3, except for the longer length of the MTVL. The commander's station is in the same place (except on the IFV-L), and usually armed with the same weapons – though it is normally surrounded with AV2 gun shields. On each side of the front hull are a cluster of four smoke grenade launchers. Over the rear of the hull is the customary large, rear-opening hatch, but it is a bit larger than on the M-113 and to the rear of this hatch is a domed adjustable ventilator.

In addition to the APC-type variants shown below, there are several specialist variants, which will be covered elsewhere.

The APC Variants

The standard MTVL is essentially like a larger M-113, able to carry a larger infantry squad, specialized teams like dismount ATGM or SAM teams, or lots of cargo to forward areas. The commander's station is as described above, and is normally armed with an M-2HB. A variant of this commander's station is an Israeli-designed Rafael OHWS, also armed with an M-2HB; in this case the commander is also a gunner who sits in the hull under armor, and aims and fires his weapon through a downlinked monitor. Reloading the M-2HB in this case is from inside the vehicle, again under armor. The ammunition complement is generally the same as that of the M-113, though of course the MTVL could theoretically carry more extra ammunition. In practice, most countries using the MTVL use a normal size of infantry squad, but carry more ammunition and heavy weapons for their infantry squad.

Two other versions of the MTVL also exist, though neither has had any takers so far. The IFVL (Infantry Fighting Vehicle – Light) is a more heavily-armed APC version of the MTVL. The normal commander's station is not fitted; in the center front of the vehicle is one-man turret mounting an M-242 Chaingun and M-240D machinegun in a fully-stabilized mount, with aiming assistance from a laser rangefinder and ballistic computer. The turret has a full-range of vision and night vision devices, including magnified sights and vision blocks, day/night TV, and thermal imaging. As with the MTVL hull, the IFVL turret can take appliqué armor plates. Existing MTVL's can be converted to IFVLs by replacing the hull top. The size of the infantry squad carried is necessarily reduced by the space taken up by the turret and ammunition. The IFVL was considered for use by the US Army's then-new IBCTs, but ultimately the Stryker was selected instead.

A heavier version of the IFVL is also built, though it is too called the IFVM (Medium). This version is topped by the complete turret of an M-2A3 Bradley (though in earlier iterations, the turret of earlier versions of the Bradley were used). This turret cannot take appliqué armor like the MTVL hull can. The turret retains the full capabilities of the Bradley turret. The result is similar to the Egyptian Infantry Fighting Vehicle, though the Egyptians arrived at their vehicle from a different process (they extended an M-113A2 hull, updated it to M-113A3 standards, and then installed an upgraded engine and transmission). The EIFV therefore does not have the ground clearance of the IFVM, most production versions of the EIFV do not have the horsepower of the IFVM, and the hulls do not have quite the armor protection of the IFVM. So far, there has been no interest in this version of the IFVM except by Egypt, who is considering replacing their EIFV in production with it. It is a heavy vehicle with corresponding performance, despite the more powerful engine.

The Mobile Tactical Vehicle Light, Cargo Carrier (MTVC)

The MTVC is sort of a "stripped out" version of the MTVL, optimized for carrying bulk cargo instead of troops. It retains the commander's station, though the commander's station is not normally ringed by gun shields as they would interfere with the rotation of the cargo crane from some angles. The commander's station itself has been moved somewhat more to the right and forward to further inhibit interference with the crane. Behind the commander's station, the MTVC has only a flatbed section with only the sides retained (with reduced armor), equipped with numerous tie-down and lock-down points and with rollers in the bed to help off-load containerized and palletized cargo. The MTVC also carries sets of stabilization blocks as well as small ramps to help off-load cargo; in the rear, these fold up then the vehicle is in motion. On each side is a large double door to help quickly off-load smaller cargoes. Next

to the commander's section, behind the driver, is a space with lockers and slide-out drawers for crew gear and a maintenance tool set. Surprisingly, the MTVC can take appliqué armor on the front and even the sides, though the side appliqué will block the access doors. Finally, the MTVC has a winch/crane on the left side at the rear which folds along the left side; this crane has a capacity of 1.6 tons at a reach of 6.3 meters.

The MTVC can be quickly converted into an engineer variant, the MTFV (Mobile Tactical Vehicle Light, Fitter's Vehicle). All that is required is a small refit inside the cargo bed and the installation of thicker floor plates. MTVCs typically use add-on flotation panels on the sides only when carrying 3.5 tons or greater; these also block the use of the side doors.

The MTVCP (Mobile Tactical Vehicle Light, Command Post)

This is essentially the "M-577" version of the MTVL, and most of what applies to the M-577A3 also applies to the MTVCP. Some of the M-577A3 particulars will be reproduced here for convenience.

The most obvious difference from the MTVL is the raised roofline; behind the driver's position, the roof has been raised by over 64 centimeters, allowing those inside to stand upright. There are work shelves on each side of the vehicle. Attached to these work shelves are folding wooden extensions (in two sections on each side). The vehicle commander's position was also radically changed; the MTVCP has no commander's cupola, though a pintle-mounted machinegun is optional (I have included one in the stats below). Instead, the MTVPC has a hatch in the roof that is about 25% larger than an MTVL's commander's hatch, making it large enough for large pieces of equipment (such as observation devices and designators) to be moved into and out of the vehicle from the top hatch. The commander's seat has been removed, replaced with a simple folding metal stand. The commander's hatch also has no vision blocks. The MTVPC, like a standard M-113 or MTVL, does have a bracket beside the driver for his M-16 or M-4, another bracket above the rear ramp (on the inside) that will hold an M-16/M-4, an M-60 machinegun, an M-240 machinegun, or an M-249 SAW. Below this is another bracket that will hold an M-16/M-4 or an M-249.

The passenger compartment has folding bench seats on either side of the passenger compartment. At the front of the raised roofline, to the right of the driver's position and in the center of the front deck, is an enclosed metal box permanently attached to the MTVPC; this is designed for a 5 kW gasoline-powered generator to power the electrical equipment without having to run the engine for long periods of time. This generator is not designed to be removed from the vehicle, and the controls for the generator are inside the passenger compartment in front of the commander's position. The generator can operate from its own fuel tanks or the vehicle's fuel tanks.

Other items which may be found (depending on configuration and purpose) on the MTVPC include a 3x3 cabinet with several drawers and a fold-out table; 3-5 folding metal chairs; a 1.2x1.8-meter map board that attaches to the right inner wall of the vehicle; and a variety of shelves (and ways to mount them) for the equipment the MTVPC carries. An MTVPC generally carries several radios; including two short-range, two medium-range, and one long-range radio; the medium-range and short-range radios are typically data-capable. Inside the MTVPC are both white lights and blackout lights to light up the interior. Though they may not all be used at the same time, there are mounts for up to five antenna aerials; in addition, a very-long-range antenna may be mounted in a bracket at the front of the raised section to the left and rear of the driver. A 10-meter telescoping antenna at the left rear is an option on the MTVCP. A ruggedized laptop computer is carried. At the rear of the vehicle, on either side of ramp on the outside, are connections for four field telephones, two generators, and two pairs of conventional electrical outlets to allow other equipment to feed off of the MTVCP (generally done only if the MTVCP is itself feeding from a generator). Something that is standard equipment is a work area-extension tent and poles; these attach to the rear of the MTVCP, and add approximately 4x5 meters of enclosed workspace. When not in use, these stow in special brackets and lash-down points atop the ramp entrance. The MTVCP can take appliqué armor, though the side appliqué armor is necessarily of a different size than the side appliqué for the MTVL. The MTVCP retains its amphibious capability.

Twilight 2000 Notes: These vehicles were primarily used by US National Guard and reserve formations in the Twilight 2000 timeline.

Merc 2000 Notes: These vehicles were popular as they offered more power and protection than an M-113, but were less expensive.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTVL (Standard)	\$156,363	D, A	2.1 tons	18.1 tons	2+13	10	Image Intensification or Thermal Imaging (D)	Shielded
MTVL (Standard) w/Appliqué	\$163,257	D, A	1.9 tons	18.9 tons	2+13	11	Image Intensification or Thermal Imaging (D)	Shielded
MTVL w/OHWS	\$175,088	D, A	2 tons	18.2 tons	2+12	11	Image Intensification or Thermal Imaging (D), Image Intensification (C/G), Thermal Imaging (C/G)	Shielded
MTVL w/OHWS & Appliqué	\$181,982	D, A	1.8 tons	19 tons	2+12	12	Image Intensification or Thermal Imaging (D), Image Intensification (C/G), Thermal Imaging	Shielded

IFVL	\$190,409	D, A	1.9 tons	18.4 tons	2+10	10	(C/G) Image Intensification or Thermal Imaging (D), Image Intensification (C/G), Thermal Imaging (C/G)	Shielded
IFVL w/Appliqué	\$197,303	D, A	1.6 tons	19.2 tons	2+10	11	Image Intensification or Thermal Imaging (D), Image Intensification (C/G), Thermal Imaging (C/G)	Shielded
IFVM	\$312,097	D, A	1.4 tons	20.9 tons	2+8	12	Image Intensification or Thermal Imaging (D), FLIR (D, C), 2nd Gen FLIR (G)	Shielded
IFVM w/Appliqué	\$318,991	D, A	1.1 tons	21.7 tons	2+8	13	Image Intensification or Thermal Imaging (D), FLIR (D, C), 2nd Gen FLIR (G)	Shielded
MTVCP	\$229,862	D, A	1 ton	18.8 tons	2+6	12	Image Intensification or Thermal Imaging (D)	Shielded
MTVCP w/Appliqué	\$237,101	D, A	900 kg	19.7 tons	2+6	13	Image Intensification or Thermal Imaging (D)	Shielded
MTVC	\$107,891	D, A	7 tons	16.3 tons	2	8	Image Intensification or Thermal Imaging (D)	Shielded
MTVC w/Appliqué	\$111,338	D, A	6.9 tons	16.9 tons	2	9	Image Intensification or Thermal Imaging (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
MTVL (Standard)	162/113	34/27/3	492	215	Std	T3	HF9 HS7 HR4*
MTVL (Standard) w/Appliqué	156/104	33/26/3	492	224	Std	T3	HF11Sp HS9Sp HR4**
MTVL w/OHWS	162/113	34/27/3	492	215	CiH	T3	TF4 TS4 TR4 HF9 HS7 HR4*
MTVL w/OHWS & Appliqué	156/104	33/26/3	492	224	CiH	T3	TF4 TS4 TR4 HF11Sp HS9Sp HR4**
IFVL	159/111	33/26/3	492	219	Trtd	T3	TF6 TS6 TR4 HF9 HS7 HR4*
IFVL w/Appliqué	153/106	32/25/3	492	228	Trtd	T3	TF7Sp TS6Sp TR4 HF11Sp HS9Sp HR4**
IFVM	141/98	30/23/3	492	247	Trtd	T3	TF11 TS8 TR6Sp HF9 HS7 HS4*
IFVM w/Appliqué	134/94	28/22/3	492	258	Trtd	T3	TF11 TS8 TR6Sp HF11Sp HS9Sp HR4**
MTVPC	155/108	33/26/3	492	224	Std	T3	HF9 HS7 HR4*
MTVPC w/Appliqué	149/104	31/25/3	492	234	Std	T3	HF11Sp HS9Sp HR4**
MTVC	180/124	37/30/4	492	194	Std	T3	HF9 HS2 HR1***
MTVC w/Appliqué.	173/121	36/27/4	492	200	Std	T3	HF11Sp HS4 HR1****

Vehicle	Fire Control	Stabilization	Armament	Ammunition
MTVL (Standard)/MTVC/MTVCP	None	None	M-2HB (C)	2000x.50
MTVL w/OHWS	+2	Good	M-2HB (C/G)	2000x.50
IFVL	+3	Good	25mm M-242 ChainGun, M-240C	600x25mm, 3300x7.62mm

IFVM	+3	Good	M-242 25mm ChainGun, M-240C, 2xTOW II Launchers	720x25mm, 2200x7.62mm, 5xTOW II
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*Hull floor for this version is 4.

**Hull floor for this version is 6Sp.

***The cab side AV is 5; the cab rear armor value is 3. The armor value shown for the sides and rear of the vehicle are for the rear cargo section only. The overhead part of the cab has standard AV value (2); the rear section is open. The "Shielded" radiological value applies only to the cab of the vehicle, the rest is "Open." The floor AV of 4 applies to the entire vehicle.

****The above applies to the MTVC w/Appliqué, except that the appliqué gives the cab section a side AV of 9Sp.

FMC LVTP-5

Notes: Once the standard tracked amphibious carrier of the US Marines, the LVTP-5 is now used (in the LVTP-5A1 version) only by Chile, the Philippines, and Taiwan. It was designed shortly after World War 2 and was meant to provide invading Marines with protection during amphibious assaults. The LVTP-5 is a progressive evolution of the LVT-1 to 4 series, is considerably larger, able to carry a full-strength Marine platoon of the time. The LVTP-5 is long, wide and flat, and carries a large amount of troops and equipment. The LVTP-5 has a decent amount of armor for an APC of its period, but is slow in the water and vulnerable there. The inverted V-shaped bow, however, can shrug off most small arms and some autocannon fire; the hull front armor value also applies to this bow, even the underside. The LVTP-5 was never considered satisfactory by the US Marines, who cited its lack of speed, protection levels, and range, as well as operating restrictions; however, the Marines continued using it until 1974, primarily since there was no more satisfactory replacement until then. The LVTP-5A1 is largely similar, but the air intake and exhaust system were modified to further ease amphibious operations and the air intake and exhaust inlets and outlets on the roof are modified in form, being in a large housing. A number of variants of this vehicle were built; APC-type variants include the basic LVTP-5 personnel carrier and the LVTC-5 command post carrier.

The Marines access the vehicle through a large ramp in the rear, and the driver and commander have their own hatches on the front hull deck. (The assistant driver does not have a hatch of his own, though he does have vision blocks.) The commander has a manually-rotating cupola mounting a light machinegun mounted as part of the cupola. The troop compartment has two long hatches over that compartment. The troop compartment is actually large enough to carry a 105mm towed howitzer. 45 troops may be carried in an emergency, but all the troops must stand in this case. When water operations are carried out, however, the maximum troop compliment is reduced to 25 Marines, primarily due to weight balance requirements; the rear end would sink with more troops inside.

The command version carries a command crew, map boards, plotting and office supplies, and a number of radios (usually two short-range, two medium-range, and two long-range radios).

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
LVTP-5	\$31,132	G, A	5.44 tons	37.4 tons	3+34	22	Headlights	Shielded
LCTC-5	\$35,456	G, A	2.72 tons	37.6 tons	3+9	25	Headlights	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
LVTP-5/LVTC-5	146/102/33	31/24/7	1726	511	CIH	T4	TF2 TS2 TR2 HF9 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
LVTP-5/LVTC-5	None	Basic	M-1919A4 or M-60D	2000x.30-06 or 2000x7.62mm

FMC M-59

Notes: The M-59 entered service in 1953 as the replacement for the less-than-satisfactory M-75 APC; however, the M-59 proved troublesome and disappointing, and work began within a few years on what would become the M-113. Though the M-59 accomplished one goal of the program (it was less costly in real-life dollars), the use of twin engines and the associated complicated transmission led to a drive train that was difficult to service and was prone to breakdowns; it was also very difficult for the driver to operate. The armor protection was also less than that of the M-75; it in fact gave the troops inside more of a feeling of protection than any substantial protection. The pair of engines also had disappointing power production and the gasoline used to fuel it led to high fuel consumption and short range. The M-59 was, however, built until M-113 production began in 1960 and used until M-113 deployment was well underway in 1965; the National Guard also used some until the early 1970s. The only known variant to enter production was the M-84 4.2" mortar carrier, which will not be covered on this page; a version, not put into production, was used as an experimental ATGM carrier for SS-10 ATGMs. Small numbers of the M-59 are reportedly used by militia/home guard-type forces in Brazil, Greece and Turkey.

Though the M-59 bears a superficial resemblance to the M-113, this is appearance only and the two vehicles are not related. The M-59 has a blunt nose with a slightly-sloped glacis plate, a vertical plate below that, and another plate angled in below that to the hull floor. On the glacis plate is a trim vane; the M-59 is (supposedly – see below) amphibious with 2 minutes of preparation, including erecting that trim vane and turning on bilge pumps). The sides are straight and the entire vehicle basically a poorly-armored box. On

the top front right is a commander's cupola, manually-rotating, circled by vision blocks, and with an integral, hard mount for a machinegun (or a simple cupola with an external pintle-mounted machinegun on early versions). The machinegun can be aimed, fired, and loaded from under armor, though the interior sights are rather poor and have a notably narrow field of view. The front of the cupola has the weapon in it, and the rear of the cupola has a clamshell hatch. This standard cupola, the M-13 cupola, allowed for additional ammunition stowage; earlier versions carried less ammunition for the machinegun. The driver's position is on the front left; he has three vision blocks to the front; an additional vision block on the top of the hatch could be removed and replaced by a night vision block. Access to the troop compartment is by a ramp with a door in the rear face; this door is surprisingly small. Atop the troop compartment are two long hatches on either side of the compartment. Down each side are bench seats. The interior is surprisingly spartan; though I have included a standard vehicle radio fit below, radios were not necessarily a design feature at the time. The compartment, however, is of surprising size; with the bench seats folded, a Jeep could be driven into the M-59, and just enough room is left to close the ramp.

The engines, being rather small, are in the walls of the troop compartment, one on each side of the hull. These engines, commercially-available truck engines, develop 146 horsepower each, and are linked by a common transmission in a rather complicated system. As stated above, the maintenance needs of servicing two engines which were not conveniently-placed, along with the complicated transmission which was underneath the vehicle, led to a vehicle that was unreliable and difficult to service. The use of gasoline-fueled engines seriously decreased the range of the M-59, even with the large fuel tanks, and the M-59's high weight made those engines and transmission work hard. The suspension, using conventional torsion bars and two pairs of shock absorbers, also worked hard. The driver also worked hard, using tillers for steering and braking, a gas pedal, and a clutch pedal as well as fighting the balky transmission. Amphibious operations, while theoretically easy, were in fact only possible through careful balancing of the vehicle beforehand and by ensuring that the troops in the rear remain very still while the M-59 is afloat.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$53,631	G, A	1.4 tons	19.3 tons	2+10	16	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
123/86	21/13/2	511	165	Std	T3	HF4 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	2205x.50 or 1470x.50 w/early cupola

FMC/GDLS LVTP-7/AAVP-7

Notes: Though development of what would become the AAVP-7 began in 1964, it was the first year of US involvement in Vietnam that really brought home to the Marines the shortcomings of the LVTP-5 series and the need for a better amphibious APC. The Marines quickly discovered that the LVTP-5 had a number of problems – its torsioelastic suspension, while it provided a comfortable ride over water and shore conditions such as rocks, sand, and reefs, was ill-suited for long trips and thus subject to frequent breakdowns. The LVTP-5 used the transmission and engine of the M-48 main battle tank – great for power, but not suited in the LVTP-5's configuration; it could take a day or more to replace the power pack, and even routine service could require pulling out large amounts of the power pack just to get to the components to be serviced. Perhaps the greatest problem with the LVTP-5 as used in Vietnam lay with the fuel system; the tanks were under the floor, the engine ran on gasoline, and as the entire vehicle was lightly armored in the first place, even an antipersonnel mine explosion could sometimes turn the interior into a fiery slice of hell.

Because many of the LVTP's problems were caused by improper employment of the vehicle, the Marines wanted something new that could take on roles Amtracs of the past could not. One of the first things to go was the torsioelastic suspension, replaced with a conventional torsion bar suspension on what was then called the LVTP-7 (later changed to AAVP-7). The armor protection was considerably upgrade, using the same 5083 aluminum armor that was used on the M-113 series. The engine chosen was a supercharged 400-horsepower 8V53T diesel truck engine with an HS-400 transmission; more importantly, the powerpack was a unified unit that could easily be lifted out of the vehicle in a matter of minutes with the proper equipment. The transmission was semiautomatic – it required no clutch, but still required gear selection on the part of the driver. The tracks were almost 54 centimeters wide for traction on soft sand as well as marshy conditions, and water propulsion was provided by two waterjets at the rear. Many other ideas were added, thrown out, or modified, and that, combined with political wrangling, meant that first deliveries of the LVTP-7 did not occur until 1972.

The LVTP-7 has a 3-man crew (driver, assistant driver, commander), and seated 25 Marines in the passenger compartment in the rear. The driver's position is in the left front of the hull, behind the engine compartment, with the commander's cupola behind and to the right of the driver. The assistant driver is on the opposite side of the hull from the driver, with a second set of driving controls. The officer or NCO in charge of the Marines in the rear has his own cupola to the rear of the driver's hatch. The driver's position as well as the OIC/NCOIC cupolas have seven periscopic vision block, and the commander's cupola has nine; the front vision blocks at each position can be removed and replaced with an infrared night periscope. (There is no such provision at the assistant driver's position.) In the rear ramp is a further vision block. In the passenger compartment, the remaining 24 Marines are seated in three rows of eight; all of the seats can be stowed away, clearing the compartment for cargo. The fuel tanks are in the walls of the vehicle. The commander's cupola of the prototypes was armed with a 20mm M-139 autocannon and an M-73E1 7.62mm machinegun. The production versions, however, replaced these weapons with a single M-85 heavy machinegun with an 8x optical sight in a smaller

cupola. An attempt was made on the prototypes to provide firing ports for the passengers, but these could not be squared with the need to maintain the watertight integrity of the hull. The rear deck has two large hatches, and the rear has a ramp with a door in it.

APC variants of the basic LVTP-7 include the LVTC-7 Command Vehicle. This version has provisions for up to seven radio antennas and a plethora of radios and communications equipment. The driver, assistant driver, and vehicle commander's position are retained, but the cupola for the Marine troop commander is deleted and covered with an armored cap that is bolted on (though the vision blocks remain in place). As with the LVTP-7, the LVTC-7 vehicle commander's cupola had a single M-85 machinegun, but in later production this cupola was unarmed so that other equipment could be stowed in the places that once held ammunition. In addition to the vehicle crew, the modified rear passenger area has a standard crew of one unit commander, four staff personnel, and five Marines to operate the communications equipment, assist the command staff, and perform other duties. There is a bench seat on the right side for these five crewmen; there is also a sliding mapboard and the communications equipment at this station. Various drawers, a folding table, and other ancillary equipment are also provided. Additional seats are found at the former troop commander's position, at the front next to the unit commander's seat, and at the rear of the vehicle.

Though the Marines expected to have the LVTP-7's successor operational by the mid-1990s, delays, funding difficulties, and continuing research on the LVTP's replacement considerably delayed its replacement (the ERV, which hasn't yet been fielded). Therefore, in the early 1980s, a SLEP (Service Life Extension Program) was started, turning the LVTP-7 into the LVTP-7A1. This SLEP included replacement of the power pack and suspension, a new communications system based around the SINCGARS radio, upgraded protection, and a general overhaul of the vehicle. The engine was replaced by a 400-horsepower VT400 multi-fuel engine and a modified form of the old transmission called the HS400-3A1. The commander's cupola was given an electric drive and the cupola enlarged slightly into a small turret with slightly-increased armor protection, along with eight smoke grenade dischargers. The shock absorbers were considerably upgraded, and shock absorbers were installed on the second set of roadwheels (where there had previously been none). Fuel tanks were replaced by flexible fuel bladders contained within the vehicle walls; these bladders are a bit further out from the passenger compartment walls and have self-sealing ability. The LVTP-7A1 was given the ability to lay a smoke screen by injecting diesel fuel into its exhaust. The assistant driver was given a night vision periscope. The bilge pumping system was given considerably more power. The LVTC-7 was given the same improvements and became the LVTC-7A1 (with the exception of the commander's weapon station).

In 1984, during a vehicle and equipment designation change that affected many vehicles and equipment, the LVTP-7A1 was redesignated the AAVP-7A1. Any older LVTP-7s still in existence were redesignated AAVP-7. The LVTC-7 and LVTC-7A1 were redesignated AAVC-7 and AAVC-7A1 respectively. At this point, the commander's weapon stations were replaced with small turrets equipped with both an M-2HB heavy machinegun and a 40mm Mk 19 automatic grenade launcher. Appliqué armor packages (designed by Rafael of Israel) were also devised for the AAVP-7 series, along with lugs for ERA; in addition, a steel mesh-type appliqué armor kit has been deployed on the AAVP-7A1. The bow plane was also modified to compensate for the weight and unbalancing effect of the appliqué armor when the AAVP-7A1 series is swimming.

Some interesting firepower upgrades were proposed for the AAVP-7A1. One of these was to replace the heavy machinegun with a 25mm M-242 Bushmaster autocannon, along with enlarging the turret. Another one (apparently seriously looked at) was to mount the turret of an M-2 Bradley on the AAVP-7A1. I have some stats for these below, but they never actually went past the conceptual phase.

The LVTP-7 and its descendants are typically called "Amtracs" or less commonly, "Gators" by their crews. Italy's San Marcos Marines, Taiwan, Thailand, and Argentina are also known users of the LVTP-7 series.

Twilight 2000 Notes: In the Twilight 2000 timeline, virtually all of these vehicles are up to the AAVP/AAVC-7A1 standard in US use. Some other countries using them (such as Taiwan, Thailand, and Argentina) are using primarily LVTP/LVTC-7A1s and some LVTP/LVTC-7s. Some older LVTP-7s and LVTP-7A1s were refurbished early in the Twilight War and brought up to AAVP/AAVC-7A1 standards, but every so often (primarily in the Southern US) one may see an older LVTP/LVTC-7 in US hands. Italy's San Marcos Marines are also known users of the AAVP-7A1. Perhaps 15% of the US Marines' AAVP-7A1s are actually modified to the AAVP-7A1/25mm standard; these are called AAVP-7A2s.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
LVTP-7	\$126,578	D, A	4.05 tons	22.48 tons	3+25	5	Passive IR (D, C, UC)	Shielded
LVTC-7 (Early)	\$139,665	D, A	5.55 tons	21.32 tons	3+10	8	Passive IR (D, C, UC)	Shielded
LVTC-7 (Late)	\$128,698	D, A	5.61 tons	21.25 tons	3+10	8	Passive IR (D, C, UC)	Shielded
LVTP-7A1	\$82,016	D, A	4.05 tons	23.35 tons	3+25	6	Passive IR (D, AD, C, UC)	Shielded
LVTP-7A1 w/Appliqué	\$89,998	D, A	3.05 tons	25.25 tons	3+25	7	Passive IR (D, AD, C, UC)	Shielded
LVTC-7A1/AAVC-7A1	\$255,924	D, A	5.55 tons	22.66 tons	3+10	9	Passive IR (D, AD, C, UC)	Shielded
LVTC-7A1/AAVC-7A1 w/Appliqué	\$263,906	D, A	4.55 tons	24.66 tons	3+10	9	Passive IR (D, AD, C, UC)	Shielded
AAVP-7A1	\$107,154	D, A	4.05 tons	25.25 tons	3+25	6	Passive IR (D, AD, C, UC)	Shielded
AAVP-7A1 w/Appliqué	\$115,136	D, A	3.05 tons	27.25 tons	3+25	7	Passive IR (D, AD, C, UC)	Shielded

AAVP-7A1/25mm	\$222,119	D, A	4.05 tons	25.43 tons	4+20	6	Passive IR (D, AD, C, UC, G)	Shielded
AAVP-7A1/25mm w/Appliqué	\$230,101	D, A	3.05 tons	27.43 tons	4+20	7	Passive IR (D, AD, C, UC, G)	Shielded
AAVP-7A1/Bradley Turret	\$384,899	D, A	3.5 tons	26.7 tons	4+18	7	Passive IR (D, AD, UC), Thermal Imaging (C, G)	Shielded
AAVP-7A1/Bradley Turret w/Appliqué	\$392,881	D, A	2.55 tons	28.7 tons	4+18	8	Passive IR (D, AD, UC), Thermal Imaging (C, G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
LVTP-7	125/88/26	25/15/5	681	284	Std	T4	HF8 HS6 HR4
LVTC-7 (Early)	128/90/27	26/15/5	681	284	Std	T4	HF8 HS6 HR4
LVTC-7 (Late)	128/90/27	26/15/5	681	284	Std	T4	HF8 HS6 HR4
LVTP-7A1	126/88/26	25/15/5	681	284	Std	T4	HF10 HS7 HR5
LVTP-7A1 w/Appliqué	115/81/24	23/14/5	681	297	Std	T4	HF10 HS10Sp HR5
LVTC-7A1/AAPV-7A1	121/85/25	24/15/5	681	276	Std	T4	HF10 HS7 HR5
LVTC-7A1/AAPV-7A1 w/Appliqué	116/81/24	23/14/5	681	288	Std	T4	HF10 HS10Sp HR5
AAVP-7A1	115/81/24	23/14/5	647	284	CiH	T4	TF6 TS6 TR5 HF10 HS7 HR5
AAVP-7A1 w/Appliqué	111/78/23	22/14/5	647	295	CiH	T4	TF6 TS6 TR5 HF10 HS10Sp HR5
AAVP-7A1/25mm	114/80/24	23/14/5	647	287	Trtd	T4	TF6 TS6 TR5 HF10 HS10Sp HR5
AAVP-7A1/25mm w/Appliqué	110/77/23	22/13/5	647	298	Trtd	T4	TF6 TS6 TR5 HF10 HS10Sp HR5
AAVP-7A1/Bradley Turret	113/79/24	23/13/5	647	289	Trtd	T4	TF 11 TS8 TR6Sp HF10 HS7 HR5
AAVP-7A1/Bradley Turret w/Appliqué	109/76/23	22/13/5	647	300	Trtd	T4	TF 11 TS8 TR6Sp HF10 HS10Sp HR5

Vehicle	Fire Control	Stabilization	Armament	Ammunition
LVTP-7	+1	None	M-85	800x.50
LVTC-7 (Early)	+1	None	M-85	500x.50
LVTC-7 (Late)/LVTC-7A1/AAPV-7A1	None	None	None	None
LVTP-7A1	+1	None	M-85	800x.50
AAVP-7A1	+2	Fair	M-2HB, Mk 19	500x.50, 96x40mm
AAVP-7A1/25mm	+2	Fair	25mm M-242 Chaingun, M-240C	400x25mm, 1000x7.62mm
AAVP-7A1/Bradley Turret	+2	Fair	25mm M-242 Chaingun, M-240C, 2xTOW II ATGM	400x25mm, 1000x7.62mm, 5xTOW II ATGM

FMC/GDLS M-2 Bradley

Notes: When the Russian BMP-1 was first revealed to the West in 1967, it was a huge shock to NATO – they thought that the Soviets had a new class of armored personnel carrier that was easily better than anything they had, with armament that allowed the BMP-1 to defeat NATO's APC and light armored vehicles and possibly even some tanks, as well as allowing their infantry to fight on an NBC battlefield. This was before some of the shortcomings of the BMP-1 were known; however, the essential point was clear – NATO's "battlefield taxis" were no longer up to the task for most purposes. On top of that, it was clear that the M-113 series could not keep up with the speedy M-1 Abrams in the attack. Though most NATO countries were quick to follow up on the new concept of IFVs (Infantry Fighting Vehicles), the US took nearly 15 years of budget wrangling and infighting between the Infantry and Cavalry branches of the Army to field an IFV – the M-2 Bradley.

The M-2 and M-2A1 Bradley

The original version of the Bradley, the M-2 (sometimes referred to as the "A0" version), was first issued to US Army troops in 1981 (though they were not considered operational until December of 1983). The most marked difference between the Bradley and previous US personnel carriers was its turret with its heavy armament. The Bradley uses a two-man turret, with the gunner operating a 25mm M-242 ChainGun (called the Bushmaster) and a twin TOW missile launcher contained in an armored box on the left side of

the turret. The commander (called a "BC" by Bradley-mounted infantry, for "Bradley Commander") has no pintle-mounted armament on his hatch, as his weapon is considered to be the coaxial M-240C machinegun. The gunner also has controls for the coaxial machinegun, however, and the commander has auxiliary controls for the ChainGun (though not the TOW missiles). Both the gunner and commander have roof hatches with periscope-type vision blocks (the gunner has them to the left side, front, and about 30 degrees to the right side; the commander's hatch is completely ringed with vision blocks), with no magnification. However, the gunner's front periscopes are completely blocked by the head of his weapon sight in its armored box. The gunner has a 5x/12x image intensifier/thermal imager to use in conjunction with his gun/missile sight; the commander can also use this sight through an optical relay. The commander and gunner also have simple magnified reticle gunsights to take quick shots with the ChainGun or coaxial machinegun at close-range targets, and these simple sights can be used from an open hatch if necessary. Both also can share an auxiliary 5x telescopic sight. The commander's and gunner's hatches may be locked fully open (i.e. 90 degrees), or locked open to a little less than half that, letting them sort of peek outside with minimal exposure. The turret is capable of two rotation rates; 30 degrees per second is considered a standard rotation rate, but a high-speed 60 degree-per-second rate is also available. The turret can also be rotated manually, and the gun and coax elevated and depressed manually, in the case of electrical failure. Once a target is just about lined up, fine adjustments to the direction the turret is pointed can also be made if necessary.

The ChainGun and the coaxial machinegun can be elevated to +59 degrees (+57 on the M2A1 and later) and depressed to -9 degrees. They cannot be independently elevated or depressed. Both are stabilized for fire on the move, at a full clip. This was thought to be adequate when the Bradley was designed, though urban warfare in Iraq has shown that in the case of elevation, it's not enough. Ideas were floated to try to increase the elevation, but the construction of the turret simply makes this impossible. (This has led to an experimental retrofit of an external M-249 SAW [see below], and BCs are sometimes seen with M-16s or SAWs in their hands, or even the excess M-231 port firing weapons that have fallen into almost-complete disuse with the M-2A2 and later versions of the Bradley.) The M-242 is unusual for a vehicle-mounted autocannon in that it can be set for semiautomatic fire; two other fire rates are available for the M-242 – 100 rpm and 200 rpm. The M-242 is a dual-feed weapon, and the gunner may switch between belts with a simple flick of a switch (though for game purposes, and to simplify things, ammo from only one belt may be fired per semiautomatic shot or burst). The M-242 is electrically powered, but the M-240C coaxial is a variant of the standard M-240B infantry model, with spade grips and a sort of chute to vent the gasses of the fired rounds outside. The spent cases from the M-240C are caught in a bag attached to the machinegun; spent cases from the ChainGun are automatically dropped outside the turret through a slot forward of the "mantlet;" a rotating mechanism cycles during operation of the ChainGun and case "ejection" is part of this cycle. A pair of four-barreled, electrically-triggered smoke grenade launchers is found at the front of the turret, with one pair of launchers found on either side of the main gun and coaxial. Above these launchers are boxes which contain eight more grenades each. Originally, the Bradley could lay a thick, oily smoke screen by injecting diesel fuel into its exhaust, but with the change in the US military to a common fuel of JP-8 jet fuel, this capability has become superfluous, as injecting JP-8 into the exhaust won't produce a smoke screen. Nonetheless, the Bradley still retains this capability (though today it is normally disabled).

The TOW launcher's armored box is on the left side of the turret. It should be noted that while the box is armored, it is not as well-protected as the turret itself; its armor rating should be considered only 4 from the left side, and 2 from the front or rear. For firing, the box swings upwards to the side 90 degrees; about 10 seconds at a minimum are required by a good gunner to raise the launcher to firing position and take a shot. Though the TOW launcher box itself can be elevated to a significant degree and even depressed a little (+29 and -19 degrees), the TOW missiles cannot be controlled effectively in flight unless the launcher no more than +10 degrees and -0 degrees from being horizontal to the ground, due to the wire guidance of the TOW-series missiles for which the Bradley's launcher is designed. (The M-2 Bradley TOW launcher is designed for TOW-1 series missiles.) Reloading of the launcher box is done by turning the turret to left a small amount (less than 5 degrees) and elevating the launcher box to its maximum elevation. Behind the turret on the rear deck is a narrow rectangular hatch that opens just enough for the crew or infantrymen in the rear to slide more missiles into the launcher box (i.e., one cannot stand up in that hatch and can just barely even peek out of it). If a TOW is in flight, the BC's fire and turret rotation controls are locked in order to avoid a spoiled shot; the gunner also cannot rotate the turret if a TOW is in flight (though he can abort the TOW missile if necessary). After the TOW hits its target (or the gunner aborts), the guiding wires release from the launcher and fall off. It should be noted that the TOW launcher cannot be used on the move; the Bradley *must* be stationary in order to fire the TOW launcher.

The passenger compartment is for the most part in the rear of the Bradley, though two of the dismount infantrymen have seats on the left side of the turret. Though the entire passenger compartment is *really* cramped, those two seats are even *more* cramped. The rearmost passenger seat is in a particularly small space (one generally puts the smallest man back there), and that man is sitting with his back to the driver with only about a half a foot separating him from knocking heads with the driver. (When I was in mech infantry, this was often called the "die-in-place" seat...). In the M-2 Bradley, there are four more passenger seats; one on the left side facing forward, one on the left side facing to the rear, one on the left side facing to the rear, and one between those two facing to rear (generally used by the squad leader, who is also part of the dismount squad). The passengers in a "plain vanilla" M-2 have firing ports and periscopic vision blocks to allow them to observe outside the vehicle, with the exception of the center rear seat, which has only a vision block. While it *is* a bit awkward, the four troops on the sides of the M-2 version have to turn sideways in their seats (this is one reason the sliding wire stocks on the M-231 port firing weapons were quickly deleted). The passenger seats can also be folded up and stowed completely out of the way. In addition, effective fire is difficult from the firing ports unless the weapons are loaded with almost entirely tracer ammunition, as vision outside the vehicle is diminished, there are no night vision devices for the firing ports, weapon sights cannot be used, and there is a slight parallax error (the periscopes actually show a field of view about a foot above the weapon and are wide-angle lenses). The rear of the passenger compartment has an electrically-lowered ramp with a hydraulic

backup, and an oval hatch is set inside the ramp on the right side. (This door has an interior lock as well as an exterior padlock; the padlock is primarily for use when the Bradley is parked in garrison to prevent unauthorized access.)

The driver is in the front right side of the vehicle, with the engine compartment to the left of him. Like all seats on the Bradley, the seats are (somewhat) padded to reduce crew fatigue, and the backrest can be folded down. The driver can enter his position from the passenger compartment, or through his overhead hatch. The driver's hatch may be locked in a 90-degree open position or open about 30 degrees; when the Bradley is in combat, the hatch is normally closed or at the 30-degree position, as the 90-degree position blocks rotation of the turret. (The turret rotation system has an interlock which keeps the turret from rotating if the driver's hatch is at the 90-degree position, in order to avoid bending the ChainGun's barrel if it were to slam into the hatch while rotating.) As the driver's hatch has as much armor as the rest of the top of the hull, it is too heavy to push open from a seated position (especially to a full 90-degree position). The hatch is therefore spring-loaded to a greater degree than the commander's or gunner's hatches.

The Bradley is protected by an aluminum alloy/steel laminate; for most of the vehicle, this armor also consists twin sections of armor spaced approximately 25mm apart to provide extra protection from HE-type projectiles. The floor of the Bradley has an additional centimeter of steel plate to increase mine protection. Track skirts with the same protection as the hull sides protect the sides; they hinge upwards for maintenance access. The M-2 version of the Bradley uses a Cummins VTA-903T diesel developing 500 horsepower; the suspension is exceptional for an APC, giving an unusually smooth ride. The M-2 version is also amphibious with preparation; about 15 minutes are required for an amphibious crossing, and requires the erection of a trim vane at the front and a flotation screen all around the vehicle.

Early experience with the M-2 revealed some shortcomings; this resulted in the M-2A1 being introduced in 1987 (though retrofitting of the central gas particulate NBC system for the driver, commander, and gunner began in May 1986). Improvements were made to the TOW missile system; these changes were primarily to allow use of the TOW-2 missile series as well as somewhat quicker target acquisition, and simplify construction and lower cost. (At first, replacement of the existing TOW launching box with a pair of non-moving launcher boxes, one on either side of the turret, was considered, but rejected as unnecessary). On the M-2 version, the turret bustle rack was angled inward; while this was ballistically more sound, it also seriously limited the storage space in the rack. The bustle rack on the M-2A1 was therefore given a square profile as well as enlarged. Ammunition storage in the bustle itself was also rearranged to allow more of the 25mm ammunition to be stored in the bustle instead of being distributed around the interior of the Bradley. Under-armor storage compartments were also added to the sides of the Bradley, though these were accessible only from the exterior of the Bradley and designed primarily for additional 25mm, 7.62mm, and 5.56mm ammunition storage. The storage for additional smoke grenades (for the grenade launchers) was removed from boxes just above the smoke grenade launchers on the turret to boxes at the rear of the vehicle on either side of the ramp; these boxes can hold a variety of mines, flares, grenades, or smoke grenades for the vehicle launchers. A thin layer of appliqué armor was added to the glacis and a small portion of the upper sides. In the interior of the M-2A1, the spall liner was improved, and a new fire suppression system was added inside the fuel tanks. The seating and stowage arrangement of the M-2A1 was rearranged, allowing for one more infantryman to be seated in the rear. The user of this seat does not have access to either a firing port or a vision block.

The M-2A2 Bradley

There had always been considerable controversy about the survivability of the Bradley. This controversy came to a head in 1984, when a series of live fire tests against M-2 versions of the Bradley were conducted. The tests were full of irregularities (for the most part in the proper combat loading of the Bradleys involved in the test), but eventually a live TOW shot against the side of a fully combat-loaded Bradley resulted in the vehicle being destroyed in a spectacular fireball. Development of the M-2A2 version of the Bradley (sometimes referred to as the Bradley II) dates to this point.

The changes from the M-2A1 to the M-2A2 were extensive, and centered around the fitting of heavier armor and lugs on the sides for reactive armor. In fact, the side armor was beefed up to the point that the sides of the Bradley were totally plated over. One immediate result of this extra armor was the loss of the side firing ports; their places on the hull were covered by the added side armor. (One vision block on either side was retained.) In addition, virtually the entire vehicle received increased armor protection – even the bustle rack was given an extra section at the rear – it can not only carry additional gear, but acts as a second layer of spaced armor. Internally, the interior of the M-2A2 was protected with an even thicker Kevlar spall liner of more modern design. The thickness of the armor on the front of the turret led to the deletion of the barrel jacket for the M-240C coaxial machinegun, and a slight redesign of the barrel extension for the M-242 ChainGun. Lugs for reactive armor blocks are found on the upper sides of the M-2A2 as well as on the glacis. These lugs can also mount bolt-on appliqué armor, bolt-on spaced armor, or the new slat armor if desired. The weight of the M-2A2 increased so much that it is no longer amphibious, and the trim vane and flotation screen have been removed. However, to cope with the increased weight, the VTA-903T was replaced with an upgraded version of the same engine, developing 600 horsepower.

Some smaller physical changes include retractable metal covers over the driver's periscopes, along with a wire guard to protect the driver from wire and obstacles strewn across the Bradley's path. Due to the changes in the frontal armor and the potential for the mounting of ERA, the design of the headlights was changed. Due to the loss of the side firing ports, the seating arrangement was again changed; on the sides of the passenger compartment, three troops sat on each side, and the "die-in-place" seat was retained. (Initially, this seat was to be removed and the dismount squad reduced back to six, but this decision was rethought.) The second seat on the left side of the turret was, however, deleted. Internal stowage, especially for the TOW missiles (and the infantry squad's Dragons and M-136s) was again re-done (and again years later when the Javelin replaced the Dragon).

After operations in 1991's Desert Storm campaign, several additions were made to the M-2A2 in response to crew wishes, new

operational requirements and capabilities, and, unfortunately, the relatively high percentage of losses due to fratricide. This package of modifications was referred to as the ODS (Operation Desert Storm) upgrades, with such modified vehicles informally called M-2A2ODSs. Modifications included an improved, eye-safe laser rangefinder, the addition of a GPS system, an IFF system, thermal imaging for the driver, and a system to jam radio-guided and IR-guided missiles (regarded as only partially effective, but better than nothing). The missile jamming system consists of sensors to detect incoming missiles and automatically put out low-grade radio-jamming signals, launch flares and IR-defeating smoke grenades.

The M-2A3 Bradley

By 1995, operations during Desert Storm had been more fully evaluated. At the same time, the introduction of the M-1A2 Abrams III meant that the Abrams now had several important capabilities the Bradley lacked, and this led to the M-2A3 (sometime called the Bradley III). The largest change in the Bradley was internal; the Bradley was given computers and communications equipment to allow it to inter-operate with the Abrams III and the AH-64D Apache on the digital battlefield. The commander has a full flat-panel display/touchscreen and computer control; the gunner and driver have touchscreens of their own that display information appropriate to their roles. In the passenger compartment, mounted on a bracket that is against the turret basket but not actually attached to it (i.e., it does not rotate with the turret), is another large display to provide the dismount squad with information on the battlefield situation and allow them to plan, receive and provide updated information. Along with this capability, GPS and an INU (Inertial Navigation Unit) have been added. The M-2A3 has a computer (which has been steadily upgraded over time) to allow it to quickly receive, integrate, display, and send real-time battlefield information; commanders therefore (usually) know where their units are and their status; the Bradley is therefore a true counterpart to the Abrams on the digital battlefield. Rebuilding of existing Bradleys to the M-2A3 standard began in 1996, and by 2008 almost all Bradleys in the US Army inventory have been rebuilt to the M-2A3 standard.

Other improvements a CIS (Commander's Independent Viewer), similar to the CITS of the M-1A2 Abrams III. The commander also retained the ability to see through the gunner's sight. In addition, the thermal imagers were replaced with long-range FLIR systems more akin to those found on aircraft and helicopters. The M-2A3 has an automatic dual target tracking ability, and as the gunner's sighted target is destroyed, the turret can be set to rotate automatically and the gun trained automatically on the commander's sighted target. Fire control is also improved (the system called the IBAS – Improved Bradley Acquisition System), and boresighting is essentially automatic instead of requiring a stop and extensive adjustments. The gunner's sight (the TAS – Target Acquisition System) has received particular attention in the fire control department. The main gun and coaxial machinegun is better stabilized and the ballistic computer improved (able to tap into, to a small amount, the primary computer of the Bradley). The TAS uses a 2nd-generation FLIR and a day TV/image intensification device, with a digital zoom from 4x to 48x, and twice the field of view of the zoom sights of earlier Bradleys. The day TV/image intensifier sees in near-infrared as well visible light, making it usable even in heavy smoke, IR-obscuring smoke, and conditions of low thermal contrast where FLIR imaging would be of little use.

The turret roof of the M-2A3 has a thin layer of added titanium alloy armor, as Desert Storm operations revealed the turret roof to be the weakest surface of the vehicle. As an adjunct to the electronic IFF system, the Bradley accommodates special panels on the sides of the vehicle made of the special aluminum alloy. These panels, when viewed through thermal imagers or FLIRs of the proper wavelength, gives off a heat signature that provides a further deterrent to fratricide. The M-2A3 includes a special cooling system for the vehicle's electronics, but experience in Iraq has led to low-power air conditioning to be fitted to the M-2A3 (and some M-2A2s still in service) to relieve the stifling heat that builds up inside the Bradley.

The M-7 Bradley ACP

One of the newest members of the Bradley to be fielded is actually based on the FISTV version of the Bradley (the M-7, found in US Tracked Artillery Support Vehicles). This is the Bradley ACP (Assault Command Post), perhaps better known by its developmental name, the BCOTM Bradley (Battle Command On-the-Move). The ACP was first fielded in April of 2003, but at the time it was only an experiment – but a circumstance of the of combat during the Battle of Taji on 16 April 2003 dramatically demonstrated the ACP's usefulness, as the pace of battle became so fast that 4th ID's DTAC could not arrive in time to set up and control the battle, and one ACP and a handful of other vehicles became the *ad hoc* DTAC for almost 18 hours.

The ACP is still considered a developmental vehicle, but more and more are in use in Iraq. They are currently found primarily at the Brigade HQ level and above, but plans are to eventually use ACPs down to Battalion level, and in a few other applications such as leaders' reconnaissance. As a part of TAC-type units, the interior of an ACP is crammed full of computers, displays, radios and other gear necessary to rapidly display and control operations of a unit. In addition, the ACP has the same level of armor protection as a standard M-2A2, though the ACP has much less ammunition for its ChainGun, TOW launcher and coaxial machinegun. As there is only so much one can stuff into a Bradley, the ACP is usually accompanied in its duties by an M-1068 CPV version of the M-113. An ACP has approximately six times the computing power of an M-2A3, and information is displayed on three large displays that are linked via a KVM and can simultaneously accept input from the three operators, the on-scene commander, the M-1068 that accompanies the ACP, and higher headquarters via radio, using a special version of a standard Cisco-made router. The three large monitors can be swung to the sides to allow personnel to get in and out of the ACP. The ACP also has a Toughbook laptop with a secure wireless connection to the ACP. The ACP can be equipped with up to ten radios, though five or six are more common. An external receptacle allows the entire ACP to be connected to an external generator to power the huge amount of electronics without rapidly draining the ACP's batteries. In addition, the electronics have two large UPSs to power them in emergencies or when generator switch-overs or maintenance are necessary. Needless to say, the ACP is definitely a cramped vehicle inside, but a commander can pretty much use an ACP to go wherever he needs to during a battle.

The BUSK

As a result of experience in Iraq, the Bradley's designers have come up with the Bradley Urban Survival Kit (BUSK) for the Bradley, similar in concept to the TUSK for the Abrams tank. This kit consists of a number of large and small modifications that can be applied at the unit level, and largely grew out of informal modifications that were already being used by Bradley crews. One of these is a handheld 3-million-candlepower spotlight, which may be powered by a rechargeable internal battery or by the vehicle's electrical system through a cable. In order to protect the crew and passengers from accidental electrocution if the antennas contact low-lying electrical wires (something I've actually seen happen in Korea), BAE Systems came up with antenna mounts that allow the antenna to be retracted with an electric motor (and a manual backup). In addition, a dome like-structure, consisting of a pair of flexible poles of a non-conductive material, can be mounted on the turret. (Bradley crews usually refer to this as a "tent," though it does not actually have any side panels.) These poles attach to the front, back, and sides of the top of the turret and meet at a 90-degree angle at the top, protecting against a lot of debris and wires that may hang across the road. Racks have been devised to give the crew and passengers extra external stowage for their gear on the sides and front of the Bradley; this not only cleans up the exterior stowage, but has the incidental effect of increasing the protection level of the Bradley (primarily by absorbing some small arms fire and pre-detonating shaped charge warheads).

One of the most interesting parts of the BUSK is CLAW. The CLAW (Commander's Light Automatic Weapon) mount is still considered an experimental part of the BUSK (as of this writing in June 2008) and consists of a mount attached to the side of the CIV, so that the attached weapon (which may be an M-231 PFW, but is most commonly an M-249 SAW of any variety) is just above the CIV. The mount also allows for standard belt containers to be attached to the SAW. The weapon attached it a standard, unmodified version, so it may be easily unclipped from the CIV and used normally. The mount includes a mechanism to pull the trigger of the attached weapon, with a cable leading to the commander's position that allows him to fire the weapon while buttoned up, and aim it using the CIV.

Twilight 2000 Notes: In Twilight 2000 pre-war active-duty US Army units, slightly over 60% of Bradleys are M-2A2s, with about a quarter of those M-2A2s being M-2A2ODSs. Most of the rest of the Bradleys in pre-war active-duty units are M-2A1s, but about 5% are "plain vanilla" M-2s and about 2% are M-2A3s. In pre-war Guard and Reserve units, Bradleys are almost half-and-half M-2s and M-2A1s, with about 10% being M-2A2s. The BUSK does not exist as such, though many of the BUSK features were added to Bradleys on an *ad hoc* basis. The M-7 ACP does not exist in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-2	\$275,216	D, A	1.8 tons	22.8 tons	3+6	7	Passive IR (D), Thermal Imaging (G+C)	Shielded
M-2A1	\$280,763	D, A	1.8 tons	22.8 tons	3+7	7	Passive IR (D), Thermal Imaging (G+C)	Shielded
M-2A2	\$313,166	D, A	1.5 tons	27 tons	3+7	8	Passive IR (D), Thermal Imaging (G+C)	Shielded
M-2A2ODS	\$328,512	D, A	1.5 tons	27 tons	3+7	8	Thermal Imaging (D, G+C)	Shielded
M-2A3	\$686,517	D, A	1.5 tons	28 tons	3+7	8	Thermal Imaging (D), FLIR (C), 2 nd Gen FLIR (G), Image Intensification (G)	Shielded
BUSK	\$2090	N/A	N/A	500 kg	N/A	N/A	N/A	N/A
BUSK w/CLAW	\$2530	N/A	N/A	600 kg	N/A	N/A	N/A	N/A
M-7 ACP	\$909,442	D, A	400 kg	26.9 tons	3+3	10	Thermal Imaging (D, G+C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
M-2	132/99	28/22/3	746	131	Trtd	T4	TF6 TS6 TR4 HF8 HS4Sp HR4
M-2A1	132/99	28/22/3	746	131	Trtd	T4	TF6 TS6 TR4 HF9 HS4Sp HR4
M-2A2/M-2A2ODS	122/92	26/20	662	142	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp
M-2A3	120/91	26/20	662	147	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp
M-7 ACP	122/92	26/20	662	157	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-2/M-2A1	+1	Fair	M-242 25mm ChainGun, M-240C, 2xTOW II Launchers, 6xM-231 PFW	900x25mm, 2200x7.62mm, 7xTOW II, 3070x5.56mm
M-2A2	+2	Fair	M-242 25mm ChainGun, M-240C, 2xTOW II Launchers, 2xM-231 PFW	900x25mm, 2200x7.62mm, 7xTOW II, 1025x5.56mm
M-2A2ODS	+3	Fair	M-242 25mm ChainGun, M-240C, 2xTOW II Launchers, 2xM-231 PFW	900x25mm, 2200x7.62mm, 7xTOW II, 1025x5.56mm
M-2A3	+3	Good	M-242 25mm ChainGun, M-240C, 2xTOW II Launchers, 2xM-231 PFW	900x25mm, 2200x7.62mm, 7xTOW II, 1025x5.56mm
M-7 ACP	+2	Good	M-242 25mm ChainGun, M-240C, 2xTOW II Launchers	250x25mm, 1100x7.62mm, 2xTOW II

*Floor armor for the M-2 and M-2A1 is 5; for the M-2A2, M-2A3, and M-7 ACP, it is 7. The turret roof of the M-2A3 has an AV 7.

FMC/GDLS M-113 Armored Personnel Carrier

Notes: By the 1950s, the US Army already knew that their earlier APCs had essentially been failures; they were too big, too heavy, and too slow. The Army wanted APCs that could keep up with their main battle tanks of the time (the M-48 series and the then-projected M-60 series), and one that was amphibious, air-transportable, and if possible, air-droppable. Early prototypes of what would become the M-113, called the T-113, were ready for testing in late 1956, but revised requirements and new developments in aluminum alloy armor meant that the updated T-113E1 and T-113E2 prototypes did not begin their testing until October of 1958. Full production of the M-113, based on the T-113E2 prototype, began in January of 1960. The M-113 has since been upgraded and modified into scores of different forms; the M-113 series is regarded worldwide as one of the most adaptable platforms in existence. US crews typically refer to the M-113 series and most of its variants simply as "tracks."

The first M-113s

The M-113 is basically a large armored box. There is a large overhead hatch designed for six of the passengers to stand with head, shoulders, and chest outside of it with their weapons (though I have seen as many as nine stuffed into that hatchway in actual use), and a hydraulic ramp at the rear with another hatch set into it on the left side. The ramp can be quickly opened by simply dropping it, or lowered more slowly by using engine power to help control the speed at which the ramp lowers. The handle to operate the ramp it to the rear of the driver, and it is the driver that is responsible for opening and closing the ramp under most circumstances. (The ramp is almost always opened in a controlled manner with the engine on, as without the engine on, the ramp will simply drop open once it is unlatched, which can damage the ramp's mechanism. Without engine power, the ramp can be raised only with muscle power, taking 3-5 troops, and this can induce too much slack in the ramp cable.) The rear of the vehicle has no firing ports or vision blocks (though some very early examples of the M-113 had a vision block on the left and right sides of the passenger compartment), and is simply an open space with bench seats that can be folded and locked, a few storage compartments for ammunition and munitions like grenades, a shelf for a radio or two, and damn little other room for anything else other than the passengers. Perhaps distressingly, the fuel tanks of the M-113, M-113A1, and M-113A2 are inside the left wall of the passenger compartment, behind rather thin plates of metal. The M-113 also has a heater for the interior, fired by the vehicle's fuel supply. At the center front of the M-113 is a small cupola for the commander; this is rotated by the commander simply unlocking the cupola and pulling him around in whichever direction desired. The cupola has periscopic vision blocks for all-around vision when buttoned up, and a platform with a seat that can be raised and lowered as necessary. The commander's cupola also has a pintle mount for an NHT, NMT, or NLT-compatible weapon (most often the M-2HB); in addition, an adapter was made to mount a Dragon ATGM on the weapon mount, and there is also an adapter to mount a laser designator (these adapters are extremely rare). The driver's position is in the left front of the hull; his hatch is above him, to the front and left of the commander's cupola. The driver has vision blocks that cover everything except the rear and part of the right-side arcs, and the front one can be easily removed and replaced with a passive IR periscope. The seat for the driver can be raised and lowered so that the driver may drive with his head outside the hatch or buttoned up. The controls consist of a gearshift, a gas pedal, and a pair of tillers to steer and brake the vehicle using differential steering. (Driving an M-113 with the tiller system actually requires a surprising amount of upper body strength – if you don't have it, you'll develop it pretty fast.)

The engine of the original M-113 is a Chrysler 75M gasoline engine, coupled to an automatic transmission with four forward speeds and one reverse. A sore spot about the M-113's power pack is the position of the exhaust – it is on the right front corner of the deck, and those standing in the troop hatch often get a bit queasy, if not outright sick to their stomachs, from the carbon monoxide in the exhaust. Many countries have taken the step of extending the exhaust pipe and running it downward to a position just above the tracks. The M-113 is amphibious with a minimum of preparation (the trim vane must be lowered to its swimming configuration, which takes no more than 15 seconds) – but the M-113 must already have rubber track skirts installed. These bolt onto the sides of the M-113 over the top part of the tracks; when the M-113 enters the water, an air bubble forms over the top of the tracks to give the M-113

the extra buoyancy needed for it to float. Propulsion is by the movement of its tracks. (These rubber skirts are easily torn up in normal field operations, and they are usually left in the motor pool.) The M-113 has a bilge pump that pumps water out of the engine compartment and from under the floor of the M-113. The M-113 used a flat torsion bar suspension, another thing that could lead to troops feeling beat-up and queasy by the time they reached the AO; I'm not the only one who has thrown up during a long off-road M-113 ride!

As stated above, the original M-113 used a gasoline engine, developing 215 horsepower. In the conceptual and prototype phases, there were to be two versions: a lighter version for use by airborne, cavalry, and scout troops, and a heavier one to be used as a general-purpose carrier in mechanized infantry units. After evaluation of both prototypes (the T-113E1 and E2 mentioned above), it was determined that the T-113E2 could meet both requirements, if FMC (the manufacturer of the M-113 at the time) could drop about 180 kilograms of weight. This was done by reducing the thickness of the rear armor and on the sponsons somewhat, but most of that weight was taken out of the floor of the vehicle. This short-sighted idea would have deadly repercussions in the future; the M-113 series is quite vulnerable to crew casualties from mine damage.

The M-113A1

Evaluations of the vehicle which would become the M-113A1 began in June of 1959, even before the original M-113 began production. The primary thrust of the modifications was the replacement of the gasoline engine of the M-113 with a diesel engine, and also making the engine, differential, final drives and transmission into an integrated power pack that could be removed as a unit for servicing, or serviced as individual components. The exterior would remain largely the same as that of the M-113. The M-113A1 entered service in 1964.

The engine chosen for the M-113A1 was the General Motors 6V53, which developed 212 horsepower and offered much better fuel economy; the better transmission of the M-113A1 ensured that the speed remained the same despite the lower horsepower rating of the engine and the greater weight. This engine and the integrated power pack concept required a new transmission. Originally, the M-113A1 was to have the differential steering system and its tillers replaced by a more conventional steering yoke and brake, but the transmission that was first chosen for the M-113A1 proved to be unreliable, and modifications to this transmission also did not work out. Objections to the original transmission were also raised by the soldiers involved in testing, since it was a manual transmission. The transmission was therefore replaced with an updated version of the M-113's original transmission, which unfortunately required that differential steering be used. The fuel capacity of the M-113A1 was also increased over the M-113; it was felt that larger fuel tanks could be put into the walls, since the fire hazard of diesel fuel was much lower than that of gasoline. Minor changes were made to improve the safety of the crew compartment heater. On the M-113, the same mechanism that provided crew heat also included ducts to heat the engine and the batteries in cold weather; on the M-113A1, a separate, temperature-sensitive mechanism heated the coolant before it circulated through the engine and also supplied heat to an exchanger in the battery box as appropriate.

The M-113A2

The M-113A1 was considered extremely reliable mechanically and adequate as an APC. However, Vietnam revealed some deficiencies (other than the mine vulnerability). This resulted in the M-113A2, introduced in 1979.

The location of the radiator and fan on the M-113A1 tended to make the engine a bit hot, as dust and oil would build up on the radiator core. The positions of the fan and radiator were reversed to improve air flow, and the radiator itself replaced with a larger one with more coolant capacity.

The torsion bars of the suspension were replaced with stronger, yet more flexible ones; the increased travel capability of the roadwheels increased off-road performance. The idler wheel was replaced with a stronger one that was also raised about 50 millimeters to contribute to the increased off-road travel. The first, second, and rear roadwheels used improved shock absorbers that also helped increase off-road performance as well as smooth out the ride (a little...). The entire ground clearance of the M-113A2 was raised by 25 millimeters.

Perhaps the greatest change in the M-113A2 was in the power pack. The 6V53 engine was replaced by the turbocharged 6V53T, which develops 212 horsepower and has an improved cooling system. The transmission was also improved, with an additional forward speed. The M-113A2 also added neutral (pivot) steering capability, with the pivot steering handles being located at the front of the driver's compartment above and in front of the tillers; however, most M-113A2s have them disconnected as it was found that the M-113A2 easily throws tracks under pivot steering, even when simply turning in place.

The M-113A2 also introduced a smoke grenade launcher kit; this consists of a pair of four-tube launchers mounted on either side of the front of the hull, above the fenders. Originally designed specifically for white or dark smoke vehicular grenades, these launchers were later modified to permit the use of colored smoke or IR screening smoke as well. The grenades are electrically fired, with a control box on the top of the wall of the engine compartment in front of the commander's position.

The increased weight of the M-113A2 made swimming perilous; the tech manuals say that an M-113A2 has a freeboard of 14 inches when fully loaded, but in practice, the freeboard is typically 10 inches or less, and it is quite possible for M-113A2s to sink in even moderately choppy water. For this reason, normal practice is to leave all top hatches of a swimming M-113A2 open so that the occupants can quickly escape if the M-113A2 sinks. Several types of buoyancy cells were tried, ranging from the ones mentioned in the Mine Reduction Vulnerability Kit below to inflatable ones, but in the late 1980s, the amphibious requirement for the entire M-113 series was dropped, and the M-113A2 was to swim only in emergencies. Many units have not been even mounting the trim vanes on their M-113-series vehicles since the late 1980s.

The M-113A3

Development of the M-113A2 continued. The transmission of the M-113A2 was eventually upgraded three times; in a way, the use of these improved transmissions was sort of a test program, for they would allow the use of a new version of the 6V53T engine called the RISE package that had improvements to power and the drive train. In addition, many M-113A2s had Kevlar anti-spall panels added to the interior. The M-113A3 would include the new transmission, the RISE package, and many other improvements. The M-113A3 was introduced in 1987.

The M-113A3's engine develops 275 horsepower; in addition, the M-113A3 has what drivers have been wanting for a long time: a conventional steering yoke and a brake pedal instead of the differential steering and braking system. This greatly reduced driver fatigue. The passive IR periscopic sight was replaced with a thermal imager. An improved neutral steering system was fitted, restoring the pivot steer capability. Kevlar anti-spalling liners were fitted to increase protection for the occupants. Finally, the external fuel cells were made standard equipment on the M-113A3, also greatly increasing crew survivability.

The M-113A3 is not "officially" amphibious; buoyancy cells of the type listed below can be added to the M-113A3's sides and to the trim vane, but swimming an M-113A3 is even more dangerous than swimming an M-113A2. Many appliqué armor kits have also been devised for the M-113A3 (see below), and any of these make the M-113A3 too heavy to swim.

The M-577 Command Post Carrier

Though the M-113 appeared in 1960, command, FDC, medical, and other specialist elements in mechanized or armored formations were still using M-59 APCs that used a plethora of *ad hoc* modifications. These *ad hoc* command vehicles had the same vulnerabilities and poor range of the M-59, and the electrical systems of the M-59 were often not up to the job they were given, particularly if the command vehicle carried a lot of communications equipment. The development of a CPC version of the M-113, designated the M-577, was given a high priority, and first issue began to US Army units in Europe in December of 1962.

The M-577's most obvious difference from the M-113 is the raised roofline; behind the driver's position, the roof has been raised by over 64 centimeters, allowing those inside to stand upright. The single fuel tank in the left side of passenger compartment was replaced by two fuel tanks, one in each side of the passenger compartment. These fuel tanks were mounted so that they extended down the sides of the compartment, and covered so that they formed a work shelf. Attached to these work shelves are folding wooden extensions (in two sections on each side; most M-577s I've seen have the front-most shelves removed, and some even have the left-side shelves removed entirely). The vehicle commander's position was also radically changed; the M-577 has no commander's cupola. Instead, the M-577 has a hatch in the roof that is about 25% larger than an M-113 commander's hatch, making it large enough for large pieces of equipment (such as observation devices and designators) to be moved into and out of the vehicle from the top hatch. The commander's seat has been removed; replaced with a simple folding metal stand. Contrary to the *Twilight 2000* rule books, the M-577 does not have a mount for any weapon by the commander's hatch or anywhere else on the vehicle. The commander's hatch also has no vision blocks. The M-577 does have a bracket beside the driver for his M-16 or M-4, another bracket above the rear ramp (on the inside) that will hold an M-16/M-4, an M-60 machinegun, an M-240 machinegun, or an M-249 SAW. Below this is another bracket that will hold an M-16/M-4 or an M-249. (I discovered in Korea that either one will also hold an AKM or the South Korean K-1A1 or K-2 rifles.)

The passenger compartment has folding bench seats on either side of the passenger compartment (another feature normally removed by units; they get in the way). At the front of the raised roofline, to the right of the driver's position and in the center of the front deck, is a metal box permanently attached to the M-577; this is designed for a 4.2kW gasoline-powered generator to power the electrical equipment without having to run the engine for long periods of time. To the rear of the driver's position are brackets for a lifting davit to allow the generator to be put on the ground and dug in to cut down on the incredible noise the generator puts out. A 50-foot generator cable is provided to allow this, and a shorter one is also provided if the generator is to be run from its carrying position on the M-577.

Other items which may be found (depending on configuration and purpose) on the M-577 include a 3x3 cabinet with several drawers and a fold-out table; 3-5 folding metal chairs; a 1.2x1.8-meter map board that attaches to the right inner wall of the vehicle; and a variety of shelves (and ways to mount them) for the equipment the M-577 carries. An M-577 generally carries several radios; the one I worked out of in Korea had four SINGCARS radios, a medium-range AM radio, and a long-range AM radio. Inside the M-577 are both white lights and blackout lights to light up the interior. Though they may not all be used at the same time, there are mounts for up to five antenna aerials; in addition, a very-long-range antenna may be mounted on in the davit brackets. At the rear of the vehicle, on either side of ramp on the outside, are connections for four field telephones, two generators, and two pairs of conventional electrical outlets to allow other equipment to feed off of the M-577 (generally done only if the M-577 is itself feeding from a generator). An M-15 collective protection system, to which the troops inside the may hook their protective masks, can be mounted in the M-577, but is not standard equipment; this system is powered by the 4.2kW generator. An airlock system can also be attached to the rear of the M-577, but it is quite rare; it is also powered from the generator. Something that *is* standard equipment is a work area-extension tent and poles; these attach to the rear of the M-577, and add approximately 4x5 meters of enclosed workspace. When not in use, these stow in special brackets and lash-down points atop the ramp entrance. (Of course, the tent does make emergency moves a bit difficult...)

Other modifications paralleled to some extent those for the M-113. The M-577A1 brought the same power pack changes as the M-113A1, though fuel capacity remained the same as the M-577. The M-577A1 began issue in 1964. The M-577A2 likewise followed the same power pack and suspension improvements as the M-113A2, as well as adding the smoke grenade launchers. Issue of the M-577A2 began in 1979, with both new M-577A2s being built and earlier M-577s and M-577A1s being upgraded to the M-577A2

standard. The M-577A3 also included most of the improvements of the M-113A3; in addition, the 4.2kW gasoline-fueled generator was (gradually) replaced by a 5kW generator that could be powered by diesel or JP-8 jet fuel. M-577A3 issue began in 1994.

The M-1068 SICPS (Standard Integrated Command Post System) began as a modernized M-577A2, but with the advent of the M-577A3, the M-577A3 was made the base vehicle for modifications, and the resulting vehicle re-designated the M-1068A3. The interior of the M-1068A3 held two folding semi-bucket seats for the crewmembers, and the standard TC's stand and the driver's position. The M-1068A3 has a dramatically beefed-up electrical system to allow the use of the ATCSS (Army Tactical Command and Control System), with its multiple communications systems, computers, touchscreens, and ancillary equipment; the M-1068A3 also carries various other equipment in drawers and shelves similar to the other members of the M-577A3 series. The extension tent was re-designed (primarily to save weight) and also contains a lighting system for the tent.

The M-113 ACAV

Notes: In Vietnam, an attempt to increase the firepower and protection levels of M-113s, particularly those operated by scout units and those operated by the ARVN. This led to various *ad hoc* modifications (parts of which later became kits made by FMC), which were informally called ACAVs (Armored Cavalry Assault Vehicles). Though the ACAV appellation later became more-or-less standard, ACAV versions of the M-113 have never been official versions of the M-113, and do not have any special designation other than "ACAV" hung after the type of M-113 in question. ACAVs were typically used as scouts, convoy escorts, or to spearhead assaults.

The first ACAVs were vehicles of the 11th ACR, based on the M-113A1. The first of these modified vehicles entered combat in 1966. The increase in firepower and protection for the gunners was considered astounding, but more importantly, it increased the confidence of the crew. These first ACAVs had an armored shield for the commander's cupola and the M-2HB (with a cutout for hatch in the rear), and M-60 machineguns on each front corner of the rear deck hatch on pintle mounts. A lug for a pintle was also mounted on the inside of the rear deck hatch. These gun shields have an AV of 2. Crews often armed one of their members with an M-79 grenade launcher and a large ammunition supply inside the ACAV. Some ACAV crews mounted other weapons on their ACAVs that were compatible (or jury-riggable), such as Miniguns, extra M-2HBs, or the XM-175 or Mk 19 automatic grenade launchers. With the gun shield removed, the rear weapons mounts could also mount 75mm, 90mm, or 106mm recoilless rifles. Experiments were also done with reduced-sized Claymore mines (often called "Minimores") attached to the sides of the ACAVs (full-sized Claymores would damage the M-113's hull). ACAVs were sometimes additionally protected by kits such as the Mine Vulnerability Reduction Kit (below) or bolt-on steel or aluminum plates; sometimes the crews took a cue from World War 2 vehicles and built frames for sandbags to protect vulnerable areas (sandbags on the floor of the ACAV were quite common). Telescopic, periscopic, or night-vision devices were sometimes added to the weapon mounts. The ACAVs would also be loaded with as much ammunition as possible, and typically carried only as many crew members as necessary to man their weapons.

After Vietnam, the ACAVs were converted back to their standard M-113 configuration, and largely seen only in museums. However, in Iraq, some M-113s have become ACAVs in all but name, and kits are available to convert the M-113s to "ACAVs," sometimes further bolstered by the P-900 armor kit (see below) or other appliqué armor.

Other M-113 Mods

In the late 1960s, a waterjet propulsion system was developed for amphibious operations. This allowed the M-113A1 on which it was tested to roughly double its swimming speed and greatly increase waterborne mobility. The waterjets were steered by vanes. Air was sucked in from the top of the waterjet modules and pushed out under the water level to form the jets. Ballast was added in the front to ensure stability. The waterjet system was, however, decided against by the Army. In game terms, adding a waterjet propulsion system adds 300 kg to the weight of the vehicle (which is subtracted from the M-113s cargo capacity) and adds \$4000 to the cost of the vehicle.

One of the interesting and creative uses for older M-113s (mostly M-113A3s and M-113A2s modified with the M-113A3's power train) is being done at the US National Training Center (NTC) at Fort Irwin, California. Designated the M-113 OSV (OPFOR Surrogate Vehicle), this vehicle is a VISMOD (Visually-Modified) that is altered in appearance, and to some extent mechanically and operationally, to resemble the BMP-2. Most of this is done with fiberglass, sheet metal, and Kevlar add-ons to change the appearance of the M-113. Atop the M-113 OSV is a turret partially made with components of a Bradley turret, but designed to look like that of a BMP-2. The turret is largely non-functional, but can rotate and has useable vision blocks, hatches, and night vision equipment. The VISMOD is imperfect – the M-113 is too short and tall to really make it look like a BMP-2 – but it does have the advantage of actually being able to carry an infantry squad, something that the previous BMP VISMODs based on M-551 Sheridans cannot. In addition, the M-113 OSV uses about half the fuel of a Sheridan.

Non-APC-type M-113-based vehicles will generally be found in the other appropriate sections of the site (generally Light Combat Vehicles or Engineer Vehicles), according to which country developed them. A large number of experiments with the M-113 chassis were also postulated and tested (particularly in the 1980s) these will (eventually) be found in the various "Best Vehicles that Never Were" sections of this site.

Add-On Kits for the M-113

With the advent of the M-113A1. FMC also devised a folding windshield kit for the driver for use in cold weather or when swimming. (Quite frankly, I've never actually laid eyes on one of these, though I've seen it in tech manuals and pictures...)

Experience in Vietnam resulted in various modifications and special kits for the M-113A1. M-113A1s used in Vietnam often got

bogged down in mud, swamps, and rice paddies; this resulted in a special kit called a Marine Recovery Kit. The kit consisted of a pair of capstans which were bolted onto the drive sprockets, and a pair of high-strength nylon ropes with hooks on one end and large ground anchors on the other. The capstans, once attached to the drive sprockets and the recovery ropes attached, could allow the M-113A1 to pull itself out of bogged-down conditions as the ropes wound around the final drives. Once the M-113A1 was extricated, it would be driven in reverse to unwind the ropes, and the kit was removed. The capstan was stowed beside the commander's hatch and the ropes and ground anchors were stowed on the left side of the vehicle.

The external armored fuel tanks were also available by themselves at an add-on kit for the M-113A1 and M-113A2. (For the M-113A3 and A4, they are standard equipment.) The tanks have a 95-liter fuel capacity (same as the internal tanks), and add 408 kilograms to the weight of the vehicle. The M-113A1 and M-113A2 cannot use both the internal and external tanks at the same time (unless either the internal or external tanks are simply used as giant fuel cans).

Appliqué Armor Kits for the M-113

As stated above, the M-113 series is very vulnerable to mines and IEDs, due to the relatively thin belly armor. This problem hit home in Vietnam, where M-113A1s were knocked out by mines on a regular basis, killing, maiming, and injuring thousands of US and ARVN troops. In an attempt to reduce this problem, FMC devised the Mine Vulnerability Reduction Kit. This kit included plates of extra belly armor (adds 1 point of belly armor to most of the vehicle, but from the commander's position forward, the armor increase is 2). A set of armored fuel tanks were devised to attach to the rear of the vehicle on either side of the ramp, along with a revised fuel line system that did not go through the floor. The driver's seat was improved to take up more shock, including a shoulder harness. In the rear of the vehicle, the ramp had an emergency release to help the passengers to escape if the ramp control behind the driver was not quickly accessible. As this kit (especially the added armor) weighs about 1 ton and unbalances the M-113, buoyancy cells were added to the trim vane and sides to allow the M-113 to be able to swim; without these cells, swimming is dicey at best. (These buoyancy cells would also make an appearance later on certain special versions of the M-113 series).

Appliqué armor of various types have been proposed, tested, or used by various countries around the world. Most of these armor upgrades are simple bolt-on plates of additional composed of various materials (mostly metals), including aluminum and aluminum alloy, steel, and titanium. Ceramics, carbon fiber composites, and even a variant of Chobham have reportedly been tested. (The US Marines in particular have been experimenting with M-113A3s with ceramic appliqué armor.) Some of this appliqué armor is reportedly capable of defeating up to 30mm rounds without causing an undue weight increase or performance hit. Bar armor for the M-113 similar to that of the Stryker series is also being tested by the US in Iraq. Due to a lack of information, I will not go into further detail in this entry; I have included this paragraph for informational purposes only.

For the M-113A3, FMC devised a comprehensive appliqué armor kit called the P-900 kit. This kit consists of large sheets of extra aluminum plate (or steel plate for the belly) that bolt onto the vehicle. The P-900 kit pretty much adds protection to the entire vehicle, including spaced armor for the hull sides, added armor for the fuel tanks, and an armored shield kit that helps protect the entire commander's cupola except for the rear. (This shield kit is almost identical to that of the ACAV kit's cupola armor.) This extra armor adds a lot of weight and does affect performance, though the added horsepower of the M-113A3's engine helps in this regard. This is the reason for the extra line below for an M-113A3 equipped with the P-900 kit.) I have not heard of any M-113A2s being augmented with the P-900 kit; I don't see why it couldn't be done, (though weight would definitely be an issue), since the Israelis have a similar kit for the M-113A2.

The Israelis have long been adding ERA to their M-113s; other countries that field the M-113 are also using them or testing the attachment of ERA to them. On the M-113, ERA is typically added only to the sides of the vehicle; it has been seen on the front on some Israeli and US vehicles, but due to the design of the M-113, there is a great danger of injuring the driver or even the commander due to an ERA tile detonation. In response to that danger, armored plexiglas windshields have been devised for the driver and commander. The rules for adding lugs and ERA to vehicles are well-covered in the *Twilight 2000* v2.2 rulebook.

It should be noted that most appliqué armor kits will not kit on the M-577 series. However, with the M-577A3 and M-1068A3, bolt-on appliqué aluminum plates were devised that will fit the M-577A3 and M-1068A3, and lugs for ERA can also be applied.

Twilight 2000 Notes: Virtually all M-113-series vehicles in service worldwide in the Twilight 2000 timeline will be M-113A2s, though in third-world countries and even some allied countries M-113A1s and even M-113s will be quite common. There will also be a decent number of what are essentially M-113A1E1s (developmental M-113A1s with the power pack, drive train and most of the suspension improvements of the M-113A2) in service due to upgrade kits; these can be treated as M-113A2 for game purposes. In the US inventory, M-113A3s and M-577A3s will constitute about 20% of the fleet, while about 3% of the M-113-based CPCs will be M-1068A3s.

ACAV-type vehicles will comprise about 15% of the M-113-type APCs at the beginning of the Twilight War; these will be concentrated in brigade and battalion-level scout platoons. As the war goes on, more ACAV-type vehicles will appear, using either kits or *ad hoc* modifications. The P-900 kit is a rare but available modification; the MVRK kit is almost unknown.

As with Sheridan-based VISMODOs, the M-113-based VISMODOs have sometimes been used for infiltration-type raids and reconnaissance against Mexican and Soviet positions in the American Southwest – almost always with operational weapons installed.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-113	\$148,222	G, A	1.3 tons	10.4 tons	2+11	4	Passive IR (D)	Shielded
M-113A1	\$148,838	D, A	1.6 tons	10.9 tons	2+11	4	Passive IR (D)	Shielded
M-113A1 w/MVRK	\$150,262	D, A	1 ton	11.8 tons	2+11	4	Passive IR (D)	Shielded

M-113A1 ACAV	\$200,172	D, A	1.4 tons	11.3 tons	4+3	5	Passive IR (D)	Shielded
M-113A1 ACAV w/MVRK	\$201,844	D, A	835 kg	12.2 tons	4+3	5	Passive IR (D)	Shielded
M-113A2	\$147,324	D, A	1.4 tons	11.3 tons	2+11	4	Passive IR (D)	Shielded
M-113A2 w/P-900 Kit	\$152,906	D, A	970 kg	12.2 tons	2+11	4	Passive IR (D)	Shielded
M-113A2 ACAV	\$201,656	D, A	1.2 tons	11.7 tons	4+3	5	Passive IR (D)	Shielded
M-113A2 ACAV w/P-900 Kit	\$207,238	D, A	790 kg	13.1 tons	4+3	5	Passive IR (D)	Shielded
M-113A3	\$146,972	D, A	1.4 tons	12.3 tons	2+11	4	Thermal Imaging (D)	Shielded
M-113A3 w/P-900 Kit	\$152,554	D, A	950 kg	13.2 tons	2+11	4	Thermal Imaging (D)	Shielded
M-113A3 ACAV	\$201,944	D, A	1.2 tons	12.7 tons	4+3	5	Thermal Imaging (D)	Shielded
M-113A3 ACAV w/P-900 Kit	\$207,526	D, A	770 kg	13.6 tons	4+3	5	Thermal Imaging (D)	Shielded
M-577	\$233,279	D, A	586 kg	10.8 tons	2+6	5	Passive IR (D)	Shielded
M-577A1	\$244,017	D, A	648 kg	11.4 tons	2+6	5	Passive IR (D)	Shielded
M-577A2	\$214,230	D, A	752 kg	11.8 tons	2+6	5	Passive IR (D)	Shielded
M-577A3	\$220,471	D, A	741 kg	12.8 tons	2+6	6	Thermal Imaging (D)	Shielded
M-1068A3 SICPS	\$414,456	D, A	766 kg	12.3 tons	2+6	6	Thermal Imaging (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-113	176/123	30/18/3	303	148	Std	T2	HF6 HS4 HR4
M-113A1	150/105	30/18/3	360	124	Std	T2	HF6 HS4 HR4
M-113A1 w/MVRK	130/91	28/17/2	360	139	Std	T2	HF6 HS4 HR4*
M-113A1 ACAV	135/95	29/17/3	360	138	Std	T2	HF6 HS4 HR4
M-113A1 ACAV w/MVRK	127/88	27/16/2	360	144	Std	T2	HF6 HS4 HR4*
M-113A2	136/96	30/20/3	360	124	Std	T2	HF6 HS4 HR4
M-113A2 w/P-900 Kit	131/91	29/19/3	360	134	Std	T2	HF8 HS6Sp HR5**
M-113A2 ACAV	134/94	30/19/3	360	138	Std	T2	HF6 HS4 HR4
M-113A2 ACAV w/P-900 Kit	126/88	28/18	360	149	Std	T2	HF8 HS6Sp HR5**
M-113A3	146/103	33/22/3	360	136	Std	T2	HF6 HS5 HR4
M-113A3 w/P-900 Kit	141/99	32/21	360	146	Std	T2	HF8 HS7Sp HR5**
M-113A3 ACAV	141/98	32/21/3	360	149	Std	T2	HF6 HS5 HR4
M-113A3 ACAV w/P-900 Kit	136/95	31/20	360	160	Std	T2	HF8 HS7Sp HR5**
M-577	133/93	29/17	454	154	Std	T2	HS6 HS4 HR4
M-577A1	131/92	29/17	454	129	Std	T2	HS6 HS4 HR4
M-577A2	134/93	29/17	454	129	Std	T2	HS6 HS4 HR4
M-577A3	145/101	31/19	454	141	Std	T2	HF6 HS5 HR4
M-1068A3 SICPS	146/103	33/22/3	360	136	Std	T2	HF6 HS5 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-113 (Any)	None	None	M-2HB (C)	2000x.50
M-113 ACAV (Any)	None	None	M-2HB (C); any combination of 3 - M-2HB, M-60, M-240, M-134, Mk 19 AGL, Dragon ATGM, or 75/90/106mm RCLR (Rt, Lt, R)	4000x.50; 4xMinimore; up to 7200x.50, 12000x7.62mm, 2300x40mm HV, 15xDragon ATGM, 40x75mm, 34x90mm, or 29x106mm***
M-577 (Any) & M-1068A3	None	None	None	None

*The MVRK gives the M-113 equipped with a belly armor AV of 4 from the commander's cupola forward. Behind that, the belly armor AV is 3.

**Belly and top deck armor AV for P-900 kit-equipped vehicles is 4.

***For ACAV ammo, the figures for all weapons except for the commander's M-2HB and the Minimores is shown as *if all three additional weapons are of the same type*. The GM must "mix-and-match" the amount of ammunition in the basic load as necessary if different types of weapons are used.

GDLS Expeditionary Fighting Vehicle (EFV)

Notes: Originally known as the AAV (Advanced Amphibious Assault Vehicle), the EFV is the last member of a program that was started in the late 1970s to provide the US Marines with a greater “over the horizon” landing reach for Marine assault units. The other members of this program, including the LCAC, the MV-22 Osprey, the UH-1Y Venom, the AH-1Z SuperCobra, and new amphibious assault ships have all yielded results, but the EFV is well behind of schedule – it is currently set to be first deployed in 2015, over 14 years behind schedule. It has been repeatedly delayed by budgetary shortfalls and overruns, repeated revisions in design, incorporation of new technology, reliability issues, alterations of perceived mission needs, and sheer political wrangling. It is noteworthy that Defense Secretary Robert Gates has recently described the EFV program as “exquisite” – a description he normally reserves for a program that he is about to cancel. The EFV retains the promise of being a revolutionary vehicle for Marine Assault Units – whether it can or ever will fulfill that promise is not known at this point. The US Army is even considering the EFV as a base chassis and hull for its new BCT Ground Combat Vehicle Program, though it is considered more likely that the Army will start anew from the ground up, considering the difficulties that the Marines are having with the troublesome EFV.

The EFV is physically a much larger vehicle than the current AAVP-7A1 that the US Marines use, though it does not carry as many troops as the AAVP-7A1. Armament is heavier, as are the protection levels. However, perhaps the most revolutionary part of the EFV's design is its propulsion, particularly in water – the EFV has been described as a cross between jet ski and an IFV. When embarking from a ship offshore, the lower hull alters through a system of movable panels, hatches, louvers, and hydrojets to produce a vehicle which skims the surface of water and is capable of speeds in water over half as fast as its top speed on road on land. This means that an EFV can get troops onto shore faster, with a smoother ride that leaves Marines less seasick and leaves them less exposed to onshore enemy fire. The change from water mode to land mode (or back again) takes only 30 seconds. However, this new propulsion system is at the very heart of the EFV's delays – it has proven to be non too reliable and very maintenance-intensive; some helicopters require less maintenance and as many as one-fourth of the vehicle trips in from ships during test have resulted in failure, with the vehicle being dead in the water. When it's working, however, it's quite a sight to see. The heart of this propulsion system is the MTU MT-883 Ka-524 multi-mode diesel engine, which produces 850 horsepower in land mode and an astounding 2702 horsepower in water mode. (Naturally, Fuel Consumption figures dramatically increase in water mode.) This engine is coupled with an automatic transmission that is also variable for land and water modes, an automatic system allowing the driver to quickly put the vehicle in and out of water mode, and the hydrojet system for water use. The hydrojets are fully steerable and allow the EFV to move forwards, backwards, and turn in place. Steering is done with a conventional driver station, and is reportedly quite easy when everything is going right. A water Travel Movement figure is provided below for water travel, as the EFV is envisioned to be able to make a long water crossing. Likewise, Fuel Consumption figures are provided for land travel/water travel.

The armor of the EFV consists of welded aluminum/copper alloy armor inner and outer plates, with ceramic and Kevlar sandwiched between them, along with a Kevlar anti-spalling liner; the EFV has a form of composite armor and has protection levels much better than those of the AAVP-7A1. This additional protection extends to the hull floor, though from the experience of recent years, there is currently a big push to incorporate some of the experience with MRAPs into the EFV's hull floor, which could result in a giant redesign. Most experts at the DoD think, however, that protection levels are sufficient, and these changes are unlikely to be used. In addition to its standard armor, the EFV can mount additional appliqué armor on its hull sides, hull front, and turret. The EFV will also have lugs for ERA on the hull front, hull sides, turret front, and turret sides. The original turret was envisioned to be the same as used on the US Army's M-2 Bradley; this was later changed to a similar turret with better protection levels but no TOW launcher, then to the current turret mounting an ATK M-230 30mm ChainGun variant (the Mk 44 Bushmaster II) which can use computer-fuzed airburst rounds as well as conventional rounds. The turret is a two-man turret; the crew also consists of a driver and assistant driver. The EFV is equipped with a laser warning system as well as a laser designator to allow the crew to assist in fire support; in addition, the EFV will most likely mount soft-kill and hard-kill active protection systems. The driver's compartments, turret, troop area, engine compartment, and fuel tanks all have automatic fire detection and suppression systems; the fuel tanks are also self-sealing. On the sides of the hull, on each side of the turret, are clusters of sixteen smoke grenade launchers. The Marines deploy from large doors in the rear of the vehicle, and can also long hatches over each side of the passenger compartment. The crew and passengers have air conditioning and heating and are protected with an NBC overpressure system with a collective NBC backup. The EFV is equipped with a GPS system and is expected to be fitted with a full Battlefield Management System. Night vision is comprehensive, including a FLIR system and low-light TV system for the commander and gunner. The main gun is fully stabilized and can fire with great accuracy from both land and water; it is equipped with modern fire control elements as well as computer-controlled fuzing for airburst and delayed modes for its 30mm ammunition. The EFV is equipped with a 30-horsepower diesel APU for use in water, and a 10kW battery APU for use on land.

The EFV's projected soft/hard-kill APS is a further extension of the P31 soft-kill system that is being tested on the M-1A2 and incorporate a Raytheon-designed hard-kill system that will be similar to the Israeli Trophy system (which is itself similar to the Russian Arena APS). The P31 soft-kill system includes a standard sort of soft-kill system, which consists of sensors and equipment mounted atop the turret and control systems mounted inside the turret and hull; the primary controls for the system are at the commander's station. The system includes an electro-optical jamming system to jam wire-guided ATGMs (on a roll of 14+ on a d20, the difficulty to the ATGM gunner is increased by one level; outstanding success indicates that the incoming missile pre-detonates before it can hit the EFV). A laser warning system is also included with the P31; when the EFV is being lased by a laser designator, an alarm sounds inside the EFV, and a pair of smoke grenades are automatically launched to help obscure the EFV to the laser beam. The laser warning system can also be triggered manually by the commander. The smoke grenades can also be triggered by the gunner manually if he feels it is necessary; the EFV uses the sixteen smoke grenade launchers on each side of the vehicle. The P31 also

includes a pair of IRCM lights (one on the turret on each side of and above the main gun) that emit coded, pulsed IR beams to decoy IR-guided munitions; their effectiveness is the same as listed for the electro-optical jammer above, and both have a 360-degree range of protection, as well as 180-degrees upwards. The VIDS system in the P31 incorporates a laser dazzling system designed to damage night vision devices and image intensifiers, as well as produce a level of temporary partial blindness in enemy gunners. The gunner-blinding part of the VIDS system, however is manual. The blinding of an enemy gunner is a Difficult: INT task on the part of the gunner or commander with a range of 2000 meters. The temporary damage to night vision and observation devices can also temporarily blind IR sights and image intensifiers; this is successful on a roll of 8 on a d20 for IR sights and 5 for image intensifiers. A computer is provided to tie all of this information from the P31 and other sensors together.

The hard-kill component of the APS projected for the EFV uses a small, short-range radar system on the turret roof to detect incoming missiles and rockets (it doesn't work fast enough to stop tank and autocannon rounds), and launches special rounds in the path of the missile that quickly break up into a cloud of tungsten pellets, destroying the missile before it can hit the tank. The system has 16 of these rounds available, and they are 75% likely to destroy the incoming missile about 10 meters from the EFV. The system protects the EFV in a 180-degree dome around the vehicle.

Stats are provided for the EFV with and without its APS, because like the EFV itself, development of the P31 and Raytheon APS systems are way behind the originally-projected timeline.

The standard form of the EFV listed above is the EFVP (Expeditionary Fighting Vehicle Personnel). A command version is also being developed, the EFVC, which has room for a command crew, a smaller, lightly-armed turret, two short-range, two medium-range, two long-range, and one SATCOM radio (with one long-range radio and the SATCOM radio being data-capable), an erectable mast antenna, two ruggedized laptop computers, LCD map screens, and the sort of map boards and plotting and office-type equipment one would expect in a command post carrier. The monitors can access information from the vehicle's sensors and display them on the monitors or the laptop computers.

Special Note: The stats below assume a reliable, reasonably-perfected form of the EFV. For the EFV in its current form, multiply the Maintenance figure by five, assume that even new vehicles have a wear value of not less than three, and give the vehicle an additional 25% chance of a breakdown per period.

Twilight 2000 Notes: This vehicle is not available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
EFVP	\$652,146	D, G, AvG, A	2.3 tons	33.8 tons	4+17	20	Passive IR (D, Asst D, G, C), Image Intensification (G, C), Thermal Imaging (D), FLIR (G, C)	Shielded
EFVP w/Appliqué	\$660,142	D, G, AvG, A	2 tons	34.8 tons	4+17	21	Passive IR (D, Asst D, G, C), Image Intensification (G, C), Thermal Imaging (D), FLIR (G, C)	Shielded
EFVP w/APS	\$695,964	D, G, AvG, A	2.2 tons	34.1 tons	4+17	22	Passive IR (D, Asst D, G, C), Image Intensification (G, C), Thermal Imaging (D), FLIR (G, C)	Shielded
EFVP w/APS & Appliqué	\$701,593	D, G, AvG, A	1.9 tons	35.1 tons	4+17	23	Passive IR (D, Asst D, G, C), Image Intensification (G, C), Thermal Imaging (D), FLIR (G, C)	Shielded
EFVC	\$989,986	D, G, AvG, A	1.2 tons	35 tons	3+7	22	Passive IR (D, Asst D, C), Image Intensification (C), Thermal Imaging (D), FLIR (C)	Shielded
EFVC w/Appliqué	\$995,615	D, G, AvG, A	1 ton	36 tons	3+7	23	Passive IR (D, Asst D, C), Image Intensification (C), Thermal Imaging (D), FLIR (C)	Shielded
EFVC w/APS	\$1,033,804	D, G, AvG, A	1.1 tons	35.3 tons	3+7	24	Passive IR (D, Asst D, C), Image Intensification (C), Thermal Imaging (D), FLIR (C)	Shielded
EFVC w/APS & Appliqué	\$1,039,433	D, G, AvG, A	950 kg	36.3 tons	3+7	25	Passive IR (D, Asst D, C), Image Intensification (C), Thermal Imaging (D), FLIR (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel	Fuel	Config	Susp	Armor
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			Cap	Cons								
EFVP	135/94/86	29/22/19	1506	351/1389	Trtd	T4	TF19Cp	TS14Sp	TR11	HF24Cp	HS12Cp	HR9*
EFVP w/Appliqué	131/91/83	28/21/18	1506	362/1431	Trtd	T4	TF24Cp	TS17Sp	TR11	HF30Cp	HS15Cp	HR9***
EFVP w/APS	134/93/85	29/22/19	1506	355/1403	Trtd	T4	TF19Cp	TS14Sp	TR11	HF24Cp	HS12Cp	HR9*
EFVP w/APS & Appliqué	130/90/83	28/21/18	1506	365/1445	Trtd	T4	TF24Cp	TS17Sp	TR11	HF30Cp	HS15Cp	HR9***
EFVC	130/90/83	28/21/18	1506	365/1445	Trtd	T4	TF19Cp	TS14Sp	TR11	HF24Cp	HS12Cp	HR9*
EFVC w/Appliqué	127/88/81	27/21/18	1506	376/1487	Trtd	T4	TF24Cp	TS17Sp	TR11	HF30Cp	HS15Cp	HR9***
EVFC w/APS	130/90/83	28/21/18	1506	365/1445	Trtd	T4	TF19Cp	TS14Sp	TR11	HF24Cp	HS12Cp	HR9*
EFVC w/APS & Appliqué	127/88/81	27/21/18	1506	376/1487	Trtd	T4	TF24Cp	TS17Sp	TR11	HF30Cp	HS15Cp	HR9***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
EFVP	+4	Good**	30mm ATK Mk 44 ChainGun, M-240C	600x30mm, 2400x7.62mm
EFVC	+4	Good**	M-240C	2400x7.62mm

*Hull floor armor value is 6Sp. Hull roof and turret roof armor are 5Sp.

**Stabilization drops to Fair when firing from water.

***Hull floor armor value for this version is 9Sp. Hull roof and turret roof armor are 5Sp.

GDLS M-4 Command and Control Vehicle (C2V)

Notes: The M-4 C2V (Command and Control Vehicle; sometimes it is called the M-4 C3I, for Command, Control, Communications, and Intelligence Vehicle) is a derivation of the M-2 Bradley chassis, designed to replace the M-577 and M-1068 in some roles for the command and control role (primarily at higher echelons, battalion and above), and also with the capability to be fitted out for a variety of other roles including a division-level communications center, FDC, electronic warfare vehicle, SIGINT vehicle, or heavy medical vehicle. The M-4 uses a large, box-like enclosure fitted onto the back of the vehicle; the turret has been deleted, and the whole thing looks similar to the M-993 MLRS (which is also derived from the Bradley chassis). The M-4 C2V has been somewhat of an experiment by the US Army, following the BCOTM (Battle Command On The Move) concept. The concept has had a hard time selling in the US Army, partially because of early misuse of the vehicle as a relatively-static command post and specialist vehicle instead of being a highly mobile platform as envisioned; one observer criticized the misuse of the M-4 C2V as an "armored, moving tent." In 1999, a total of 400 M-4 C2Vs were envisioned for procurement by the US Army, but as of 2010, only about 40 had been deployed; most of these are the command post variants, and only a very few are medical vehicles. The M-4 C2V is still being manufactured at a snail's pace under an LRIP program, with only 1-2 being finished and delivered in a given year. The M-4 C2V may get a second lease on life under the IEWCS (Intelligence and Electronic Warfare Common Sensor) program, but it is still considered a sort of advanced, combat-deployed experiment whose future is highly in doubt. In addition to misuse, the M-4 C2V has problems with an inadequate APU and the resulting need to eat up fuel due to the running of the vehicle's engine, and lower and higher echelons communicating primarily using text reports instead of the complex data the M-4 C2V is able to send and receive (this is a problem in general with the use of BMS systems in the Army and Marines, and is a problem with under-utilization of capability). The vehicles also have a unique appearance that can be a magnet for enemy fire, and are considered to suffer from overall under-armoring and vulnerability to IEDs. The M-4 C2V has also suffered from having no formal requirements for the program since it is still considered an experiment. The M-4 C2V is one of the last survivors (so far) of the Force XXI program vehicles, which originally included the Comanche, the MLRS MSTAR rocket, the Avenger Block II, the Grizzly, the Wolverine, and the ATACMS Block IIA.

All variants of the M-4 C2V are equipped with a basic version of a BMS and GPS.

The Command Variant (CV)

Though this category includes primarily replacements for the M-577 at battalion, brigade, and division level, it also includes division-level FDC and FALO vehicles; the command-type vehicles themselves can also vary greatly in fit and equipment installed as well as the interior layout. A general sort of equipment fit will be discussed here. Externally, the primary distinguishing factor in the CV are the five whip antennas and the folding, extendible 10-meter mast antenna, which service as many as two short-range, two medium-range, and four long-range radios, with all of these radios being data-capable. In addition, many are also fitted with SATCOM radios which are data-capable and the associated folding antennas, and these are included in the stats below. The radio system is interoperable with ground units, aircraft, and ships, as well as fixed positions and being able to receive signals from all over the globe

if equipped with SATCOM. The Command Variant is equipped with a full ATCCS (Army Tactical Command & Control System), sort of a BMS on steroids, plus large LCD screens for the display of maps, navigation information, and other information gathered and collated from intelligence reports and battle information. Three computers tie together this information, including lots of hard drive storage space. The usual sorts of ordinary map boards and plotting and office-type supplies are also present. This information is primarily concentrated in four ATCCS stations. The electronic equipment is contained in shock and vibration-resistant mounts. The entire vehicle is NBC sealed with an overpressure system and a collective NBC backup system. The vehicle includes a internally-mounted 25.6 kW APU (in the roof at the vehicle's left rear side), which has surprisingly proved to be inadequate for the purposes of powering the vehicle's equipment for an extended period while the vehicle's 600-horsepower engine (the same as in the M-2A3 Bradley) is switched off. The vehicle is equipped with air conditioning and a heater, as well as amenities such as a water tank and cooler and a hot plate. The interior of the rear command section is also rather tight, with all the equipment and personnel that are to be accommodated, including four operators for the ATCCS stations and four staff officers (with more often jamming in). In the cab, above the commander's position, is a mount for a heavy machinegun or grenade launcher; in the case of an M-240D or M-2HB, this weapon can be aimed and fired from under armor with the hatches closed. The cab has a large bullet-resistant windshield in front and bullet-resistant windows in the doors in the sides, over which armored louvers can be closed or opened in an adjustable manner. The louvered section can also be completely swung down or up, though this must be done manually from outside the vehicle. The body has small bullet-resistant windows at the rear, but no other windows or firing ports. No appliqué armor has yet been devised or envisioned for the M-4 C2V, though it may be in the works; future ERA lugs are also a possibility for the future, as is an APS. These are not reflected in the stats below.

Armored Medical Treatment Vehicle (AMTV)

The AMTV goes beyond the typical armored medical vehicle – it is essentially a small surgical suite and advanced medical treatment facility for wounded soldiers on the battlefield. The typical AMTV carries a full range of medical supplies (including a full set of surgical tools, the equivalent of 5 Doctor Medical Bags, enough refills for the personal medical kits of an entire platoon, a full range of drugs, at least 10 units of each blood type, plasma, and IV fluids, and advanced first aid kits). A large refrigerator is carried, as well as a freezer, a 25.6 kW generator for running equipment with the engine off, a defibrillator, oxygen equipment for three casualties, medical monitors for five casualties, and radios to communicate with air as well as ground elements. The crew of the AMTV normally consists of a driver, commander, medic, and nurse plus a doctor or physician's assistant; the commander and the driver are normally medics. The AMTV has the capability to carry four stretcher cases and up to five seated casualties; alternately, two of the stretcher stations and room for two seated patients can be folded and moved out of the way to make room for surgical treatment of one patient. The AMTV can provide advanced and/or surgical treatment as complex as primary 3rd-degree-burn treatment, amputations, treatment for wounds as severe as disembowelment, and of course treatment for gunshot and fragment wound, including multiple life-threatening hits. The AMTV is essentially a mobile, self-contained, armored MASH-type unit. The AMTV can extend a tent at the rear of the vehicle to allow for the treatment of more casualties (though it of course becomes temporarily immobile in such a case. The AMTV is normally unarmed; the hatch above the commander's position is a simple hatchway. The cab windows have the same armored windshield louvers as on the CV. The AMTV can be externally characterized by the virtual absence of antennas and aerials (it typically has only one whip antenna) and under most circumstances, by prominent medical insignia (i.e., a large red cross on the front, sides, rear, and top). The medical personnel have a small computer with decent hard drive storage capacity, which is used to consult a medical database. This computer can connect via a data-capable long-range radio to medical units in the rear, both to alert of incoming casualties and consult other medical personnel on treatment options and procedures.

Electronic Warfare Variants

This category is comprised of two versions – an EW (Electronic Warfare) vehicle used for the jamming of radio and radar signals, which itself has several versions depending upon the mission, and a SIGINT (SIGnals INTelligence) version, which is used for MIJI (Meaconing, Intrusion, Jamming, and Interference) against enemy radio and intelligence broadcasts.

The mission of the EW version is essentially straightforward. Radio-jamming versions can jam VLF and LF radio frequencies and the lower half of HF frequencies; HF and VHF radio frequencies, or the upper half of HF and VHF radio frequencies as well as the typical frequencies used for communications with certain ships and aircraft. It is rumored that a radio-jamming EW version with these capabilities may also be able to jam GPS signals. The jamming of these signals by an M-4 EW vehicle is so effective that broadcasting or listening to frequencies within its 100-kilometer jamming range is two levels more difficult than normal. GPS jamming is handled differently; GPS units used by enemy troops within the jamming range will be degraded so that they completely fail to give a reading 25% of the time, and give the wrong reading 50% of the time. GPS jamming can be ameliorated on a roll of 10 or greater on a d20; if successful, the GPS operator can immediately attempt a second GPS reading, with the chances of GPSs failure being reduced to 12% and of a bad reading reduced to 25%.

Other EW vehicles are used to jam radar, including counterbattery radar. Jamming range for these vehicles in general is 100 kilometers. Again, there are several versions of this type of EW vehicle, which is called an ECM (Electronic CounterMeasures) vehicle. One is used to jam signals such as ground-surveillance radar and counterbattery radar; the ECM version can also jam radio signals used by ATGM, wire-guidance signals used by ATGMs, and IR guidance signals used by fire-and-forget ATGMs and TV guidance signals used by some air-to-ground missiles. It also has a small chance of jamming GPS signals used by some air-to-ground ordinance, with this being similar to GPS signal jamming as above but successful for a complete miss 10% of the time and tripling the scatter radius for a miss 25% of the time. This jamming protects all friendly units within a 100-meter radius of the vehicle.

For use against counterbattery radar and GSR, this ECM vehicle degrades effectiveness by two levels. EW vehicles typically have a standard radio fit, plus a long-range radio with data capability.

Another type of ECM vehicle is optimized for use against the type of aircraft used by aircraft; degrading its effectiveness by two levels in the case of radar used to find and target ground targets and by one level for air-to-air targets. This version can also jam maritime radars, with effectiveness against ground targets being degraded by two levels and against other maritime targets within the radius and air targets by one level.

The SIGINT version is designed intercept and interfere with radio signals. At its simplest, the Intrusion mode, the SIGINT version is used to listen in on enemy radio broadcasts; in this mode, the computers of the SIGINT version use some of their power to dynamically find and keep up with enemy radio broadcasts. The SIGINT version has four such listening devices, which can be tuned to listen in on VLF and LF broadcasts, HF and VHF broadcasts, aircraft broadcasts, and ship broadcasts. Capacious hard drives, three computers, and conventional tape recorders record these broadcasts for analysis by intelligence soldiers, and assist in this analysis. The SIGINT vehicle can pass on its findings to higher headquarters via several radios with data capability. This equipment gives the operator a two-level boost in his chance of success at intercepting enemy signals. Meaconing allows the SIGINT vehicle to masquerade as a friendly radio source; the operator can then attempt to pretend to be a friendly unit (this would be a CHA or Disguise skill, as well as Language skills, more than anything else). Meaconing involves the same procedure and has the same chances as the breaking into of an enemy radio unit as Intrusion above. Jamming and Interference are not generally a part of the SIGINT vehicle's prevue, though the vehicle can attempt such; this jamming has a flat 10% base chance of success. These functions have a 100-kilometer radius.

These versions have the same cab as the other versions of the M-4 C2V. On this version, the cab is armed in the same manner as the CV above. Of course, these variants can be externally characterized by a plethora of specialized antennas. EW and ECM vehicles typically are equipped with powerful computers to help control the functions of their electronics suite. As with the other versions, the EW variant has a 25.6 kW APU. Crewmembers for these versions are normally four electronics specialists, two intelligence soldiers, and the driver and commander (who are normally themselves intelligence or electronics specialists). These vehicles typically have a standard radio fit, plus a long-range radio with data capability.

Twilight 2000 Notes: Only 12 of these vehicles were available for the Twilight War, all of the CV type; five were sent to the Middle East, four to Europe, one to Korea, one to Alaska, and one, for some strange reason, ended up in California with the forces defending against the Mexican invasion. The later vehicle was still known to be operational as late as 2003, though two of the BTCOM stations were known to be minimally-operative and one to be partially-inoperative (in addition to the loss of capability caused by the worldwide lack of communications).

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-4 C2V CV	\$1,121,127	D, A	7 tons	30.6 tons	2+8	24	Passive IR (D)	Shielded
M-4 AMTV	\$389,796	D, A	5.5 tons	29.3 tons	*	21	Passive IR (D)	Shielded
M-4 EW Radio Jammer	\$417,183	D, A	2.3 tons	29.1 tons	2+7	20	Passive IR (D)	Shielded
M-4 ECM Vehicle	\$3,257,136	D, A	2.3 tons	30.1 tons	2+6	20	Passive IR (D)	Shielded
M-4 SIGINT Vehicle	\$859,631	D, A	2.3 tons	28.1 tons	2+6	20	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-4 C2V CV	110/84	24/18	725	160	Std	T3	HF8 HS4 HR4
M-4 AMTV	114/87	25/19	725	154	Std	T2	HF8 HS4 HR4
M-4 EW Radio Jammer	116/88	25/19	725	152	Std	T2	HF8 HS4 HR4
M-4 ECM Vehicle	112/86	24/18	725	157	Std	T2	HF8 HS4 HR4
M-4 SIGINT Vehicle	120/92	26/20	725	147	Std	T2	HF8 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-4 C2V (Except AMTV)	None	None	M-2HB (C)	900x.50

*See above for Crew and passenger capacity.

IHC M-3 (Half-Track)

Notes: By 2000, this famous veteran of World War 2 was long out of service in most countries, being actively used only by Yugoslavia, some South American countries, and in a reserve role in Israel and Lebanon. It was an attempt to provide an armored personnel carrier with the maneuverability and fuel efficiency of a medium truck and the cross-country capability of a tracked vehicle. The Half-Track was easy to make, but was a poor compromise between a truck and a tracked vehicle, not having the good attributes of either. In addition, it is open topped, providing no protections against air attack, airbursting munitions, or even a lucky grenade throw. They are easier to repair than a full-tracked vehicle, but not as mechanically simple as a full-wheeled vehicle. By 2000, most half-tracks that were still in use were being used as specialist vehicles such as weapon carriers, artillery tractors, ambulances, and logistics carriers, instead as APCs. There are doors on either side of the cab for the driver and commander, and a door on the rear of the hull for passengers; however, the primary method of egress in combat was meant for the troops to simply jump out over the sides. Over the commander's position there is a ring mount for a heavy machinegun, and on each side of the passenger compartment there is a mount for a medium or light machinegun. In most versions, there are either a roller to assist in moving over high obstacles (to prevent the front bumper from digging into the obstacle and getting lodged) or a winch to assist in getting the stuck half-track (or other vehicle) unstuck. Though the stats below include a standard radio fit, radios did not become a standard feature on half-tracks in most cases until the late-1950s or early-1960s.

M-2 Half-Track Car

The story of the M-3 Half-Track actually started with the M-2 Half-Track Car, which was a version of the M-3 White wheeled scout car converted so that the rear wheels and suspension were replaced with a two-bogied, four roadwheeled tracked section. The M-2 entered service in 1940. The tracked section was itself taken from the Timken prototype of a half-track truck (the T-9), that truck, when armored, was woefully underpowered and in the M-2 Half-Track, it was replaced with a White 160AX gasoline 147-horsepower truck engine coupled to a manual transmission. The construction is primarily of bolted steel; the front end is primarily slightly-sloped, with an almost-horizontal armored hood. The front of the vehicle has armored shutters for the radiator which could be adjusted from the driver's position and bullet-resistant glass over which could be lowered armored shutters with vision slits. Armor protection on the M-2A1 is slightly heavier. The driver's controls were basically standard truck controls (a steering wheel, gearshifts, and a gas, brake, and clutch pedal). Though the M-2 had enough passenger capacity to serve to transport a small infantry squad (one that would be considered greatly-understrength at the time), it's primary role was as a scout vehicle and as prime mover for light and medium field guns and howitzers. Unlike the M-3, the M-2 did not have the side machineguns, though an M-2A1 version has those side guns and also one in the rear on the right side of the rear door (there was no rear door on the M-2; it did not appear until the M-2A1). The M-2 had its commander's machinegun in a semi-rectangular skate mount over his seat (a rectangle with rounded-off corners, giving him a 360-degree field of fire); the M-2A1 used a ring mount. The M-2 also had one rear machinegun, also on a skate mount, which extended across the rear end and slightly to the right and left, allowing fire to the left and right sides and somewhat to the front (about a 245-degree field of fire total). A version given to allies under the Lend-Lease program, the M-9, also did not have a rear door, though due to demand from those allies, an M-9A1 version was designed that did have a rear door. The M-9 and M-9A1 versions are identical for game purposes to the M-2 and M-2A1. Versions with field guns mounted and AAA guns mounted were also developed, though they will not be covered here. The protection levels on the M-9A1 are also upgraded, as on the M-2A1.

M-3 Half-Track

Entering service in 1941, the M-3 and its variants served over the years in the armies of 20 countries. Israel used them in large numbers as late as the 1990s; Bolivia, Vietnam, Nicaragua, Laos and Lebanon are believed to still be using small amounts of them. The M-3 is essentially a longer version of the M-2, able to carry a crew of 3 and 10 troops (about half an infantry squad in the US Army in World War 2). It entered service with the US Army in 1941. Some demilitarized versions are also still in use by civilian companies, particularly logging companies and construction companies in severe terrain.

The M-3 was not only designed to use as many components of the M-2 as possible, but as many commercially-available components as possible. Most M-3s used the same White 160AX 147-horsepower gasoline engine as the M-2. The M-3 used the same thickness of armor panels as the M-2 and had the same general design. As originally produced, the M-3 had racks down each side to hold antitank or antipersonnel mines to be emplaced by the troops inside; however, these were often removed and replaced with larger racks for crew and troop equipment. There were also spaces under the troop seats for ammunition and rations, and racks behind the seats for weapons to be placed in when they were not needed (something that didn't often happen either in a combat zone or in training). The M-3 from the beginning had a door in the rear face. The M-3A1, as the M-2A1, used a ring mount for the commander's machinegun instead of a skate mount. The M-3A1 added two machineguns on each side on a pintle mount on each side and another mount at the rear to the right of the rear door. Five troops sit down each side of the troop compartment; the cab has room for the driver on the left and commander on the right, as well as one person who could sit in the center (though in practice, this position was rarely occupied). Construction was primarily of bolted steel, with armored shutters for the radiator which could be adjusted from the driver's position and bullet-resistant glass over which could be lowered armored shutters with vision slits; the M-3A1 had heavier side armor. Like the M-2, the M-3 had several versions with AAA, field guns, or field howitzers mounted on them, as well as mortar carriers. The M-2A1, M-5 and M-9A1 versions carry more ammunition for their machineguns, primarily due to rearrangement and the carriage of .30-06 ammunition replacing some of the .50-caliber ammunition.

The M-5 version was a large upgrade. The M-5 used a liquid cooled engine, rather than the air-cooled engine of the M-3, though the IHC RED 450B engine developed only 143 horsepower. The M-5 used primarily welded steel instead of bolted steel. The walls of

the rear passenger section were of one-piece wrap-around steel rather than being bolted or welded. The M-5 used only the commander's machinegun. The primary disadvantage, from a manufacturing standpoint, was that most parts of the M-5 were not interchangeable with the M-3; only about half of the drive train, the tracks, wheels and bogies, and machinegun mounts were interchangeable. The M-5 was primarily targeted at US Lend-Lease partners and was not used much by US troops in World War 2 or Korea. The M-5A1 was the equivalent of the M-2A1 in the M-5 line, with the skate mount for the commander's machinegun being exchanged for a ring mount, three machineguns being added around the rear passenger compartment, and side and front armor being heavier.

Not to be confused with the M9 Half-Track Car, the M-9 Half-Track did away with the externally-mounted radios of the M-3 and M-5, bringing them inside the vehicle. The M-9 is otherwise like the M-5A1 for game purposes. Like the M-9 Half-Track Car, the M-9 Half-Track was primarily aimed at Lend-Lease customers. Note that the Israelis designated all of their half-tracks as "M-3," even those based on M-2s, M-5s, or M-9s (of either type). In addition, in the 1970s, many Israeli half-tracks were retrofitted with the Detroit Diesel 6V53 212-horsepower diesel engine of the M-113 as well as its Allison TX-100N transmission. Suspension is also improved. Most Israeli half-tracks were based on the M-9 version; even M-2s were updated to an "M-9" standard (referring to the M-9 Half-Track and not the M-9 Half-Track Car), though they were based on the M-9A1 Half-Track Car version. The Israelis also used a command variant of the M-9 Half-Track, which differed primarily in having extra radios (one short-range, two medium-range, and one long-range), and including a hand-held image intensifier, as well as a map board and plotting and office-type supplies, and five pairs of binoculars.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-2	\$39,348	G, A	715 kg	8.7 tons	2+6	6	Headlights	Open
M-2A1	\$41,008	G, A	665 kg	8.9 tons	2+6	6	Headlights	Open
M-3	\$29,511	G, A	1 ton	9.1 tons	2+11	6	Headlights	Open
M-3A1	\$50,965	G, A	950 kg	9.3 tons	2+11	6	Headlights	Open
M-5	\$29,501	G, A	950 kg	9.3 tons	2+11	6	Headlights	Open
M-5A1	\$51,328	G, A	900 kg	9.8 tons	2+11	6	Headlights	Open
M-9 Half-Track Car (Israeli)	\$40,431	D, A	715 kg	8.7 tons	2+6	6	Headlights	Open
M-9 Half-Track (Israeli)	\$51,743	D, A	900 kg	9.8 tons	2+11	6	Headlights	Open
M-9 Half-Track Command (Israeli)	\$117,672	D, A	450 kg	10.3 tons	2+5	9	Headlights	Open

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp*	Armor**
M-2	128/89	21/13	230	78	Std	T2/(W)1	HF3 HS2 HR2
M-2A1	125/87	21/13	230	80	Std	T2/(W)1	HF3 HS3 HR2
M-3	124/87	20/13	230	82	Std	T2/(W)1	HF3 HS2 HR2
M-3A1	122/85	20/12	230	83	Std	T2/(W)1	HF3 HS3 HR2
M-5	120/84	20/12	230	83	Std	T2/(W)1	HF3 HS2 HR2
M-5A1	116/81	19/12	230	88	Std	T2/(W)1	HF4 HS3 HR2
M-9 Half-Track Car (Israeli)	166/117	27/17	230	82	Std	T2/(W)1	HF3 HS3 HR2
M-9 Half-Track (Israeli)	155/109	25/16	230	99	Std	T2/(W)1	HF4 HS3 HR2
M-9 Half-Track Command (Israeli)	147/104	24/15	230	104	Std	T2/(W)1	HF4 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-2/M-2A1	None	None	M-2HB (C), M-1919A4 (R)	700x.50, 7750x.30-06
M-3/M-5	None	None	M-2HB (C)	4000x.50
M-3A1/M-5A1/M-9	None	None	M-2HB (C), 3xM-1919A4 (R, Rt, L)	700x.50, 7750x.30-06
M-9 Half-Track Car (Israeli)	None	None	M-2HB (C), MAG (R)	700x.50, 7750x7.62mm
M-9 Half-Track (Israeli)	None	None	M-2HB (C), 3xMAG (R, Rt, L)	700x.50, 7750x7.62mm
M-9 Half-Track	None	None	M-2HB (C)	2675x.50

Command (Israeli)	
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*If the tracks are hit, the Suspension value is T2. If the front wheels are hit, the Suspension value is (W)1. Suspension hits are a 50/50 proposition as to whether the tracks or wheels are hit.

**This vehicle has no overhead protection at all; hull roof AV is 0. Floor armor, however, is 2.

IHC/FMC M-75

Notes: This was the first successful US post-World War 2 APC design, and second full-tracked US APC design. The first US post-World War 2 design, the M-18 Hellcat-based M-44, was produced only in limited numbers for a very short time, as it proved to be too large, too heavy, and generally unsatisfactory as an APC. Development of the M-75 therefore began almost immediately on top of the introduction of the M-44 in 1946, and production began in 1952. Eventually, the breaking point of the M-75 was its cost – though it was better in almost every respect than the M-59 that replaced it, its *real-world* price was unacceptably high for the US Army at the time (though the Twilight 2000 price is lower than the M-59, it was in fact much more expensive than the M-59), despite continual changes to the design during and after development to reduce cost, and the use of many of the components of the M-41 light tank to further reduce costs. However, the high profile of the M-75 (2.8 meters) was also cited as a detriment, and the air cooling vents were considered vulnerable to small arms fire. The M-75 also has no amphibious capability. However, the single engine of the M-75 and relatively uncomplicated transmission made maintenance much easier and the vehicle on the whole more reliable, and armor protection was superior to that of the M-59. The M-75 saw service in Korea, arriving in-theater in 1952. Some 1780 were built; the last known users were Belgium, who used them into the 1980s in a reserve role; they were also given out liberally to other US allies and used into the late 1970s and early 1980s by them. Though several variants were evaluated, ultimately no variants were put into production; again, the Army felt the cost of the M-75 was too high.

The design of the M-75 was like most APCs of its time – a large armored box on tracks. As with the M-59, construction was mostly of welded steel, though some parts used bolts for fastening. The front of the vehicle has a modest slope, and has an unusual “double-slope” design with the upper part of the glacis having about twice the slope of the lower part of the glacis. The lower part of the glacis had the access hatch for the engine. The driver was in the front left hull, and center front of the hull, to the rear of the engine, had the commander’s position. The commander’s position was a simple manually-rotated cupola with a pintle-mounted machinegun. Late in production, the M-13 cupola, as used on the M-59, was fitted to the M-75. (During development, several other cupola and gun arrangements were tried, including a cupola with an M-1919A4 machinegun, twin remote-operated machineguns, and a pair of M-1919s on the cupola roof.) The driver had three vision blocks to his front; the commander had all-around vision blocks. In later production vehicles, an additional vision block on the top of the hatch could be removed and replaced by a night vision block. Access to the rear troop compartment was by a pair of hatches in the rear of the vehicle – these were wider at the top than the bottom. At the rear of the troop compartment, extending almost to the commander’s cupola, were a pair of center-folding hatches for the troops to stand in.

The M-75 used a Continental AO-895-4 gasoline engine which was air-cooled, necessitating large armored cooling louvers in the front of the vehicle in the upper part of the glacis. These cooling louvers in fact occupied most of that part of the glacis. The driver used a T-bar for steering, and had a gas pedal, brake pedal, and clutch pedal. The high silhouette was in part because of the placement of the transmission and large drive train, underneath the vehicle; the fuel tank was also in the floor. The suspension was virtually identical to that of the M-41 Walker Bulldog light tank. Early M-75s had very thin roof armor; this was almost doubled soon after production started; the M-75 was also noted for relatively-heavy floor armor. However, on early vehicles, the first two pairs and last pair of roadwheels had shock absorbers; later, as part of cost-cutting measures, the second pair of roadwheels lost its shocks. The M-75 had an early version of a semi-automatic fire suppression system, requiring only the pull of a fire-extinguisher handle located in the front and back of the vehicle (either one would do). Radios were not normally fitted to individual M-75s (except command vehicles), but I have included a standard radio fit below.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-75 (Early)	\$22,701	G, A	1.1 tons	18.8 tons	2+10	14	Headlights	Enclosed
M-75 (Late)	\$24,417	G, A	1.1 tons	18.9 tons	2+10	14	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-75 (Early)	126/88	21/13	568	166	Std	T3	HF5 HS3 HR3*
M-75 (Late)	126/88	21/13	568	166	Std	T3	HF5 HS3 HR3**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-75 (Early)	None	None	M-2HB (C)	1800x.50
M-75 (Late)	None	None	M-2HB (C)	2205x.50

*Hull floor AV is 3; hull deck AV is 1.

** Hull floor AV is 3; hull deck AV is 2.

SPDR/BVP M-60P

Notes: The M-60P (at first designated the M-590) is a “basic box” sort of APC, being a boxy metal shell on an old artillery tractor chassis (the GJ-800, which is in turn based on the Hungarian K-800). It was first seen in public in a parade in 1965, and is similar to the type of APCs being developed at the time – it is a contemporary of vehicles like the M-113 and FV-432. Once the basic designs of the M-60P versions were finalized, they were never upgraded, modified, or enhanced – not even to the point of having appliqué armor being installed. They are now therefore a bit dated, and the examples which are still to be found are likely to be in less than sterling shape. The Serbians still use 165 of these vehicles, and the Croatians still use small numbers of them.

The M-60P is essentially a steel box; there is little real protection for the occupants except from shrapnel and relatively low-power small arms. The driver is in the left front hull, with three vision blocks to his front; the center block can be replaced with a night vision block. On the right side of the hull at the front is a bow machinegunner, who also has auxiliary driving controls. He has only one wide-angle vision block built into his hatch cover and cannot replace it with a night vision block. Both have hatches that open to the rear. Behind the driver is the vehicle commander, who has a single periscope built into his hatch which can be rotated 360 degrees. Behind the bow machinegunner is the vehicle gunner, who has a manually-rotating cupola with a two-piece hatch. Unusually for a former-Eastern Bloc vehicle, its pintle mount takes an M-2HB machinegun, and the M-60P also carries a tripod mount on the right side of the hull to allow this weapon to be removed from the vehicle and fired from the ground. The troops sit on folding bench seats on either side of the rear troop compartment; they enter and leave through a pair of large doors in the rear of the hull and also have a pair of long hatches above the troop compartment. There are three firing ports on each side of the vehicle and one each rear door, but these are merely simple holes cut in the hull (or rear door) with simple swing-open shutters.

The M-60P is seriously underpowered, its diesel engine developing only 140 horsepower. The simple torsion bar suspension, a modified form of the suspension on the SU-76 self-propelled gun, does not have any shock absorbers; the cross-country ride of the M-60P must be hellish, but at least it will not be moving very fast. The transmission is manual and reportedly quite a handful for its driver. The M-60P has no amphibious capability. The M-60P is not a big vehicle as APCs go, but 10 troops were expected to jam into it along with the four-man crew. Operating out of an M-60P just sounds like a horrible experience.

The M-60PB is a modification of the M-60P armored personnel carrier. In this variant, the passenger compartment is partially taken up by ammunition storage and a suspended seat for the gunner of the twin M-60A recoilless rifles. The mount rotates, but shots in the direction of the gunner's machinegun cannot be made, since the recoilless rifles are mounted on the same level as the machinegun; in addition, fire straight forward is not possible when the driver's or commander's hatch is open.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-60P	\$53,701	D, A	1 ton	11 tons	4+10	6	Passive IR (D)	Enclosed
M-60PB	\$139,593	D, A	500 kg	11.3 tons	4+6	7	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-60P	105/74	26/15	150	55	Std	T2	HF6 HS3 HR2
M-60PB	102/72	25/15	150	57	Std	T2	HF6 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-60P	None	None	M-2HB, M-53 (Bow)	500x.50, 500x8mm
M-60PB	None	None	2xM-60A 82mm recoilless rifles, M-2HB, M-53	8x82mm, 500x.50, 500x8mm

SPDR/BVP M-80

Notes: The M-80 was known as the M-980 while in development; it was designed to replace the obsolete M-60P in almost all roles. Design began in 1969, but was a long process complicated by budget problems, the ready availability of Russian-made equipment, the continual incorporation of new technology, and negotiations with other countries for the use of their technology. The M-80 began production in 1980 in the former Yugoslavia; production continued until the breakup of Yugoslavia in 1991, and has never picked up again, by Serbia or any other former Yugoslavian country. The M-80 and its variants are still used by most of the former Yugoslavian countries, including Serbia, Bosnia, Macedonia, Slovenia, and Croatia; in addition, most of these countries, while not manufacturing complete vehicles, they are still making parts for the M-80 series.

The M-80

The resulting vehicle is similar in appearance to the BMP-2, though it is not related to that vehicle. The roadwheels are fewer in number and more widely-spaced, and the turret is more akin to the BRDM series, with different main armament than the BMP-2. Armor is aluminum, and a bit on the light side. The driver sits on the left front of the vehicle, and the commander has a hatch on the turret roof. There are two large hatches on the rear deck and rear face for troops. The driver's compartment has a conventional design, with a steering yoke, a brake pedal, a gas pedal, and a clutch pedal. The driver has three vision blocks to the front, one of which can be removed and replaced by a night vision block. The driver's position is in the front left of the vehicle. The turret is a two-man turret, though the gunner sits low in the turret basket, with only his head and upper shoulders in the actual turret, sitting just high enough to access his sights. The commander has a hatch on the roof, and has all-around vision blocks; the gunner has no hatch and normally enters and exits the vehicle through the troop compartment. The turret has minimal night vision equipment, as well as telescopic sights for the armament. The autocannon is of Swiss make and Swedish design, though license-produced in Yugoslavia

(the Yugoslavians designated this autocannon the M-55); the 260-horsepower engine is the same as used on the French AMX-10P, the Hispano-Suiza HS-115 turbocharged diesel, and is again license-produced in Yugoslavia. The transmission is manual. Suspension is by conventional torsion bars, with shock absorbers on the front and rear pair of roadwheels (this is a more-or-less standard form of tracked APC/IFV suspension). The main armament is supplemented by a pair of launchers for Maljutka ATGM (a Yugoslavian version of the AT-3 Sagger). The Maljutka ATGMs must be reloaded with the commander's head, chest, and the upper half of his abdomen outside his hatch; firing is done via a sight outside the hatch and the driver must expose his head to use it, though the actual controls are inside the turret. The troops in the rear can also reload the Maljutka launchers through the hatches in the roof of the troop compartment. The troop compartment is accessed through a large door in the rear, and there are two narrow, long rectangular hatches on the rear deck which open to either side. There are three firing ports on each side of the troop compartment and two in the rear. The troops sit down the center of the vehicle, facing outwards, with the squad leader sitting in the front of the troop compartment behind the turret, facing to the rear. Radiological protection is notably minimal, with no thought provided to resistance to chemical or biological agents or radiation, and no sort of even a collective NBC system.

The M-80A

The Yugoslavians were almost immediately dissatisfied with the M-80, in particular feeling it was underpowered and that the suspension was not robust enough. As a result, the M-80 was produced only in small numbers, and work on its successor, the M-80A, began almost immediately upon introduction of the M-80. Low-rate initial production of the M-80A began only about a year later. The initial changes to the M-80A involved a reinforced suspension able which also gave a smoother ride; however, the primary change was the switch to the Daimler-Benz OM-403 320-horsepower turbocharged diesel engine along with an automatic transmission (the M-80 had a manual transmission). In addition, a slight change in armament was made, to a dual-feed version of the same autocannon (which the Yugoslavians still designated the M-55). Radiological protection remains deficient.

Shortly thereafter, another change was made to the design, this time to the armament. The 20mm autocannon was replaced with a heavier-caliber German-designed autocannon, and the ATGM launchers, while they still must be reloaded in the same manner as on the M-80 and M-80A, could be aimed, fired, and controlled from under armor, with the hatch closed. This version was designated the M-80AK.

Three command versions of the M-80AK were built; the M-80AKC is designed for use by company commanders and has one additional short-range and medium-range radios and a long-range radio. The M-80AKB is designed for use at the battalion command level; it has the additional radios of the M-80AKC, plus another long-range radio and an inertial navigation system. In both cases, the interior is rearranged to allow for a map board, plotting and office-type supplies, a hand-held thermal image and image intensifier; the M-80AKB also has a hand-held laser rangefinder. The interior seating has a small folding work shelf and has seating for a radio operator and a small command staff. Small amounts of another command version, the VK-80A, were also put into production. Designed for use at brigade level, the VK-80A's turret is armed only with a single machinegun, and has additional vision devices and a laser rangefinder. It has the radios of the M-80AKB above, but the long-range radio is data-capable and the VK-80A carries a ruggedized laptop computer.

The M-80A Sn is an armored ambulance version of the M-80A. The hull remains the same as that of the M-80A, but the turret is deleted and the vehicle is unarmed. The rear door remains, but there is a single oblong hatch in the rear roof of the vehicle. There is a commander's cupola, though it is unarmed. The commander and the driver are medics, and there are also two other medics (or sometimes a medic and a nurse or PA) as members of the crew. The M-80A Sn can transport four stretcher cases and two seated patients or two stretcher cases and four seated patients. The M-80A Sn has a defibrillator, an oxygen administration set, a small refrigerator for perishable medical supplies, the equivalent of two doctor's medical bags and 20 personal medical kits, and a collection of assorted bandages, cravats, and splints.

A local modification uses the chassis of the ACRV (also known as the MT-LBu, using the chassis of the 2S1 SP howitzer), and is therefore technically a different vehicle; I have included it in this entry, however, for completeness. The turret is that of the M-80A, and the vehicle is used as an IFV with an ability to carry more troops and armor rather than as any sort of specialist vehicle. This gives the vehicle, often called the ACRV/M-80A, a YaMZ-238N 300-horsepower diesel engine and the hull armor of the MT-LBu, as well as the hull layout with three firing ports, one in the front right and left sides of the troop compartment, and the other in the rear door. The rear compartment has a large square hatch on the rear deck which opens to the rear, and troop access is by a pair of large doors in the rear of the vehicle. The normal commander's and gunner's hatches are deleted, replaced by the turret. They do have the advantage of having an NBC overpressure system with a collective NBC backup. I have not been able to find out whether the ACRV/M-80A was ever put into production or whether it was simply an experiment, but I have provided stats below.

The M-80A1 Vidra

In the late 1990s, the Serbians began replacing/supplementing their M-80As and M-80AKs with the M-80A1 Vidra variant. This version used a new Czech-designed turret, which was a bit smaller (though much taller), more angular and had better armor protection. The autocannon was replaced with a locally-designed autocannon which was virtually identical to the M-80AK's German autocannon. The Maljutka ATGMs are also replaced by locally-produced versions of the AT-4 ATGM, with a single launcher instead of the twin launcher of the earlier versions of the M-80. The engine was replaced with a more powerful locally-produced version of the OM-403 engine, a turbocharged diesel developing 335 horsepower. The main armament is better-stabilized and has the assistance of a laser rangefinder; the gunsight and telescopic day vision equipment is also in general improved. The M-80A1 has the ability to lay a smoke screen by injecting diesel fuel into its exhaust, something earlier versions could not do. A pair of smoke grenade launchers

was also added to each side of the turret. The M-80A1 normally mounts lugs for ERA on the hull front, hull sides, turret front, and turret sides. Unfortunately, production of the M-80A1 was cut short by the breakup of Yugoslavia and bombing by NATO forces.

In 2004, the Serbians began fielding a new, updated form of the M-80A1, the M-98 Vidra (sometimes called the M-80/98). This version has a further modified turret which is more rounded than that of the M-80A1, and it is armed with a locally-produced version of the Russian NN-30 AAA autocannon using new, locally-designed ammunition which provided effectiveness against other APCs, IFVs, LAVs, and from some angles, tanks. The a round of ammunition for this gun, being based on the NN-30's ammunition, is huge, but has a large warhead backed by a large propellant charge, and gives the M-98 excellent hitting power (though it greatly reduces the amount of ammunition for the autocannon the M-98 can carry). The gun length is, however, quite short, which limits range. Early M-98s used a version of the NN-30 designated the M-86, which feeds from a single ammunition belt; however, most versions have the M-89 autocannon, which is a dual-feed weapon. The autocannons are the same as mounted on the BOV-30 self-propelled AAA gun, though of course the ammunition mix carried on the vehicle is quite different. The M-98 retains the stabilization, laser rangefinder, and ballistic computer of the M-80A1, and also adds thermal imaging for the gunner, which can also be accessed by the commander. Some more thought was also given to NBC warfare, with radiation shielding being added as well as a collective NBC system.

Twilight 2000 Notes: The M-80AK and M-80A and their variants both formed about 40% each of the Yugoslavian M-80 force at the start of the Twilight War. The remaining vehicles were about 15% M-80s and 5% M-80A1s; very small amounts of ACRV/M-80As were also employed. The M-98 was not available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-80	\$199,715	D, A	1.5 tons	13.6 tons	3+7	10	Passive IR (D, G, C)	Enclosed
M-80A	\$263,588	D, A	1.3 tons	14 tons	3+7	10	Passive IR (D, G, C), Image Intensification (G, C)	Enclosed
M-80AK	\$271,413	D, A	1.3 tons	14 tons	3+7	10	Passive IR (D, G, C), Image Intensification (G, C)	Enclosed
ACRV/M-80A	\$306,245	D, A	1.8 tons	15 tons	3+11	10	Passive IR (D, G, C), Image Intensification (G, C)	Shielded
M-80A1	\$254,729	D, A	1.2 tons	14.2 tons	3+7	9	Passive IR (D, G, C), Image Intensification (G, C)	Enclosed
Vidra								
M-98	\$285,617	D, A	1.1 tons	14.2 tons	3+7	9	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G)	Shielded
Vidra								
M-80AKC	\$295,750	D, A	750 kg	14.7 tons	3+4	11	Passive IR (D, G, C), Image Intensification (G, C)	Enclosed
M-80AKB	\$384,025	D, A	750 kg	14.7 tons	3+4	11	Passive IR (D, G, C), Image Intensification (G, C)	Enclosed
VK-80A	\$472,729	D, A	750 kg	14 tons	3+4	12	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (C)	Enclosed
M-80A Sn	\$97,776	D, A	750 kg	14 tons	*	11	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-80	143/100	35/21/4	510	135	Trtd	T2	TF4 TS4 TR4 HF8 HS3 HR2
M-80A/M-80AK/VK-80A	153/107	37/22/4	510	153	Trtd	T2	TF4 TS4 TR4 HF9 HS3 HR3
ACRV/M-80A	138/96	34/20/3	540	142	Trtd	T3	TF4 TS4 TR4 HF5 HS2 HR2
M-80A1/M-98 Vidra	154/108	38/23/4	510	158	Trtd	T2	TF6 TS4 TR3 HF9 HS3 HR3
M-80AKC/M-80AKB	136/95	33/20/3	510	142	Trtd	T2	TF4 TS4 TR4 HF9 HS3 HR3
M-80A Sn	153/107	37/22/4	510	153	Trtd	T2	HF9 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-80	+1	Fair	20mm KAA, PKT, 2xMaljutka ATGM	1400x20mm, 2000x7.62mm, 4xMaljutka

M-80A	+2	Fair	20mm KAB, PKT, 2xMaljutka Launchers	ATGM
M-80AK	+2	Fair	30mm Mauser MK-30, PKT, 2xMaljutka Launchers	ATGM
ACRV/M-80A	+2	Fair	20mm KAB, PKT, 2xMaljutka Launchers	ATGM
M-80A1 Vidra	+3	Fair	30mm Mauser MK-30, PKT, AT-4 Launcher	ATGM
M-98 Vidra	+3	Good	30mm M-89, PKT, AT-4	ATGM
M-80AKC	+2	Fair	30mm Mauser MK-30, PKT, 2xMaljutka Launchers	ATGM
M-80AKB	+2	Fair	30mm Mauser MK-30, PKT, 2xMaljutka Launchers	ATGM
VK-80A	+1	Fair	PKT	ATGM

*See text above for crew and passenger capacity.