

MORTAR CARRIERS

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TAMSE VCTM

Notes: The VCTM (sometimes called the VCTM-TAM or TAM-VCTM) is an Argentine mortar carrier based on the chassis of the VCTP armored personnel carrier. The Argentines have 54 of these vehicles on hand at present, though they do not currently have plans to manufacture more. In this role, the turret is removed, and in its place is a hump-backed rear with a set of large hatches, which are opened when the mortar is to be fired. What is normally the rear cargo area is taken up by the mortar, a turntable built into the floor of the vehicle, a special bipod and sight assembly designed for the vehicle, and ammunition racks. However, the VCTM carries only a limited amount of ammunition and charges internally (like almost all mortar carriers) and during most extended firing missions, the VCTM is fed by crewmembers manning ammunition stacks and charge containers outside the rear doors of the vehicle, who attach the charges to the rounds according to the range required and then pass them by hand to the assistant gunner (the crewmember who actually drops the round down the tube). The VCTM also carries a normal baseplate and bipod for firing the mortar outside of the vehicle if necessary. The VCTM retains the rear-mounted remote-control machinegun of the VCTP. Firing ports and their associated vision blocks are deleted. There is a commander's cupola, but it has no provision for armament, though it does rotate manually and all-around vision blocks. The driver has three vision blocks to his front; the two on the outside are wide-angle vision blocks and the one in the middle gives a normal field of view. The middle block can be removed and replaced by a night vision block.

Like the VCTP, the VCTM is a sort of descendant of the Marder. It therefore shares having decent armor protection, though it is not as good as an actual Marder. The VCTP series, including the VCTM does, however, use a more powerful MTU MB-633 720-horsepower turbocharged diesel. The engine is coupled to a manual transmission, and the VCTP series (including the VCTM) is mechanically simplified as much as possible over the Marder or its TAM descendant. The VCTM is amphibious with a minimum of preparation; a trim vane must be erected (this can be done by the driver from the driver's compartment), and the driver must switch on bilge pumps. However, crews are loath to swim the VCTM, as freeboard is not great, and swimming speed is slow. On the front of the glacis, towards the outside and about halfway up, are a cluster of four smoke grenade launchers on either side. A small, hand-held mortar ballistic computer is included in the price below. Drums on each side of the VCTM carry auxiliary fuel, though they are normally filled only during long movements, and the driver draws from those tanks first. The reason for the simplification is because the VCTP series was to be built in Argentina as much as possible (a few specialized parts are built in Germany and the mortar is built in France), and the Argentines have a lesser manufacturing base. Some 70% of the VCTM components are built in Argentina, and 100% are assembled in Argentina.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$93,995	D, A	400 kg	26 tons	5	9	Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
195/136	45/32/2	640+400	385	Std	T3	HF14 HS6 HR6

Fire Control	Stabilization	Armament	Ammunition
None	None	120mm TDA AM-50 Mortar, MG-3 (R)	61x120mm, 2500x7.62mm

Steyr 4K 7FA AMC 81

Notes: The mortar carrier version of the 4K 7FA was in development at almost the same time as the basic APC, and both appeared in the late 1970s. While the 4K 7FA APC has been almost totally replaced in Austrian service, the 4K 7FA AMC 81 remains in service. Several other countries who use the 4A 7FA also use its mortar carrier iteration. In form, the 4K 7FA AMC 81 is externally and automotively virtually identical to the 4K 7FA APC, though there are external mountings for a baseplate, bipod, and aiming stakes for when use of the mortar away from the vehicle is warranted. The driver remains on the front left of the vehicle with three vision blocks to his front, the centermost of which can be replaced with an IR vision block. The commander's cupola is also retained, with its two-part hatch that opens to the right and left and can be locked open vertically to provide some protection to the commander. The cupola also has all-around vision blocks, and on the rear are four smoke grenade launchers. The cupola may also be fitted with all-around gun shields which are AV2 and add \$400 to the cost of the vehicle. The 4K 7FA does not, however, have any firing ports or associated vision blocks. The rear deck hatch is modified for the use of the mortar through it, and does not have any pintle mounts around it except in the rear. The front-most seat on the right side is still present, and generally reserved for the mortar squad leader; however, he does not have the rotating periscope of the 4K 7FA APC.

Of course, the most dramatic modifications are inside the vehicle. The rear area carries a specially-mounted 81mm mortar, racks for ammunition for the mortar, and limited seating for the mortar crew and very limited room for just about anything else. The mortar on its mount folds down partially inside the vehicle when the hatches are closed. Even so, it's a tight fit for the crew (the driver has perhaps the most space), and most crew equipment invariably gets tied to the outside of the vehicle. Modern 4K 7FA AMC 81s carry a hand-held mortar fire control computer that allows them to calculate items like gun angle and the amount of charges to put on their shells based on the coordinates given to them by the FDC.

As with the rest of the 4K 7FA series, the 4K 7FA AMC 81 has a 320-horsepower turbocharged diesel engine coupled to a semiautomatic transmission. The 4K 7FA AMC 81 uses special wide tracks for performance on snow and mud, and the normally rubber track pads can be replaced with track pads with steel claws in them for performance on ice and in difficult terrain. The engine compartment has an automatic fire extinguishing system, as does the crew and passenger compartments. As with the rest of the 4K 7FA series, the 4K 7FA AMC 81 has a gyrocompass to aid navigation.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$387,386	D, A	400 kg	14.8 tons	5	10	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
151/106	36/22	360	178	Std	T3	HF8 HS6 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm TDA mortar, MAG (R), M2HB	85x81mm, 1000x7.62mm, 600x.50

X-1A Mortar Vehicle

Notes: When the Brazilian Army modified most of their X-1As into X-1A1s and X-1A2s, some were modified into mortar carriers. The turret was removed and the turret ring was fitted with large double hatches to be opened for operation of the mortar. Like most such vehicles, the X-1A Mortar Vehicle carries a baseplate, bipod, and aiming stakes on the side for use if the mortar must be dismounted and used away from the vehicle. A commander's cupola has been added at the front left, with all-around vision blocks and a pintle mount; it is manually-rotated. The driver remains in the front right of the hull, with three vision blocks to the front and one to his right. A small number of these vehicles remain in service, but like the X-1A2 itself, they have mostly replaced with more modern mortar vehicles and light artillery.

The interior is heavily-modified to include a special baseplate built into the floor of the vehicle, a special bipod which allows the mortar to be partially folded so the deck hatches can be folded, and an extension for the sight which allows the gunner to see over the vehicle to use it. There are racks for ammunition which surround the walls of the former turret basket and crew compartment on three sides, as well as some behind the driver. The mortar fires over the rear of the vehicle, as in most mortar vehicles. Crew and operating space is as a premium in the X-1A mortar vehicle, with only cramped fold-up seats for the two crewman who are carried in the rear and almost none for personal gear or even the ammunition for their personal weapons.

Like the X-1A, the chassis of the X-1A mortar vehicle is based on a highly-modified M-3A1 Stuart light tank. This chassis has a Saab-Scania 280-horsepower engine and larger fuel tanks than on the M-3A1, a heavily-sloped glacis plate along with mildly-sloped sides, and a new volute suspension which improves off-road performance and smoothens the ride. The transmission is manual.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$26,754	D, A	400 kg	15 tons	4	10	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
142/99	33/23	320	148	Std	T2	HF6 HS5 HR5

Fire Control	Stabilization	Armament	Ammunition
None	None	120mm Mortar, M-2HB (C)	77x120mm, 670x.50

EE-11 Mortar Vehicles

Notes: These are EE-11 Urutu wheeled armored personnel carriers modified to carry mortars instead of standard armament, and suitably modified for that role. Two such vehicles exist: one which is turretless and carries an 81mm mortar firing through rear roof hatches, and one which has a 60mm gun/mortar in a small turret matched to a heavy machinegun. These vehicles are used by most countries using the EE-11 Urutu, especially the version carrying the 81mm mortar.

The EE-11 Mortar Vehicle

This version carries an 81mm mortar in the rear and the associated ammunition and equipment. The base chassis is that of a turretless version of the EE-11, though it is suitably modified. The rear deck of the EE-11 Mortar Vehicle has two large hatches opening right and left to allow use of the mortar; the mortar folds down just enough to allow the hatches to be shut, and is raised before firing. The EE-11 Mortar Vehicle retains the commander's cupola of the standard turretless EE-11, which has hatches that open to the right and left, all-around vision blocks, manual rotation, and a pintle weapons mount. Optionally, the commander's cupola can be fitted with all-around AV2 gun shields.

The rear of the EE-11 Mortar Vehicle is heavily-modified to carry the mortar and ammunition racks, as well as some associated equipment such as simple plotting equipment. As with virtually all such mortar vehicles, the baseplate is built into the floor of the vehicle, and bipod is specially designed to be used in a vehicular role. A hand-held mortar fire control is optional (it is not included in the cost below). The mortar fires over the rear of the vehicle. A baseplate, bipod, and aiming stakes are carried strapped to the outside of the vehicle; the aiming stakes are standard mortar firing equipment when a fire control computer is not used, and the baseplate and bipod are for use if the mortar is fired away from the vehicle. Though the standard EE-11 Mortar Vehicle has no firing ports or vision blocks in the sides or rear of the vehicle, the manufacturer will put one firing port in each side of the vehicle and up to two in the rear if desired by the buyer. There are two seats in the rear, the other two crewmembers are the driver and commander. Since the EE-11 Mortar Vehicle is not the biggest mortar carrier around, the ammunition racks in the vehicle are not large; EE-11 Mortar Vehicles often tow an ammunition trailer or are accompanied by an ammunition-carrying vehicle.

The EE-11 Gun/Mortar Vehicle

This version has a small turret mounting a 60mm gun/mortar and a coaxial heavy machinegun. The mortar is capable of near-vertical elevation, but only slight depression; it can therefore conduct conventional mortar indirect fire, or be fired in direct fire like a small low-power cannon. The standard commander's cupola is deleted in this version; the commander is, instead, in the turret (he has all-around vision blocks, but no weapon mount). The turret is small and the gunner is seated mostly in the hull of the vehicle, and the turret has only one hatch, normally for the commander. The turret is capable of fairly quick traverse and can do a full rotation in as little as 10 seconds. Fire control is basic at best for direct fire (the figures listed below); however, the EE-11 Gun/Mortar Vehicle has perfectly adequate sights for indirect fire which do not require aiming stakes to be set up, and a hand-held mortar fire control is optional. Depending upon the buyer's wishes, the EE-11 Gun/Mortar Vehicle may have up to two firing ports in each side and two in

the rear; normally, however, the EE-11 Gun/Mortar Vehicle does not have firing ports or even vision blocks in the sides or rear. Unlike the EE-11 Mortar Vehicle above, the Gun/Mortar Vehicle has no provisions for ground mounting of the mortar (or the machinegun, for that matter) away from the vehicle. Though the rear of the vehicle is primarily filled with ammunition racks, there is some space for equipment, and there are two folding seats for the two crewmembers in the rear, who function as loaders as well as preparing the charges on the mortar shells. The EE-11 Gun/Mortar Vehicle is perfectly capable of conducting normal fire support missions, but is also a capable scout vehicle, and can even be used as a light assault gun vehicle.

Common Features

As with a standard EE-11, the standard EE-11 Mortar Vehicles are powered by a 158-horsepower turbocharged diesel engine with manual transmission (an automatic transmission is optional). In 1988, most Brazilian EE-11 Mortar Vehicles were upgraded to use the same 6V53 212-horsepower turbocharged diesel engine as used on the M-113A2, along with an automatic transmission as standard. In addition, vehicle upgrades were offered with more powerful versions of the 6V53 developing either 230 or 260 horsepower. (Generally, at the same time, the radios and night vision equipment was also upgraded.) The EE-11 Mortar Vehicles have a 4x6 suspension, with the four rear wheels being the drive wheels. The suspension is designed for cross-country travel, and both the wheels and tires are large, with run-flat tires. The EE-11 Mortar Vehicles are amphibious, propelled in the water by waterjets and to a lesser extent by the motion of the wheels. The driver is in the front left and has three wide-angle vision blocks to his front; the center block can be replaced with a night vision block. A removable windscreen can be fitted to protect the driver's face and eyes from dust, dirt and mud when he is driving with his head outside of his hatch; this windscreen is of plastic panels in a canvas frame, and folds away and stows inside the driver's compartment when not in use. There is a door in the rear of the vehicle, which may be opened by either the crew or the driver. A second door is on the left side opposite and slightly to the rear of the commander's cupola. On each front fender is a cluster of three smoke grenade launchers.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
EE-11 Mortar Vehicle (153hp)	\$53,212	D, A	600 kg	14.8 tons	4	10	Passive IR (D)	Enclosed
EE-11 Mortar Vehicle (212hp)	\$46,912	D, A	600 kg	14.8 tons	4	10	Passive IR (D)	Enclosed
EE-11 Mortar Vehicle (230hp)	\$46,982	D, A	600 kg	14.8 tons	4	10	Passive IR (D)	Enclosed
EE-11 Mortar Vehicle (260hp)	\$47,092	D, A	600 kg	14.8 tons	4	10	Passive IR (D)	Enclosed
EE-11 Gun/Mortar Vehicle (153hp)	\$107,406	D, A	540 kg	15.3 tons	5	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed
EE-11 Gun/Mortar Vehicle (212hp)	\$81,626	D, A	540 kg	15.3 tons	5	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed
EE-11 Gun/Mortar Vehicle (230hp)	\$81,696	D, A	540 kg	15.3 tons	5	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed
EE-11 Gun/Mortar Vehicle (260hp)	\$81,806	D, A	540 kg	15.3 tons	5	10	Passive IR (D, G, C), Image Intensification (G)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
EE-11 Mortar Vehicle (153hp)	105/53	29/14/3	380	84	Std	W(3)	HF10 HS4 HR3
EE-11 Mortar Vehicle (212hp)	128/68	36/17/4	380	114	Std	W(3)	HF10 HS4 HR3
EE-11 Mortar Vehicle (230hp)	135/70	37/18/4	380	124	Std	W(3)	HF10 HS4 HR3
EE-11 Mortar Vehicle (260hp)	148/76	41/20/4	380	142	Std	W(3)	HF10 HS4 HR3

EE-11 Gun/Mortar Vehicle (153hp)	97/49	26/13/3	380	86	Trtd	W(3)	TF4 TS3 TR3 HF10 HS4 HR3
EE-11 Gun/Mortar Vehicle (212hp)	118/60	32/16/3	380	119	Trtd	W(3)	TF4 TS3 TR3 HF10 HS4 HR3
EE-11 Gun/Mortar Vehicle (230hp)	125/63	33/17/3	380	130	Trtd	W(3)	TF4 TS3 TR3 HF10 HS4 HR3
EE-11 Gun/Mortar Vehicle (260hp)	137/69	37/18/4	380	149	Trtd	W(3)	TF4 TS3 TR3 HF10 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
EE-11 Mortar Vehicle	None	None	81mm Mortar, MAG or M-2HB (C)	36x81mm, 1260x7.62mm or 750x.50
EE-11 Gun/Mortar Vehicle	+1	Basic	Thomson-Brandt 60mm Gun/Mortar, M- 2HB	62x60mm, 1260x.50

EE-11 Gun/Mortar Vehicle

Notes: This is a variant of the EE-11 Urutu with a turret mounting a TDA 60mm gun/mortar. This weapon is capable of conventional indirect fire, or can be direct-fired like a small cannon. The turret is small, light, and inexpensive, yet very capable.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$114,100	D, A	1.2 tons	15.55 tons	5	5	Passive IR	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
179/107	38/23/4	380	96	Trtd	W(3)	TF3 TS2 TR2 HF10 HS4 HR3

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	60mm Gun/Mortar, MAG	65x60mm, 2000x7.62mm

Alvis/BAE FV-432 Mortar Carrier

Notes: This is a version of the standard FV-432 serving as a carrier for an 81mm mortar. The current FV-432 Mortar Carriers in service are based on the Mk 2 version, though of course they were originally based on Mk 1 versions and later the Mk 1/1 upgrades. There is some talk of applying most of the Mk 3 Bulldog improvements, but a final decision by the British MoD has yet to be reached as of the time I write this (late June 2011). Other than the British, the Indians bought six FV-432 Mortar Carriers, and the British Army keeps some of them on NATO training bases in Canada for use when their troops go on training exercises there. Currently, a replacement for the FV-432 Mortar Carrier does not appear on the horizon, and it will undoubtedly soldier on for some time, just like the APC version of the FV-432, and it may persist for a while after even the APC version of the FV-432 leaves service.

The FV-432 Mk 1 and Mk 2 Mortar Carriers, and the FV-432 Mortar Carrier in General

Externally, the FV-432 Mortar Carrier appears virtually identical to the standard FV-432, though the baseplate and bipod for ground-mounting the L-16 mortar and a bag containing aiming stakes strapped to the left side of the vehicle near the rear may tip one off. The driver's compartment is in the same place on the left front deck, with three vision blocks to the front, and the middle vision block removable and replaceable by a night vision block. (like the M-113, the FV-432 driver controls his vehicle largely using laterals for steering and braking.) The commander's cupola is likewise in the same place, behind and slightly to the right of the driver. The cupola usually has a cupola for a light weapon (it's not stressed for the sort of weapon which would require an NHT). Though it is not as common as on FV-432 APCs, the commander's cupola of the FV-432 Mortar Carrier may be surrounded by AV2 gun shields. The FV-432 Mortar Carrier has a cluster of three smoke grenade launchers on each side of the vehicle at the top of the glacis.

The rear area of the FV-432 Mortar Carrier is, of course, heavily modified for its mission. Though there are no troop seats and merely three seats for the remaining members of the crew, the normally-roomy interior of the FV-432, gives the crew a little extra working room when manning the mortar and space for an astounding amount of ammunition for the mortar, as well as a little room for troop equipment. Like most such vehicles, the mortar sits on a special baseplate built into the floor of the vehicle, and a special "bipod" designed specifically for vehicular use. The sight comes with an extension to allow it to see over the top of the vehicle. Unlike most such mortar carriers, the L-16 mortar in the rear has a full 360 degrees of traverse – though this can be useful in a fast-changing tactical situation or if the mortar vehicle finds itself lined up wrong when it reaches a firing position, the optimum position for firing remains having the mortar fire over the rear of the vehicle. The normal two-piece circular hatch on the rear deck is replaced by a longer rectangular two-piece hatch on the FV-432 Mortar carrier; the hatchway in general offers more open area when the hatches are open, giving the crew more room to work with the mortar. The large rear door with a vision block in it remains. The FV-432 also has the signature feature of the FV-430 series – the large external NBC pack on the right side of the vehicle, and the associated collective NBC system for the crew. Starting in the mid-1980s, FV-432 Mortar Carrier crews were more and more often issued hand-held mortar fire control computers, and these are part of the cost of the Mk 2 (and Mk 3) versions in the stats below.

The Mk 1 version of the FV-432 Mortar Carrier uses 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. As with the FV-432 Mk 1, the FV-432 Mk 1 Mortar Carrier 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. Due to the heavier weight of the FV-432 Mortar Carrier, swimming is even more dicey, and less recommended than swimming the FV-432 APC. A minor upgrade, the Mk 1/1 version, 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. The Peak Engineering light turret that was applied to some Mk 2 FV-432 APCs was not applied to any FV-432 Mortar Carriers. The short-lived Mk 2/1 modification, which moved the NBC pack inside the FV-432 APCs walls, was never applied to the FV-432 Mortar Carrier.

The FV-432 Mk 3 Mortar Carrier – a Possible Upgrade

As stated above, it is still a question among the British MoD as to whether any Mk 3 upgrades will be applied to the FV-432 Mortar carrier. The Mk 3 FV-432 upgrade primarily addressed protection and mobility issues, but tactical doctrine calls for mortar carriers to be several kilometers behind/away from the main fight. The Mk 3's integrated power pack, along with some other mechanical and electrical improvements, do make maintenance much easier, and that is a motivation for applying at least that part of the upgrade. And of course, enemy forces, especially irregular groups like insurgents, can appear literally anywhere, so this is a motivation for protection upgrades. The stats below, therefore, reflect the maximum amount of projected Mk 3 upgrades for the FV-432 Mortar Carrier being applied.

The engine used in the upgrade is a 260-horsepower diesel engine, along with a fully automatic transmission. The laterals for vehicle control are gone, replaced by a steering yoke and a standard gas pedal and brake pedal. The FV-432 Mk 3 Mortar Carrier 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, freeing up some interior space. Other improvements include a beefed-up suspension for the crew and troops seats. The FV-432 Mk 3 Mortar Carrier is generally equipped with a GPS unit as well as an extra long-range radio. The smoke grenade clusters have increased from three to four.

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. The commander's position is equipped with a light

weapon, as on other FV-432 Mortar Carriers; however, this weapon is standard. Also standard are the AV2 gun shields for the commander's cupola. The FV-432 Mk 3 Mortar carrier is not slated to receive the RCWS station (any iteration of it). 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 carrier. 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 FV-432 Mortar Carrier's crew will not know that the mine is there.

It should be noted that the Mk 3 Mortar Carrier is not amphibious.

Twilight 2000 Notes: In the Twilight 2000 timeline, the Mk 3 does not exist in any form. FV-432 Mortar Carriers and FDCs that were formerly used for training purposes in Canada were "impounded" for use by the Canadians. The Indians never received any FV-432 Mortar Carriers in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-432 Mk 1 Mortar Carrier	\$84,298	G, A	630 kg	16.4 tons	5	12	Passive IR (D)	Enclosed
FV-432 Mk 2 Mortar Carrier	\$106,298	D, G, A	630 kg	16.4 tons	5	12	Passive IR (D)	Shielded
FV-432 Mk 3 Mortar Carrier	\$110,641	D, A	580 kg	17.5 tons	5	12	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV-432 Mk 1 Mortar Carrier	106/73	26/16/4	454	143	Std	T2	HF6 HS4 HR3
FV-432 Mk 2 Mortar Carrier	106/73	26/16/4	454	107	Std	T2	HF6 HS4 HR3
FV-432 Mk 3 Mortar Carrier	103/70	25/15	454	133	Std	T3	HF8Sp HS6Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV-432 Mortar Carrier	None	None	81mm L-16 mortar, L-7A2 (C)	160x81mm, 1600x7.62mm

*Hull floor AV is 4.

BAE Simba Mortar Carrier

Notes: This is a Simba Low-Profile APC modified for the mortar-carrying role. The Simba Mortar Carrier was originally designed along with the Simba APC by GKN-Sankey as a private venture, and as with the Simba, had sales only to the Philippine Army and police. They bought only a few of the mortar carrier version, for general fire support; the Philippine Army concentrated on the APC versions. Unlike the normal Low-Profile Simba version, the Simba Mortar Carrier is a military vehicle, and does not have the PA system or flashing lights and siren of the normal Low-Profile APC.

As with most such vehicles, the normal passenger is taken up by a mortar using a special turntable set into the floor of the vehicle, and a specially-designed bipod which allows the mortar to fold enough for the overhead hatches to be closed. The Simba Mortar Carrier also has associated equipment such as an extension for the sight, a baseplate and bipod for operation of the mortar away from the vehicle, and minor plotting equipment. A mortar fire control computer is optional and not included in the price below. Much of the space in the rear is taken up by racks for the copious amount of ammunition carried by the vehicle. Space for the crew is limited, and there is a little more room for equipment; there are two folding seats in the rear near the front for the two crewmembers who ride in the rear.

The Simba Mortar Carrier has two large hatches added to the roof of the vehicle to allow the mortar to fire over the back of the vehicle. The driver is on the front left, with a hatch above him and bullet-resistant windows around him; no provision is made for night vision equipment. Behind the driver on a slightly-raised platform is the commander's cupola, which has all-around vision blocks and manual rotation. It has a pintle mount for a weapon. On the frontal AV2 gun shield, a searchlight is mounted. On the left side of the hull to the rear of the commander's cupola is a large clamshell door; there is another (normal) door in the rear. As with the standard Simba APC, firing ports and vision blocks are an option, though a standard fit for the Simba Mortar Carrier is a vision block in the left-side door, the right side at the same place in the hull, and in the rear door; none of these have firing ports. On the upper front, on each side, is a cluster of four smoke grenade launchers.

The engine is to the driver's right and is a Perkins 210Ti Phaser turbocharged diesel developing 210 horsepower. Transmission is automatic. Frontal armor is substantial, but side and rear armor are none too thick. The off-road suspension is 4x4, but run-flat and/or puncture-resistant tires are optional.

Twilight 2000: In the Twilight 2000 timeline, the Simba Mortar carriers were often used against crowds of protesters. They normally fired CS rounds into crowds, but sometimes heavier ordinance was used. They were also used in a more normal fire support role. A factory for these vehicles was set up in the Philippines just before the Twilight War, and continued operating and

exporting these vehicles for at least 10 years after the Twilight War before being burned by rioters. In Britain, production of these vehicles for home use did not start until the Twilight War, and the Simbas used by Britain were largely employed in an internal security role, mostly against marauders, Scottish separatists, and IRA terrorists.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$60,531	D, A	960 kg	10.3 tons	4	6	WL Searchlight (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
169/85	78/39	296	99	Std	W(3)	HF8 HS3 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm mortar, MAG or M-60 or M-2HB(C)	77x81mm, 1500x7.62mm or 900x.50

Alvis/BAE Stormer Mortar Carrier

Notes: This is a Stormer FV-4333 modified to carry an 81mm or 120mm mortar. It is similar in concept and design to the US M-106 and M-125 mortar carriers, modified to carry the 81mm L-16 or (formerly) a 120mm mortar of a make I have yet to be able to find out. The British Army in the mid-1990s dropped the heavy mortar from its inventory, leaving only the 81mm mortar vehicle. I have included stats below for this heavy mortar vehicle, however. Though the Stormer series has been exported, the mortar carrier never has.

The driver of the Stormer Mortar Carrier is in the customary place in the top left of the glacis, with one wide-angle vision block to the front, replaceable by a night vision block. The commander's cupola is behind him; being a No 16 cupola, he has all-around vision blocks and can aim and fire his weapon (but not reload) while buttoned up. The vision blocks have no magnification, but the machinegun mount has a dual-channel x1/x10 periscope with an aiming reticule. The squad leader's hatch on the right is there, but not normally used by the mortar squad leader (who is usually the vehicle commander), and is just for general use or observation. The rear deck hatches are enlarged for the mortar; the mortar folds down just enough to allow the hatches to be closed. The Stormer Mortar Carrier, like most such mortar carriers, carries a ground-mount baseplate and bipod, as well as aiming stakes (which have largely been made superfluous by the hand-held mortar fire control computer, not included in the price below). The rear area is largely given over to the mortar and its ammunition and charges; though there are two folding seats for the crewmembers which ride in the rear and there is some space for crew equipment, interior space is at a premium.

The Stormer Mortar Carrier 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 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. The Stormer Mortar Carrier is amphibious with preparation (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 Mortar Carrier for amphibious operations, doubling the Stormer Mortar Carrier'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).

One handicap of the 120mm mortar-carrying version was the limited onboard ammunition, meaning it often had to tow an ammunition trailer, be followed by one of more ammunition-carrying vehicles, or overstuff the interior and exterior with crates of ammunition.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
81mm Mortar Carrier	\$70,943	D, A	610 kg	12 tons	4	6	Passive IR (D, C)	Shielded
81mm Mortar Carrier (w/Appliqué)	\$71,515	D, A	600 kg	12.6 tons	4	8	Passive IR (D, C)	Shielded
120mm Mortar Carrier	\$69,332	D, A	600 kg	12.1 tons	4	6	Passive IR (D, C)	Shielded
120mm Mortar Carrier (w/Appliqué)	\$69,904	D, A	590 kg	12.7 tons	4	8	Passive IR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
81mm Mortar	141/99	35/21/2	405	124	Std	T3	HF8 HS4 HR4

Carrier 81mm Mortar	134/94	33/20/2	405	129	Stnd	T3	HF10 HS6 HR4*
Carrier (w/Appliqué) 120mm Mortar	140/98	35/21/2	405	125	Stnd	T3	HF8 HS4 HR4
Carrier 120mm Mortar	134/94	33/20/2	405	129	Stnd	T3	HF10 HS6 HR4*
Carrier (w/Appliqué)							

Vehicle	Fire Control	Stabilization	Armament	Ammunition
81mm Mortar	+1	None	81mm Mortar, L-7A2 (C)	75x81mm, 3000x7.62mm
120mm Mortar	+1	None	120mm mortar, L-7A2 (C)	30x120mm, 3000x7.62mm

*Belly armor for this variant is 3.

GDLS Bison Mortar Fire Support Vehicle

Notes: This is a Bison armored personnel carrier with a turntable mounting an 81mm mortar in the center of the passenger compartment. As such, the interior is heavily-modified to accomplish its mission; in particular, the former rear passenger area is largely taken up by a turntable and special bipod mounting for the 81mm mortar, ammunition racks, stowage for associated equipment, and a bit of interior room to carry part of the mortar crew and some of their equipment. As the standard Bison is spacious inside, this allows the Bison Mortar FSV to carry a large supply of ammunition for its mortar as well as a standard ammunition complement for its roof-mounted machinegun. The Bison Mortar FSV also carries a standard baseplate and bipod to allow the mortar to be removed from the vehicle, ground-mounted, and fired away from the vehicle if it is necessary. Aiming stakes are also carried for properly aiming the mortar if a mortar fire control computer is not available (though one is included in the cost below).

Like the standard Bison, the Bison Mortar FSV is a variant of the LAV II chassis and therefore a relative of the LAV-25, with the turret removed and the rear area raised by almost the same amount, forming a large rear space. The Bison Mortar FSV's driver and commander occupy their customary spaces, the same as those on the standard Bison, and the chassis and hull are largely the same as that of the standard Bison externally. However, instead of relatively small roof hatches with a large flat space behind them, the Bison Mortar FSV has larger hatches to allow unimpeded operation of the mortar. On early Bison Mortar FSVs, the mortar had to be raised into position partially above the roofline before a fire mission; later Bison Mortar FSVs have even larger roof hatches and a periscopic mortar sight extension, allowing fire missions to be conducted with the crew protected by the vehicle's armor (except from the top). Unusually, the mortar fires primarily over the front of the vehicle on the Bison Mortar FSV, though the turntable has a traverse of up to 15 degrees to each side. The rear ramp with a door in it is retained, as are the large stowage bins on the rear sides of the vehicle. Likewise, the air conditioner is retained, as is the collective NBC system, the amphibious capability, and the cluster of four smoke grenade launchers on each side of the hull near the front.

Power is provided by a Detroit Diesel 6V53T turbocharged diesel developing 275 horsepower, coupled to an automatic transmission and conventional driver's controls. The Bison Mortar FSV is amphibious with a minimum of preparation (about 2 minutes), and propulsion in the water is by a pair of waterjets steered by rudders. Drive is 8x8, with the front four and rear four sets of wheels able to steer independently to tighten steering radius. The tires are run-flat. Construction is largely of steel, with a Kevlar anti-spalling liner. The Bison Mortar FSV can take a version of QinetiQ's LAST appliqué armor kit, which includes additional internal anti-spalling panels. In the front of the hull is a winch with a capacity of 6.8 tons and 100 meters of cable.

Twilight 2000 Notes: In the Twilight 2000 timeline, the US Marines acquired 12 of these vehicles in 1995-1996 to help close perceived gaps in the Marines' mortar support capabilities. The US Army bought three Bison Mortar Fire Support Vehicles as test vehicles in the early 1990s for the 9th Motorized Infantry Division, and they put these into action when hostilities started.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Bison Mortar FSV	\$97,492	D, A	450 kg	13.3 tons	4	9	Passive IR (D)	Enclosed
Bison Mortar FSV (LAST)	\$99,080	D, A	340 kg	14.6 tons	4	11	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Bison Mortar FSV	154/49	36/17/4	300	148	Std	W(6)	HF6 HS4 HR3*
Bison Mortar FSV (LAST)	140/44	33/16/3	300	163	Std	W(6)	HF10Sp HS6Sp HR4**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Bison Mortar FSV	None	None	81mm mortar, C-6 (C)	90x81mm, 1620x7.62mm

*Hull Floor AV is 3.

**Hull Floor AV is 5; Hull Roof AV is 3.

GDLS LAV-M

Notes: This is a mortar carrier modification of the LAV-25 designed by GDLS Canada specifically for use by the US Marines, and designed to be a companion to the LAV-25. So far, only the US Marines use the LAV-M. The hull of the LAV-25 has been retained, though the roofline has been raised a little bit (about 100mm or so). The turret is removed, and the rear area has large hatches to open and permit operation of the mortar. In most other respects (except the interior), the hull is identical to that of the LAV-25.

The driver is in his customary position on the front right, with three frontal vision blocks, one of which can be removed and replaced by a night vision block. The commander has an adjustable stand with a simple commander's hatch; the commander has

three vision blocks to his front, one to the right side, and one to the rear. The center front vision block has an IR channel. Like most Marine vehicles, the LAV-M did not at first have a machinegun for its commander, but most had them added by the commander's request throughout the Marines.

The rear ramp with a door in it is retained, along with the two rear vision blocks. All firing ports have been deleted. At the rear of the vehicle, above the ramp, is a tent extension of the working area, approximately to double normal size; ammunition is often stored in this tent extension if the LAV-M is going to be operating in an area for an extended period. A cluster of six smoke grenades is mounted on each side of the front hull, as the upper point of the glacis plate.

As a variant of the Piranha, the LAV-M has the wedge-shaped nose and moderately-sloped sides of the basic chassis, and an 8x8 suspension with front and rear sets of wheels with independent steering, giving the LAV-M a surprisingly small turning radius. For standard road use, the LAV-M normally uses only the four rear wheels as drive wheels, switching to 8-wheel drive off road. The LAV-M is amphibious with a minimum of preparation (about 2 minutes), and is propelled in the water by propellers and steered by rudders. Power is provided by the standard LAV II engine, the Detroit Diesel 6V53T 275-horsepower turbocharged diesel. This is coupled to an automatic transmission.

The rear area is largely taken up by the mortar on its special floor-mounted turntable and modified bipod, along with an extension allowing the sight to sight targets outside of the vehicle, and racks for mortar ammunition. Two seats are installed for the two crewmembers that are carried in the rear, and there is room for a small amount of personal gear and other equipment. A standard baseplate and bipod is carried externally, being the primary aligning system; this is being increasingly supplanted by mortar fire control computers (included in the cost below). The rear area is largely taken up by the mortar and the ammunition for it; crew space is actually quite small.

The LAV-M was subjected to a version of the SLEP in the 1990s, becoming The LAV-MA1. The mortar fire control is included (and is included in the cost of the basic LAV-M as well), along with a small computer able to generate fire solutions if no FDC vehicle is present. The chassis has been given a general overhaul under the SLEP program. An air conditioner has been added. Currently, LAV-MA1s are scheduled to receive part of the A2 upgrades, including the LAST kit as standard, fire suppression equipment, and suspension upgrades.

The LAV-M is able to take the LAST kit, though only that able to be fitted to the hull, and even this is adapted to the LAV-M's greater height.

As with the LAV-25, power is provided by the standard LAV II engine, the Detroit Diesel 6V53T 275-horsepower turbocharged diesel. This is coupled to an automatic transmission and the driver has a conventional drive control setup. The driver is located on the front left and has three vision blocks to his front. An 8x8 suspension with front and rear sets of wheels with independent steering, giving the LAV-25 a surprisingly small turning radius. For standard road use, the LAV-25 normally uses only the four rear wheels as drive wheels, switching to 8-wheel drive off road. The LAV-25 is amphibious with a minimum of preparation (about 2 minutes), and is propelled in the water by propellers and steered by rudders.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
LAV-M	\$128,676	D, A	525 kg	14.3 tons	4	9	Passive IR (D)	Enclosed
LAV-M (LAST)	\$131,614	D, A	335 kg	15.8 tons	4	10	Passive IR (D)	Enclosed
LAV-MA1	\$162,943	D, A	515 kg	14.3 tons	4	10	Passive IR (D)	Enclosed
LAV-MA1 (LAST)	\$165,881	D, A	325 kg	15.8 tons	4	11	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
LAV-M/MA1	155/78	36/18/5	300	168	Std	W(6)	TF6 TS4 TR4
LAV-M/MA1 (LAST)	139/70	32/15/4	300	177	Std	W(6)	HF10Sp HS6Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
LAV-M/MA1	None	None	81mm M-252 mortar, C-6 (C)	84x81mm, 1620x7.62mm

*Roof armor for this version is 3; Floor armor is 5.

Type 63 Mortar Carrier

Next: Two types of mortar carriers based on the Type 63 APC were built by Norinco; both were produced for export and were not used by the PLA. The full list of operators is not known, but probably includes North Korea, Iran, and possibly Iraq, Thailand, and Myanmar; any Iraqi Type 63 Mortar Carriers have almost certainly all been destroyed, while any Iranian Type 63 Mortar Carriers have likely been superseded by newer designs and are in use only by second- or third-line units. As far as is known, all Type 63 Mortar Carriers have been sold with 82mm mortars or 120mm mortars designed for Russian/Chinese-type ammunition.

Type 63 Mortar Carriers are based on the YW-531C (Type 81) version of the Type 63 APC, with a somewhat stretched hull (though with the same amount of roadwheels); nonetheless, the rear of the vehicle is very cramped for its crew, as it is so stuffed with the mortar and associated equipment, and especially, copious ammunition storage. Like most mortar carrier vehicles, the two Type 63 Mortar Carriers carry aiming stakes and a sight extension for aiming the mortar, and a baseplate and bipod externally to allow the mortar to be removed from the vehicle and ground-mounted if necessary. The vehicle can plot fire via manual methods, using a map, protractor, and aiming circle; however, these instruments on the mortar carrier are considered backups, as an FDC vehicle would normally plot the actual fire coordinates. Both vehicles have hookups for two field telephones, though the field telephones and commo wire are generally carried by the accompanying FDC vehicles or cargo/ammunition carrier vehicles. The two types of Type 63 mortar carrier are the YW-304, which carries an 82mm mortar (and has the capability to carry an 81mm mortar instead compatible with basic Western-type ammunition, as well as some Western-type 81mm mortars), and the YW-381, which carries a 120mm mortar (which may be designed to fire Russian/Chinese-type ammunition or basic Western-type ammunition – the Chinese produce several types of 120mm ammunition compatible with Western-type mortars, as well as several Western-type 120mm mortar analogs). The model of mortar depends upon the buying country's wishes. Forward of the rear section, the Type 63 Mortar Carriers have largely the same front area as the Type 63 APC, with the driver on the front left, who has three vision blocks to the front, the center of which may be replaced with a night vision block. The gunner's position is deleted; the rear deck has a large circular hatch opening right and left, with the mortar firing through this hatch over the rear of the vehicle. Like most mortar carriers, the mortars in these vehicles must be raised up into firing position (which consists of removing some locking pins and raising the mortar into place, then reinserting the locking pins). The commander's position is carried over from the Type 81 version of the Type 63 APC (which means it is on the left behind the driver); however, on the mortar carrier versions, the armament for the commander is normally a heavy machinegun instead of a light weapon, and the commander's position may or may not be surrounded with AV2 gun shields. The observation hatch behind the driver is deleted, as are the firing ports and side vision blocks. The crew enters and exits through the deck hatches, the commander's hatch, or driver's hatch.

Being a variant of the Type 81 version of the Type 63, the Type 63 Mortar Carriers have a German-designed 320-horsepower turbocharged KHD BF8L and a manual transmission. The vehicles are amphibious after the erection of a trim vane and turning on a bilge pump; however, like the WZ-701 and Type 81 ACV, freeboard when swimming shrinks to what some consider dangerous levels. Propulsion in the water is by the motion of its tracks. Note that like Thai Type 63 APCs, Thai Type 63 Mortar Carriers mount M-2HBs instead of Chinese machineguns and mount Western-type mortars.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
YW-304	\$57,037	D, A	470 kg	13.5 tons	4	7	Passive IR (D)	Enclosed
YW-381	\$58,624	D, A	430 kg	13.8 tons	5	7	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
YW-304	146/103	36/23/4	450	179	Std	T3	HF6 HS3 HR2
YW-381	151/106	30/25/3	450	184	Std	T3	HF6 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
YW-304	None	None	81mm or 82mm Mortar, DShK or W-85 (C)	120x81mm or 82mm, 500x12.7mm
YW-381	None	None	120mm mortar (Chinese/Russian or Western), DShK or W-85 (C)	50x120mm (Chinese/Russian or Western), 500x12.7mm

Type 85 Mortar Carrier

Notes: Like the Type 63, the Type 85 APC has two mortar carrier versions; the 81/82mm-carrying version has the designation of YW-382, and the 120mm-carrying version has the designation of YW-383. Unlike the Type 63 Mortar Carriers, the Type 85 Mortar Carriers are used by the PLA as well as having been exported to most of the countries that the Type 85 APC was exported to.

As the Type 85 APC is essentially a stretched, updated Type 63 APC, the Type 85 Mortar Carriers are for the most part the same in layout as the Type 63 Mortar Carriers. As the hulls of the Type 85 Mortar Carriers are longer than the Type 63 Mortar Carriers, the rear area and commander's positions of the Type 85 Mortar Carriers is a little more roomy. (The driver's position is unchanged from that of the Type 85 APC.) The driver is in the right front of the hull on the Type 85 Mortar Carriers, with the engine to his left, with three vision blocks to the front, the center of which can be replaced with a night vision block. The commander is to the rear of the driver and is almost always surrounded by AV2 gun shields; note that like the Type 85 APC, Thai Type 85 Mortar Carriers mount M-2HB machineguns (and have Western-type mortars) The third hatch for a gunner is deleted, as is the two small hatches on either side

of the center deck; all firing ports and associated vision blocks are deleted with the exception of the one in the large rear door. On the rear deck is an oversized, two piece, circular hatch that is used to fire the mortar through and can be used for troops standing in vehicle defense. (Note that like on the Type 63 Mortar Carriers and most other mortar carriers, the mortar must be raised into position to fire and lowered again to close the roof hatches.) The mortar carriers carry over the Type 85 APCs collective NBC system.

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. Type 85 Mortar carriers have an automatic fire detection and suppression system for the crew compartment, passenger compartment, engine compartment, and fuel tanks. 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 engine for the Type 85 Mortar Carriers 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 Mortar Carrier is amphibious with a minimum of preparation – a trim vane must be erected at the front of the vehicle and a bilge pump turned on.

The Type 90 APC was also developed into mortar carrier versions; like the Type 90 APC, it was offered only for export, its primary customer being Iran, though rumors of other countries' use have circulated. Like the Type 90 APC, the Type 90 Mortar Carriers are essentially very-little-improved versions of the Type 89 APC (itself a slightly-improved version of the Type 85). Hull armor is not improved over that of the Type 85 Mortar Carriers. Like the Type 90 APC, the machinegun armament is located inside a small turret, though this turret is moved to the commander's position, and the gunner's position itself deleted. The roof hatch deletions and layout is essentially the same as that of the type 85 Mortar Carriers, with the same firing ports and vision blocks being deleted. The driver's station is essentially the same as that on the type 85 Mortar carriers, though the Type 80 Mortar carriers have automatic instead of manual transmission. The engine of the Type 90 Mortar carriers is the same as on the Type 85 Mortar Carriers, and they are likewise capable of amphibious movement under the same conditions. They have the same smoke generation grenades, provision for external fuel tanks, fire suppression equipment, and collective NBC system of the Type 85 Mortar Carriers; they also carry aiming stakes and equipment to ground-mount their mortars. As the Type 90 Mortar Carriers are somewhat larger than the Type 86 Mortar Carriers, they carry somewhat more ammunition for their mortars, and have more internal room for crew and their equipment than on the Type 85 Mortar Carriers. Type 90 Mortar Carriers are typically equipped with a Mortar Fire Control Computer, and can to a limited extent plot their own fire by using this computer. Though normally the mortar is fired over the rear of the vehicle, the Type 90 mortar carriers have the rare ability to fire through a 360-degree arc. The 81/82mm-carrying version is designated the YW-384, and the 120mm-carrying version the YW-385. Though the Chinese are willing to equip the Type 90 Mortar Carriers with Western-compatible mortars, so far, this does not appear to have been done,

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
YW-382	\$84,407	D, A	710 kg	14.7 tons	4	9	Passive IR (D)	Shielded
YW-383	\$86,756	D, A	700 kg	14.8 tons	5	9	Passive IR (D)	Shielded
YW-384	\$98,173	D, A	950 kg	14.9 tons	4	9	Passive IR (D)	Shielded
YW-385	\$98,687	D, A	925 kg	15.3 tons	5	9	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
YW-382	145/101	35/21/4	400+300	173	Std	T4	HF6 HS3 HR2
YW-383	144/100	34/20/4	400+300	174	Std	T4	HF6 HS3 HR2
YW-384	144/101	35/21/4	520+300	178	CiH	T4	TF5 TS4 TS3 HF8 HS3 HR2
YW-385	141/99	33/30/3	520+300	184	CiH	T4	TF5 TS4 TS3 HF8 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
YW-382	None	None	81mm or 82mm Mortar, DShK or W-85 (C)	120x81mm or 82mm, 1000x12.7mm
YW-383	None	None	120mm Chinese/Russian or Western mortar, DShK or W-85 (C)	50xChinese/Russian or Western 120mm, 1000x12.7mm
YW-384	+1*	None	81mm or 82mm Mortar, W-85	125x81 or 82mm, 1050x12.7mm
YW-385	+1*	None	120mm Chinese/Russian or Western Mortar, W-85	52xChinese/Russian 120mm, 1050x12.7mm

*This Fire Control modifier applies only to the W-85 machinegun in its turret.

Type 05 Mortar-Howitzer

The Type 05 was originally meant to be an export-only system, and was offered up on the international market in 2001, with no takers. This version was based on the original Type 90 Wheeled APC chassis. The Type 05 has since been in service with the PLA since 2008, but is currently used only by the PLA 127th Light Mechanized Infantry Division and the 54th Army Group in the Jinan Military region. These current Type 05s are based on an updated version of the Type 90 Wheeled APC, the Type 92. However, I will

include below the original export version (designated PLL-05) for comparison and the “what-if” factor. The Type 05 is one of those vehicles that blur the line between mortar carrier and self-propelled howitzer.

Type 05 (Type 92 WAPC-Based)

On the Type 92 WAPC chassis is mounted a turret, which has the primary armament of a 120mm mortar-howitzer. One might notice that the turret bears a marked resemblance to that on the Russian 2S23 NONA-SVK. Rumors state that the Chinese had a deal all set for 100 2S23s, but it was cancelled at the last minute for unknown reasons. However, the Chinese got details of the turret system, including its armament and fire control systems. The turret therefore is basically the NONA-SVK turret, and the mortar-howitzer essentially the same as the Russian NONA-S. However, the Chinese version of the NONA-S is capable of firing both 120mm mortar rounds as well as 120mm howitzer rounds designed especially for the Type 05, as well as 120mm RAP mortar rounds also specially-designed for the Type 05. (Standard 120mm mortar rounds cannot be used with the Type 05.) Other details will be given under its entry in Large-Caliber Guns (I will admit that, for the moment, the entry is not there yet; a little time is all I ask for...) Fire control in all cases is computer-assisted: For mortar firing, the mortar is laid by GPS and an integral mortar firing computer which allows the Type 05 itself to plot and aim its own fires and operate independently of an FDC (though in most cases, a FIST will still be needed for indirect fire. For use in indirect fire in howitzer mode, the same GPS system along with a separate fire calculation computer specific to howitzer mode does the same job when the gun is firing howitzer rounds. In direct-fire mode, a third fire control computer is used in connection with a laser rangefinder to help the gunner line up his shots, like any other vehicle conducting direct fire with a large-caliber gun. In mortar or howitzer modes, the gun may be fed by an autoloader that allows the Type 05 to conduct sustained shelling (the duration of this, of course, will be dependent upon ammunition supply -- and whether counterbattery fire finds them.) The Type 05 does not carry the baseplate, or bipod of normal mortar carriers, as the mortar-howitzer is not dismountable from the vehicle. However, as a last-ditch backup for conduct of indirect fire, the Type 05 carries aiming stakes in a bag strapped to the side of the hull and manual fire plotting tools. The mortar-howitzer has a high degree of flexibility, with full turret traverse and fire and gun elevation and depression ranging from +80 degrees to -8 degrees.

Physically, the Type 05 looks like the Type 92 in the hull, with the driver's cab separated from the hull by an airtight and armored bulkhead that not only protects the driver from hits that penetrate most of the hull, but also prevents gasses from the mortar-howitzer or from exterior chemical attack from entering the driver's compartment. The driver has conventional controls as well as an automatic transmission and steering and brakes which are switchable from automatic or manual (and the manual modes can also be used as a backup). The driver has three large windshields to the front and each side, and can access a night vision block set in his overhead hatch. The entire vehicle has heating, air conditioning, and an NBC overpressure system with a collective NBC backup, but the driver and the fighting compartments have their own independent systems for these functions. The turret is basically a squared-off oval mounted in the center of the hull, with the turret having hatches for the commander and loader atop, and the gunner using the loader's hatch. In addition to the 120mm mortar-howitzer, the Type 05 has a coaxial Type 59 machinegun, along with a W-85 heavy machinegun as a commander's weapon. The commander's position is ringed by vision blocks. The Type 05 has four smoke grenade launchers on either side of the turret. Ammunition is carried in both the hull and turret, as are the radios; the radio suite consist of two data-capable long-range radios, one medium-range radio, and three short-range radios, ensuring necessary communications. A ruggedized laptop helps sort out and sift data.

Other than a fighting compartment specific to its mission and the resultant ammunition storage, the Type 05's hull is virtually identical to that of the Type 92 WAPC. This includes an uprated version of the German-designed KHB F8L-413F diesel engine, coupled to an automatic transmission. This gives the Type 05 320 horsepower; though as a result of the higher weight it is not as agile as its Type 93 forebearer, it still does well enough. The tires are run-flat and puncture-resistant, and the driver has controls for central tire-pressure regulation. However, all firing ports and associated vision blocks are deleted on the Type 05. The rear doors remain, as they are quite useful for reloading the Type 05, especially during a long fire mission.

PLL-05 (Original Export Version, Type 90 WAPC-Based)

The PLL-05 is for the most part like the Type 05 but...just a little less so. The turret is the same turret, and the armament is the same; the primary differences are in the hull. The driver's cab is similar to the Type 05, but it has no airtight, armored bulkhead between it and the fighting compartment, and it does not have independent systems for heating, air conditioning, and the NBC overpressure or its collective NBC backup. The driver also does not have the night vision block in his overhead hatch. The turret has only three smoke grenade launchers on each side of the turret. As with the Type 05, the rear doors remain, though all firing ports and associated vision blocks are deleted. Of course, the PLL-05 is equipped with the original KHD F8L-413F turbocharged diesel engine, which develops only 256 horsepower, and is linked to a manual transmission. Most other features remain the same as on the Type 05. Many speculations on why the PLL-05 got no export bites have been made, but most of them center around cost and the fact that the Russians are willing to sell their 2S23 for a smaller (real-world) price.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 05	\$629,512	D, A	350 kg	16.1 tons	4	10	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
PLL-05	\$629,272	D, A	350 kg	16.1 tons	4	10	Passive IR (D,	Shielded

G), Image
Intensification
(G), Thermal
Imaging (G)

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 05	135/68	31/16/3	300	156	Trtd	W(3)	TF6 TS5 TR4 HF6 HS4 HR3
PLL-05	131/66	30/16/3	450	133	Trtd	W(3)	TF6 TS5 TR4 HF6 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 05	+1/+3	None/Fair*	120mm Type 05 Mortar- Howitzer, Type 59, W-85 (C)	30x120mm Mortar-Type Rounds, 6x120mm Howitzer- Type rounds, 1000x7.62mm, 500x12.7mm
PLL-05	+1/+3	None/Fair*	120mm Type 05 Mortar- Howitzer, Type 59, W-85 (C)	30x120mm Mortar-Type Rounds, 6x120mm Howitzer- Type rounds, 1000x7.62mm, 500x12.7mm

*Fire Control and stabilization are for Mortar and Howitzer Mode (before the slash) and direct-fire mode (after the slash).

ZTS PRAM-S Mortar Carrier

Notes: The Czechs have long been building the BMP-2 under license, calling it the BVP-2. In 1990, ZTS completed a conversion of the BVP-2 into an under-armor mortar carrier, with actual production beginning in 1992. However, with the fall of the Iron Curtain, production of the PRAM-S stopped, after 12 were converted; currently the Czech Republic has six and the Slovaks have six. There has been no recent production of the PRAM-S. However, the PRAM-S is still being marketed internationally, this time by ZTS of Slovakia.

The BMP-2 is heavily-modified for its new role; the turret is removed and the roof is raised by about half a meter. The chassis has been lengthened, and now has seven roadwheels. Mounted on the forward part of the roof is the 120mm mortar, which is breech-loaded from within the vehicle. The mortar has a traverse of 15 degrees right and left and from +40 to +80 (thus direct fire is not possible). When on the move, the mortar is lowered to the minimum elevation and locked into place. Armored shutters then close on either side of the mortar, to be opened again before making the mortar ready to fire. On the roof, to the rear of the commander, is a pintle-mounted weapon, normally manned by the loader; however, ZTS will upon request (if they have any sales) mount different secondary weapons on the PRAM-S, including weapons such as an AT-4 ATGM. In addition to the roof hatches, there is a hatch in the left side with a vision block and a door in the rear for resupply of ammunition; it is not accessible by the crew.

The driver sits in his customary place in the front left hull, with the engine to his right. The driver has three vision blocks to his front, the center of which can be removed and replaced with a night vision block. The commander is to the right of the mortar, with a roof hatch above him, three wide-angle vision blocks to his front, and an IR searchlight which he can swivel from inside the vehicle; his center vision block can display the view of the gunner's night vision gear. The gunner is on the left; he has a roof-mounted day laying system as well as a night vision laying system, and he can also turn the IR searchlight as necessary. However, at night, he is more likely to use a combination of inertial navigation (ZTS will add GPS or GLONASS to current versions offered for sale) and a small plotting computer into which coordinates can be punched to produce accurate fire. This system includes a mapping computer with a map display, which the driver can also access. This computer is also used during day fire. The loader is normally seated to the rear of the mortar, and keeps the autoloader filled and puts any special fuzes or charges on the mortar shells. A common option for the PRAM-S on sale these days is an external thermal imaging camera, which is accessible by the gunner and commander. Another option offered for the PRAM-S is a capability for the secondary weapon to be aimed and fired from under armor, and another is a self-surveying ability.

The ammunition is kept on either side of the vehicle and at the rear (but more towards the center); the mortar is normally fed by an automatic loader. The interior is quite cramped for the crew and their equipment, as ammunition supply is copious. The magazines hold 56 rounds of the ammunition supply and the automatic loading system 21 rounds. Radios include two long-range radios, one of which is data-capable; they are normally operated by the commander. Four smoke grenade launchers are positioned on either side of the front of the top of the hull.

The firing ports and the associated vision blocks of the base BVP-2 chassis are deleted on the PRAM-S. The large roof hatches are also deleted. As stated above, the interior of the PRAM-S is largely taken up with ammunition racks and the mortar itself, and room for the crew and their equipment is rather small. The PRAM-S does not carry the baseplate and bipod that most mortar carriers have, as the mortar is not dismountable; however, aiming stakes are carried strapped to the outside for use if the fire control or mapping computers go down. The PRAM-S's mortar fire control system can compensate for the vehicle (and mortar) being canted up to 12 degrees to the left or right, or forwards by 15 degrees or backwards by 9 degrees; it can also, to an extent, compensate for more than one direction of canting. The PRAM-S has a heater and air conditioner for the crew, and the crew is protected by an NBC overpressure system with a collective NBC backup. The crew and vehicle are further protected by an automatic fire detection and suppression system.

The PRAM-S is powered by a UTD-20/3 supercharged diesel with 300 horsepower. The PRAM-S also has double the normal battery complement, allowing the PRAM-S to operate with the engine turned off for a longer time. While the main fuel tanks remain the same as those of the BVP-2, the rear door configuration is different, and there is only one rear fuel tank, which is not in the large rear door, but offset to the right side. The PRAM-S is amphibious with the same preparation as the BVP-2 (the extension of a frontal trim vane and the switching on of bilge pumps, requiring 5 minutes). However, swimming a PRAM-S is in some ways more dangerous than swimming a BVP-2 – the vehicle's added weight is both a help and hindrance in this respect, as the PRAM-S is more stable in the water, but it is also more sluggish and has a dangerously low amount of freeboard. Like the BVP-2, the PRAM-S has shallow foam-filled side skirts to aid in buoyancy.

Note that for the "Updated" version of the PRAM-S below, I have elected to include all the possible modifications listed above.

Twilight 2000 Notes: In the Twilight 2000 timeline, only 12 of these vehicles were built by the November nuclear strikes, so they are rather rare.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PRAM-S (Original)	\$219,617	D, A	325 kg	17 tons	4	10	Passive IR (D, G), Image Intensification (G)	Shielded
PRAM-S (Updated)	\$319,617	D, A	325 kg	17 tons	4	10	Passive IR (D, G), Image Intensification (G), Thermal	Shielded

Imaging (G)

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
PRAM-S	118/83	29/23/3	430	187	Std	T3	HF9 HS5 HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
PRAM-S	None	None	120mm breech-loading mortar, NSV (C)	80x120mm, 500x12.7mm

*Hull floor armor for the PRAM-S is 3, except in the part of the vehicle under the driver and turret, where it is 4.

Patria XA AMOS

Notes: Various referred to in different sources as the XA-203 AMOS and the XA-200 AMOS, "XA AMOS" seems to be the designation of the vehicle in most sources. Though in development, the Finns tested the vehicle with an XA-185 base chassis, the current production vehicle uses an XA-203 chassis. This is topped with the Hagglunds/BAE AMOS (Advanced MOrtar System), which consists of a large but low-profile turret housing a pair of long-barreled (barrel length of 2.4 meters) mortars which can fire in the direct-fire mode of conventional indirect fire mode. Several countries are interested or have already purchased the XA AMOS; the Slovaks have already purchased the XA AMOS, and some other Baltic States and Middle Eastern countries are seriously considering the vehicle. One surprising future customer is the US Marines, and AAI in the US has already gotten a license to domestically-produce the XA AMOS for that purpose (though there is still some discussion going on about what the base chassis might be, the Marines appear to be interested in the complete XA AMOS vehicle). It is rumored that the US Army is interested in the AMOS turret system, but wish to mount it on a Stryker chassis. The Swiss and the Saudis are reportedly trying to decide between the XA AMOS and the CV-90 AMOS. The Estonians will probably be the next country that puts the XA AMOS into service, though some reports have them waiting until the AMV AMOS enters production. The Finnish themselves were originally supposed to have the XA AMOS in service in 2003, but delays meant that LRIP did not start until 2006, and deliveries were not completed until 2010. The turret is essentially the same as mounted on the Swedish CV-90 AMOS vehicle, and rounds are being developed in a joint venture between the Swedish, Finnish, Swiss, and Israelis.

In Finnish service, the XA AMOS is intended to be replaced by the AMV AMOS, though full replacement may take until as long from now as 2025. Some other countries are also waiting until the AMV AMOS is in full production.

The AMOS system's mortars are breech-loaded by an automatic loader and can fire a variety of 120mm mortar rounds, some of which were developed specifically for use with the AMOS (though many of these new rounds can also be used with most NATO-compatible 120mm mortars). The mortar barrels are unusual in that they include fume extractors. The turret can rotate, like any other turret, a full 360 degrees; it can also fire regardless of angle of rotation. The AMOS system also includes comprehensive fire control equipment, including a GPS (inertial navigation in prototype phases) coupled to a full computerized mapping system, along with a computer for automatic laying of the mortars (once the vehicle is halted). The automatic laying computer generated fire coordinates from the GPS and mapping computer along with map coordinates given by higher headquarters, an FDC, or a FIST in a more forward position. Alternately, the laying system can generate fire coordinates if the position of the enemy is known (such as in a direct lay) or using coordinates from a counterbattery radar site or vehicle. The AMOS system also has a fire control computer and sights for direct fire. A machinegun is mounted coaxial to the mortars. Night vision equipment is provided for the driver and gunner; the commander can access the gunner's night vision sights, as well as his sight picture. He can also use his own set of sights to prepare the vehicle to engage the next target. The night vision can also be used in direct fire, and for both direct and indirect fire magnified day sights and magnification for the night sights is provided.

The XA AMOS's rear area is largely taken up by ammunition racks and the automatic loading system; the turret is largely taken up by the mortars and the fire control equipment. This means that the interior is rather cramped for the crew and there is little room for their equipment. The driver is in the front left of the vehicle, with the engine to his rear; the entire cab of the XA-203 appears to be there when viewed from the outside, but the right side of the cab is used for equipment storage and also houses some of the computer equipment. The driver has a large windshield to his front and a smaller one to his side; these are made of bullet-resistant glass and have the same armor value as the sides of the vehicle, and an armored shield with vision slits can be lowered over the front windshield to give it the same AV as the rest of the front of the vehicle.. The driver's overhead hatch has a vision block which can be replaced with a night vision block. The rear roof hatches are deleted (the turret is there instead), and the normal commander's hatch is replaced with one on the roof of the turret; this hatch is ringed with vision blocks. The commander does not have a weapon mount. The gunner also has a hatch, but his vision blocks do not include the right side. Crew consists only of the driver, gunner, and commander; the autoloading system generally allows the gunner to run most firing operations, though the commander can also assist if necessary. Firing ports and the associated vision blocks are deleted. The rear doors are retained, but used largely for loading ammunition. As the mortars are not dismountable, the XA AMOS does not carry a set of baseplates or bipods; however, manual plotting boards, a set of maps, several calculators, and a minicomputer are carried, along with aiming stakes, for use if the fire control computers are damaged or aren't otherwise working. Radio communications consist of two long-range, data-capable radios and a medium-range radio.

The XA AMOS is powered by a Valmet 612 DWIBC turbocharged diesel engine developing 271 horsepower. This is coupled to an automatic transmission with manual backup. As with the XA-203, the XA AMOS has a modular power pack which can be replaced with appropriate equipment and personnel in half an hour. An air conditioning module can be easily fitted. The XA AMOS also has several access panels and hatches to further ease maintenance. The XA AMOS has a 6x6 suspension with run-flat tires. An automatic fire detection and suppression system is provided for the power pack, fuel tanks, turret, ammunition storage, and driver's compartment. The crew is also protected by an NBC overpressure system with a collective NBC backup. On each side of the turret are five smoke grenade launchers.

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

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$523,821	D, A	375 kg	26.3 tons	3	12	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
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95/48	22/11	325	197	Trtd	W(4)	TF7 TS4 TR4 HF12 HS6 HR4*
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Fire Control**	Stabilization**	Armament	Ammunition
+3	Basic	Twin 120mm AMOS Mortars, PKT	100x120mm, 2000x7.62mm

*Floor armor is 4; roof armor is 3.

**Fire Control and Stabilization modifications apply only to direct fire from the mortars or the coaxial machinegun.

Patria XA-361

Notes: As with the XA AMOS, this vehicle is referred to in various sources by several designations, including XA-360 AMOS and XA AMV AMOS. I have used what seems to be the most common designation here. Using the same base concept as the XA AMOS, the AMV AMOS is an XA-360 AMOS chassis topped with the Hagglands/BAE AMOS (Advanced MOrtar System) turret, with its twin 120mm long-barreled breechloading mortars. Though orders for the XA-361 were placed by Finland as early as 2003, delays in the AMV program meant that deliveries under LRIP did not begin until 2008, and full-scale production has only just begun late in 2010. Other countries who have ordered the XA-361 or a variant include Slovenia (who ordered a single-barreled variant in the same turret known as the NEMO system), South Africa, Croatia (who also ordered the NEMO variant), and Macedonia (likewise). These customers have either not received their XA-361s or variants yet or have received only a few as of late November 2011. Possible future customers include the UAE and Sweden (who designed the AMOS turret and already use it on a CV-90 chassis). The XA-361 is also being tested by the US Marines alongside the XA AMOS for a possible future role in the US Marines; one of them will probably be chosen, with production of the chosen vehicle under license by Lockheed Martin in the US and (according to current plans) first vehicle delivery in 2015.

The NEMO variant will be covered later, when I have more information.

The XA-361 uses the same AMOS turret as the XA AMOS, and readers can refer to the XA AMOS above for most of the details on the turret, mortar autoloading system, and ancillary equipment such as radios, computers, and backup manual equipment. The night vision suite is improved somewhat, especially in the case of the commander, who has his own night vision devices. The primary improvement of having the AMOS turret on an AMV chassis is to take advantage of the greater protection, engine power, and abilities of the AMV. The base chassis is modified somewhat in the XA-361: the roof hatches are deleted, as is the RWS. The driver remains in the same place as in the XA-360, in the front left with three wide-angle vision blocks to his front (and to an extent, they also partially give him vision to the left side. The driver's hatch has a port into which a night vision block can be inserted. Instead of the commander being to his right, the former commander's place is used for equipment storage and some ammunition storage. As with the XA AMOS, the commander and gunner are in the turret. The crew is protected by an NBC overpressure system with a collective NBC backup, and a fire detection and suppression system for the power pack, driver's compartment, turret and mortars, ammunition storage, and the fuel tanks. On each side of the turret are five smoke grenade launchers. The ammunition is loaded through the rear door, which also has a vision block; in addition, a camera in the rear allows the commander to monitor ammunition loading and replenishment using an LCD screen mounted at his station.

As with the XA-360, the XA-361 is powered by a Scania DI-12 543-horsepower turbocharged diesel, coupled to an automatic transmission. The driver has conventional controls. The suspension is 8x8, switchable to 8x4 for road use (with the rear set of wheels being the drive wheels in this case). The rear four wheels steer independently from the front four wheels to tighten the turning radius. As with the XA-360, the XA-361's hull can take MEXAS appliqué armor as well as be fitted with lugs for ERA (though no country has yet ordered MEXAS kits for the XA-361, and it is not covered below). There is no MEXAS kit for the turret, though it too can be equipped with ERA on the turret sides, turret rear, and the front third of the turret roof (there is not enough roof on the turret front to mount ERA). Unlike the XA AMOS, the XA-361's commander's station is equipped with a pintle mount, with the weapon mounted depending upon the customer.

Twilight 2000 Notes: The XA-361 does not exist in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
XA-361	\$547,599	D, A	550 kg	25.6 tons	3	20	Passive IR (D, G), Image Intensification (G,C), Thermal Imaging (G,C)	Shielded
XA-361 w/Appliqué	\$551,127	D, A	425 kg	26.1 tons	3	20	Passive IR (D, G), Image Intensification (G,C), Thermal Imaging (G,C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
XA-361	155/78	36/18/4	810	376	Trtd	W(8)	TF7 TS4 TR4 HF15Cp HS8Cp HR6Sp*
XA-361 w/Appliqué	152/77	35/18/4	810	384	Trtd	W(8)	TF7 TS4 TR4 HF19Cp HS10Cp HR8Sp**

Vehicle	Fire Control***	Stabilization***	Armament	Ammunition
XA-361	+3	Basic	Twin 120mm AMOS Mortars, PKT or MAG, NSVT, WKM-B, or M-2HB (C)	100x120mm, 2000x7.62mm, 500x12.7mm or .50

*Roof armor for this version is 5Sp; Floor armor is 8Sp.

**Roof armor for this version is 5Sp; Floor armor is 10Sp.

***Fire Control and Stabilization modifications apply only to direct fire from the mortars or the coaxial machinegun.

GIAT AMX VTT/PM

Notes: Like many countries in the 1960s and 1970s, the French produced a version of one of their standard APCs, the AMX-VCI, for use as a mortar carrier. The AMX VTT/PM entered service shortly after the AMX-VCI in 1968, and was produced in four variants – one with an 81mm mortar, one with a 120mm mortar, with each being initially equipped with gasoline engines and later retrofitted with diesel engines (and other improvements). The broad vehicle designation was the AMX VTT/PM, but the exact designation for the 81mm mortar carrier version was the AMX VCPM de 81, and for the 120mm mortar carrier version, the AMX VCPM de 120. Though 10 countries used the AMX VCI APC or variants of it, only France employed the AMX VTT/PM, and a good number of these vehicles still serve in the French Army, despite being a bit long in the tooth.

The AMX VTT/PM is largely built the same as the AMX VCI APC, with a relatively long chassis, a steeply-sloped glacis with a flat front deck for the driver and engine, and a pulpit-type position behind the driver, in the case of the AMX VTT/PM being manned by the commander instead of a dedicated gunner. 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 commander has a pintle mount for a medium or heavy machinegun (or other weapon which can fit on the same mount); his position is actually a manually-rotating cupola with all-around vision blocks. The former commander's position remains to the right and rear of the gunner, along with the overhead hatch and vision blocks to the front and right, but is normally occupied by one of the mortar crew. The AMX VCI's slide-open firing ports have been welded shut on the AMX VTT/PM. The AMX VTT/PM has the same dual long overhead hatches in the fighting compartment; unusually, the mortar fires through right-hand hatch, and the mortar fires *forward* over the vehicle instead of over the rear like almost all such mortar carriers. The mortar, however, has limited traverse – 15 degrees to the right and 30 to the left. Larger deflection changes require quick pivot steering by the driver. Early AMX VTT/PMs made the crew rely on their protective masks and chemical protective suits in a chemical warfare environment, but in 1987, they were fitted with a collective NBC system (of course, if the hatches are open, like when the mortar is being fired, chemical protective suites must still be used, and having their masks plugged into a collective NBC system while the crew is rapidly moving about to use the mortar could be problematic).

The original engine of the AMX VTT/PM was a SOFAM 8Gxb 250-horsepower gasoline engine, with a manual transmission. In the 1980s, this was replaced by 280-horsepower Baudouin 6F11SRV turbocharged engine and a semiautomatic transmission. (These diesel-powered versions are sometimes referred to as AMX VTT/PM 1987s.) At about the same time, radios were updated and the driver's night vision block was also updated. 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 VTT/PM are steel, but rubber track pads can be retrofitted. The AMX VTT/PM is not amphibious, though fording of up to 1 meter is possible.

The two versions of the AMX VTT/PM are almost identical in weight (negligible for game purposes) and with the mortar down, are externally identical except for the baseplates and bipods carried externally to allow ground-mounting of the mortar if necessary. It is not included here, but in the mid- to late-1990s hand-held mortar fire control computers were issued to the crews of these vehicles, and add-on GPS units were added. The AMX VCPM de 81 carries 128 81mm mortar shells with a full load, but only 88 of these can be more modern mortar shells, WP shells, or illumination shells, which are generally longer than older mortar shells. A further 40 short mortar shells (primarily smoke and HE rounds) can also be carried in addition to those 88 rounds.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AMX VCPM de 81	\$86,522	G, A	450 kg	16 tons	6	11	Passive IR	Enclosed
AMX VCPM de 81 1987	\$86,947	D, A	450 kg	16 tons	6	11	Passive IR	Enclosed
AMX VCPM de 120	\$81,241	G, A	450 kg	16 tons	6	11	Passive IR	Enclosed
AMX VCPM de 120 1987	\$81,666	D, A	450 kg	16 tons	6	11	Passive IR	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AMX VCPM de 81/120	111/78	24/18	410	149	Std	T3	HF8 HS4 HR4
AMX VCPM de 81/120 1987	121/85	26/20	410	158	Std	T3	HF8 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AMX VCPM de 81	None	None	81mm Mortar, M-2HB (C)	128x81mm*, 2000x.50
AMX VCPM de 120	None	None	120mm Mortar, M-2HB (C)	60x120mm, 2000x.50

*See Notes above for special rules about 81mm ammunition carriage.

LOHR 120mm SP Mortar System

Notes: Despite the fancy name, this is little more than a 120mm rifled mortar mounted in the back of the High-Mobility version of

the Renault TRM 2000 truck, with racks added for the ammunition and the cab expanded to carry the mortar crew and a couple of extra ammunition handlers (to allow the mortar to be fed from ammunition on the ground around the truck or in an accompanying vehicle). Despite being on the market since 1990, and being demonstrated to various countries, no sales have been generated by this system; nonetheless, it is still offered for sale, and LOHR is still ready to start up production should the need arise. (I have not been able to discover if such production would require Renault to manufacture new TRM 2000 trucks, as Renault stopped making them in 2002, or LOHR would license-produce the trucks, or LOHR would simply modify existing TRM 2000s.)

The mortar is mounted on a conventional bipod and baseplate which are attached to the heavily-modified truck bed using quick-release/attach clamps and fittings. The mount is a standard towed-mortar mount, and the wheels remain attached to the mount and the tow bar used to help secure the mortar in the vehicle, also using quick-release/attach fittings. Ammunition racks are mounted at the front of the truck bed and down one-quarter of each side. Before firing, a large spade is lowered at the rear to help stabilize the vehicle as a firing platform; in addition, the suspension is greatly beefed-up, with special extra-heavy-duty shock absorbers, also to take up the shock of firing. While traveling, the mortar is lowered almost flat and locked down, with the mortar sight being removed and stored in a compartment in the ammunition racks; tarps are also carried to protect the mortar and ammunition during movement in inclement weather. 30 seconds are required to bring the mortar into firing position and 20 seconds are required to stow the mortar for movement. The mortar fires forward over the vehicle, with a limited amount of movement being allowed by the mountings to allow large deflection changes. The truck bed is essentially removed, replaced by small platforms for the crew to fire the mortar. The primary advantage of the LOHR 120mm SP Mortar System is that it is more mobile and quicker to bring into action than a towed mortar system, and it can be easily carried by aircraft and helicopters; the system offers little or nothing in the way of protection. The vehicle can also be air-dropped or delivered via LAPES.

The LOHR 120mm retains most of the features of its Renault TRM 2000 chassis, except for the special suspension and larger cab and modified rear. The vehicle is powered by a Renault Type 720S supercharged diesel developing 115 horsepower; at the buyer's option, this may be coupled to an automatic or manual transmission and the vehicle can be supplied with right-side or left-side driver positions. The suspension is 4x4 and the vehicle has run-flat tires. Opposite the driver's side of the cab, the commander's position has a roof hatch with a pintle mount for a light or medium weapon (it is not stressed for heavier weapons such as heavy machineguns or automatic grenade launchers); the pintle is attached to a mount which manually rotates. Since the system uses the High-Mobility version of the TRM 2000 as a base, the ground clearance of the truck is relatively high at 0.425 meters, and the enhanced suspension gives the system good off-road performance and a good ride even over rough terrain. In addition to the hydraulically-operated spade at the rear, the truck has a tow hook at the rear allowing it to tow a trailer with a load of 2 tons. The crew enters the cab through two doors on either side. At the front of the vehicle is winch with a capacity of 2.5 tons.

Twilight 2000 Notes: In the Twilight 2000 timeline, the LOHR 120mm SP Mortar System was often found in French airborne units, and extensively utilized by Foreign Legion units.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$76,997	D, A	580 kg	6.3 tons	6	5	Headlights	Open

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
258/73	85/24	130	37	Std	W(2)	HF1 HS1 HR1

Fire Control	Stabilization	Armament	Ammunition
None	None	120mm TDA MO-120-RT-61 mortar, AAT-F1 or MAG	40x120mm, 2000x7.62mm

TPK VBL Mortar Carrier

Notes: This is an open-topped version of the TPK 4.20 VBL APC with drop sides and rear, allowing the mounting of an 81mm mortar and ammunition racks in the rear. However, the VBL Mortar Carrier does not have a roof over the rear area; only the cab has overhead armor. The mortar can be one of a number of standard 81mm mortars; the mortar is locked down in its standard configuration with clamps mounted on the floor of the carrier. The mortar fires over the rear of the vehicle; it has very limited traverse, however, other than that provided by manipulating mortar controls. The cab has the driver on the right side; on the left is the commander, who has an overhead hatch with a weapon mount. Like the VBL APC, the cab has a large two-piece bullet-resistant windshield to the front, with armored shutters that can be lowered over the windshield. The shutters have vision slits in them. The cab also has a small bullet-resistant on each side in the door, and a sliding panel can be slid over these windows. The rear area has no windows, vision blocks, or firing ports; defenders simply fire over the open top.

The VBL Mortar Carrier has a 4x4 suspension with run-flat tires; puncture-resistant tires are optional. The standard transmission is manual, though an automatic transmission can be provided at buyer request. The engine is a Perkins diesel engine developing 135 horsepower engine.

Twilight 2000 Notes: Though at the beginning of the 1990s, only the Central African Republic, Gabon, and the Ivory Coast had any VBL Mortar Carriers, the French manufactured a batch of about 50 and supplied them to their Army, and especially, to the Foreign Legion.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$54,513	D, A	700 kg	7.8 tons	5	7	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
143/72	74/36	360	46	Std	W(3)	HF5 HS3 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm mortar, AAT-F1 (C)	40x81mm, 800x7.62mm

VAB PM 120R 2M

Notes: Before we begin, I should note that the designation I have given this vehicle is probably not the right one. It is based on the designations of other vehicles in similar roles, and I have not been able to discover the actual designation of this mortar carrier. This mortar carrier consists of a VAB VTT APC which has been modified to carry the TDA 120R 2M recoiling rifled 120mm mortar, but the recoil-dampening system of the mortar allows it to be carried by much lighter vehicles and reduces considerably the wear on the vehicle's shock absorbers. This VAB-based version of this 120R 2M mortar carrier began testing by the French Army in 2003, and has since gone into production and service; the mortar itself has since gone onto ground- and trailer-mounted versions and mounting into a variety of vehicles, which have been marketed since 1994 or have actually sold on the international market. Readers can see the stats on the TDA 120R 2M in the appropriate section, French Mortars (though I'll admit it is not there yet, and will be a future addition to these pages. I'm quite remiss in the area of large-caliber guns and mortars.)

To make a long story short, the mortar can be rotated through 110-degrees on either side of facing to the rear and fired in that direction, another thing that the 120R 2M's shock-absorbing system allows. Instead of the manual manipulation that must rear-mounted mortars require, elevation, traverse, and leveling of the mortar (to an extent) are handled hydraulically by the 120R 2M's system through the use by the gunner of a joystick and small LCD screen (about the size of a modern iPhone) and an integrated mortar fire control computer. The same system allows the mortar to be lowered enough for the VAB PM 120R 2M to close its roof hatches, making the VAB PM 120R 2M look pretty much like any other VAB VTT (though seemingly lightly armed). Most countries opt for their 120R 2M mortars to be equipped with an automatic loading system, as do the French; the 120R 2M is still breech-loaded, but the rounds are put on a sort of elevating system which raises the round quickly to the proper height, then drops it down the tube. Therefore, even firing the mortar can be done from inside the armor envelope, with only the top hatches being open. The VAB PM 120R 2M does not require an auxiliary ground-mount baseplate, bipod, or anything like that; the 120R 2M in this mode cannot be dismounted and turned into a ground-mounted version without a great deal of depot-level work. The mortar has its own baseplate inside the vehicle and does not require a bipod; it does have a sensor head with day and night cameras to allow the gunner to control the mortar fire while inside the armor envelope of the VAB.

Of course, the base chassis is that of the VAB VTT basic wheeled APC. (This will be a tip-off to some, even when the mortar is retracted and the hatches are closed, because few countries of units use the base VAB VTT chassis, preferring one of the VAB's many variants.) The driver is on the front left of the vehicle, with the commander to his right; both have overhead hatches, and there is also a door on the hull side for each of them. The driver and commander have bullet resistant windshields to their front and bullet-resistant windows to their sides; these may be further protected by closing armored shutters, with the front shutters having vision slits in them. The commander has an enlarged hatchway with a ring mount above his station, and the ring mount can take any one of several light, medium, or heavy weapons ranging from Minimi-type weapons to automatic grenade launchers. The weapon station to the rear of the driver and gunner that are normally present on the VAB VTT is deleted. The front two armored shutters on either side of the former passenger area are retained, but the rest are welded shut. The two rear doors are retained, largely for the loading of ammunition and/or equipment (though space is tight for that sort of thing), and also allowing for the entry and exit of crewmembers. The crew has the benefit of a collective NBC system, as well as fire detection and suppression systems for the engine, rear area, and fuel tanks. Radios include a data-capable long-range radio, a further long-range radio, and a data-capable medium-range radio. The vehicle is equipped with GPS and a mapping system, accessible by the commander and driver via small LCD screens; it is capable of self-plotted fire (based on map grids; it does not have access to satellite information other than position and it does not have a laser rangefinder). The VAB PM 120R 2M does carry a hand-held laser designator, though of course this would primarily be useful in the case of self-observed fire, and the vehicle's designator can only guide smart 120mm mortar shells. On the upper side front on each side are three smoke grenade launchers.

The use of a VAB VTT base chassis gives the VAB PM 120R 2M basic, but not exceptional armor. However, armor is somewhat improved in the rear section by the installation of both solid Kevlar panels and Kevlar anti-spalling blankets, which are meant primarily to protect the ammunition, with additional crew protection being an incidental. Armor is of all-welded steel and is moderately-sloped on the front and sides. The VAB PM 120R 2M has an automatic fire detection and suppression system for the troop compartment, driver/commander compartment, engine compartment, and fuel tanks. The VAB PM 120R 2M is fully amphibious, requiring the erection of a trim vane at the front and switching on bilge pumps, requiring two minutes. Propulsion in the water is via waterjets at the rear with deflection vanes for steering. The driver controls these vanes by a joystick. The waterjets are not powerful, but better than propulsion by motion of the wheels. Other driver controls are conventional, and transmission is manual. The VAB PM 120R 2M uses the 6x6 configuration, which is switchable to 6x4 for road use. The suspension is cross-country and uses large run-flat tires. As with some other French VABs, the VAB PM 120R 2M is powered by a Renault MIDR 06-20-45 450-horsepower turbocharged diesel, chosen because the mortar system and the ammunition and other equipment carries already make the vehicle much heavier than the standard VAB VTT.

Twilight 2000: The French Army had six of these vehicles at the start of the Twilight War, with 6 more being produced during the

war. This compares with 36 Piranha-based 120R 2M mortar carriers, with 10 more being acquired during the War, and 72-trailer-mounted TDS 120M 2R mortars. The VAB-based mortar carriers were retained in France, and four of them survived the War.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$37,176	D, A	395 kg	17.8 tons	2 (+3)	3	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
120/67	27/16/2	300	176	Std	W(4)	HF6 HS5 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	120mm TDA 120R 2M Mortar; Mk 19 or HK GMG or M-2HB or AAT-F1 or MAG or Minimi (or other such types)	50x120mm; 380x40mm or 1200x.50 or 2000x7.62mm or 2740x5.56mm

VPX 40 M 120

Notes: This is an interesting little vehicle; it is in fact one of those vehicles that stretches the definition of the word "vehicle." Essentially, the VPX 40 M 120 is little more than a light platform on treads, with a 120mm mortar on a special mount at the rear of the vehicle. The VPX 40 120 M is designed to provide mobile heavy mobile fire support to airborne, heliborne, and light infantry. The VPX 40 M 120 has a rudimentary driver's position at the front left, and another seat is in the front right; the rest of the crew sit on two small seats in the rear of the vehicle (very small seats). In between the two front seats and the rear section is an ammunition storage area. The VPX 40 M 120 is armored, but the armor protection extends only as far up as the sides of the vehicle, which provides only a little over a meter of protection for those in the rear and a bit more for those in the front seats (their head and shoulders are above the armor envelope). The armor is also rather thin, though it is all-welded armor plate. There is no overhead protection, not even a provision for bows, and the rear of the vehicle is also open. No mounts for weapons other than the mortar are provided.

The turbocharged 125-horsepower diesel engine is mounted at the rear right of the vehicle, with the fuel tank on the left. The engine power is quite good compared to the low weight of the VPX 40 M 120, giving the little machine surprising agility. The transmission is automatic. Firing the mortar takes a fair amount of preparation; the mortar must be unlocked and lowered, and when unlocked it rests on a heavy A-shaped strut extending from the rear of the vehicle and another which connects to the mortar barrel. The suspension of the vehicle is also lowered at the rear, almost to the ground, where it rests on the baseplate, which is built into the floor of the vehicle and extended through the floor of the vehicle so that it is in contact with the ground when the suspension is lowered. Preparing for a move consists of the reverse of those steps. Traverse is limited to what the mortar controls can mechanically provide. A mortar fire control computer is provided with the vehicle.

Twilight 2000 Notes: This vehicle was primarily in use by French Foreign Legion and airborne forces, and then only in small numbers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$77,109	D, A	150 kg	4.5 tons	4	3	Headlights	Open

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
158/111	35/25	75	34	Std	T2	HF3 HS2 HR0

Fire Control	Stabilization	Armament	Ammunition
None	None	120mm MO-120-RT-61 mortar	20x120mm

FMC/Rheinmetall M-113G Mortar Carrier (PzMrs)

Notes: This design is in many ways similar to the current US heavy mortar carrier; however, the Germans have been using their license-produced M-113Gs as a basis for a Tampella mortar carrier since the late-1960s. Like virtually all German Army mortars, the M-113G Mortar Carrier series mounts a 120mm mortar; it is a point of controversy both in the German military and outside of it as to why the German Army does not feel the need to use any light mortars. As with US M-113-based mortar carriers, the exterior is largely the same, but the rear area, what is normally the passenger area, is heavily-modified for its role as a mortar carrier. This includes an extra long-range radio, racks for ammunition for the mortar, and the baseplate and bipod as well as special mounting features for the mortar. Unlike similar US mortar carriers, the M-113G Mortar Carrier does not carry a baseplate on the side of the vehicle, as the mortar is not meant to be dismounted except for repairs. The Germans are currently looking for a replacement for the M-113G mortar carrier, including versions of the Puma AFV and Boxer ACV.

Like the M-113, there have been several versions of the M-113G mortar carrier over the years. The Germans use the abbreviation for their word for armored mortar, PzMrs (Panzermörser) as part of the designation for their mortar carriers, including those based on the M-113. The first were the M-113G PzMrs, which were modified from M-113G infantry carriers, when they were replaced by the M-113A1G. The M-113G PzMrs was used from 1969-1973, when the infantry got new M-113A2Gs and the old M-113A1Gs were modified into M-113A1G PzMrs. (The old mortar carriers were then scrapped for parts or used as range targets – always a sad end in my mind.) The M-113A1G Mortar Carriers were used only from 1977-78, when, like the infantry and specialist carriers were upgraded to the M-113A2GE standard. In 2001, the mortar vehicles, along with the rest of the German M-113-based fleet, were subject to an NDV (the German acronym for a SLEP), which included an upgrade to a M-113A3GE base; this was not a simple upgrade to the M-113A3GE, but included a number of improvements.

The M-113G mortar carrier is basically a close-copy of the M-113, license-built by Rheinmetall. Like the M-113, it has a two-part hatch on the left side and a half-width hatch on the right side. Otherwise, the rear ramp and the commander's manually-operated cupola remain. Half-length fold-down seats are available on each side, with a small part behind the driver given over to the radios. The commander's position is in the cupola, and he has all-around vision blocks (though no night vision). The commander's seat can be raised and lowered and locked in those positions to give the commander a better view. M-113G Mortar Carriers mount an MG-3 instead of an M-2HB on the commander's mount. The driver's position remains in the same place, along with the same tiller-and-gas controls (though the instruments and other labeling is in German). The driver has three vision blocks to his front, one is angled somewhat to the right, and one somewhat to the towards the left. The other two members of the crew sit in the fold-up seats during travel. The rear seat positions also have folding tables, and M-113G mortar carrier may or may not have a pair of folding seats strapped to the outside (interior space is at a premium).

The engine is the standard M-113 engine – is a Chrysler 75M gasoline engine, coupled to an automatic engine, developing 215 horsepower. Of course, this causes the M-113G Mortar Carrier to gulp fuel. Swimming the M-113G Mortar Carrier is not recommended, and the extra weight of the mortar weighing down the back and the mortar ammunition can easily cause the M-113G mortar carrier to sink. The M-113G Mortar Carrier has a bilge pump to remove excess water in the vehicle, but this normally not enough to bail out a swimming M-113G Mortar Carrier, though it is good enough for fording. The exhaust column is high to facilitate swimming and fording – just high enough to blow in the commander's and crewmembers (if they are standing up) faces. The power pack is easily accessed by opening the front panel (normally covered by the trim vane when traveling), and an extension of the front hatch; in fact, the entire powerpack can be removed and replaced as a unit. Like many tracked vehicles that have to operate on European roads often, the M-113G Mortar Carrier has rubber track shoes, which generally have to be changed once every six months to a year (depending on government regulations). The rear of the vehicle has a full-sized ramp, with a hatch for use when the crew prefers to not drop the entire ramp.

The M-113A1G was Germany's first update for their M-113 fleet. The M-113A1G Mortar Carrier updates entered service in 1977, but only stayed in service until 1978, as the M-113A2G mortar carrier quickly followed it. The upgrade generally followed those of the M-113A1 in the US, such as the use of a General Motors 6V53 unitary powerpack and a matching transmission. The new engine developed 212 horsepower, but was a diesel engine that greatly increased the M-113A1G Mortar Carrier's operating range. The M-113A1G did not have the transmission problems of the M-113A1 in the US, as they were sorted out before the M-113A1G upgrade occurred. Like the M-113A1G had the larger fuel tanks, but also had the hazard of the fuel tanks in the walls of the vehicle. The M-113A1G had the battery warmer. However, the Tampella-made mortar was replaced by a Rheinmetall-based mortar of about the same capabilities, but greater strength and reliability, and able to fire more modern projectiles.

At this point (in the early to late-1990s), upgrading of the M-113A1G PzMrs sort of -- forked. The M-113A2GE is used not only by the German Army, but also by the Danish Army starting in 2002; the Danes used the M-113A2GE plans and upgrade kits to do a licensed upgrade for their M-113A1 mortar carriers. Australia and Norway have also shown interest in the upgrade. The major part of the upgrade package for the M-113A2GE PzMrs is the drive train, including driver's controls. The new engine is an MTU 6V 183 TCU supercharged diesel developing 300 horsepower. The new powerpack meets EURO II emission standards (and has the secondary effect of reducing the characteristic M-113 exhaust plume). The engine is coupled to a ZF LSG 1000 automatic transmission. This is controlled in the driver's compartment, who has a small steering wheels and pedals for braking and gas. The driver also has a parking brake, and an electric gearshift control. The driver's seat back has been moved back and the padding improved; the seat back can still be removed to allow the driver to go into the crew compartment. The brakes have also been replaced; it has a dual-circuit power-assisted system with hydraulic boosting. The brake system is independent of the drive train; even if the M-113A2GE PzMrs loses all power for any reason, the driver can still brake with full force if necessary. The pivot steer system has been improved to keep the tracks from shedding in a pivot turn and allow for a rapid turn around its center of gravity. Also

with the M-113A2GE came a mortar ballistic computer, which allows the crew to compute fire coordinates if the position of the target is known, and new radios which are smaller but can work over longer ranges; this allowed a second long-range radio to be installed.

Meanwhile, another version of the M-113 mortar carrier began deliveries to the German Army – the M-113G3 PzMors. It too has been taken into service by the Danish Army. It has much of the improvements of the M-113A2GE PzMors, but also several differences. The M-113G3 uses the MTU 6V183 TC 22 supercharged diesel engine, which develops 335 horsepower and is a variant of a commercial truck engine, the Mercedes-Benz OM 441 LA. The transmission is also a ZF LSG 1000, the radios and mortar ballistic computer are also present. Instead of an MG-3 machinegun for the commander, the M-113G3 PzMors gives the commander an M-2HB machinegun. Cross-country performance is improved due to modification of the standard M-113 suspension. New tracks are installed which have a much longer life than the standard M-113 tracks. The M-113G3 can be easily distinguished from its brethren by noting it's rear-mounted fuel tanks, one on each side of the rear of the vehicle at the top. The M-113G3 PzMors will probably be the version of the M-113 PzMors that will be accepted for the German Army, in favor of the M-113A2GE.

Twilight 2000 Notes: The M-113A2G PzMors and the M-113G3 PzMors are present in the Twilight 2000 timeline, but they are few in number (with the M-113G3 PzMors fewer in number than the M-113A2G). The primary version in service with the Germans and Danish in the Twilight 2000 timeline is M-113A2G PzMors.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-113G PzMors	\$196,024	G, A	838 kg	11.6 tons	5	7	Passive IR (D)	Shielded
M-113A1G PzMors	\$194,324	D, A	850 kg	12.1 tons	5	7	Passive IR (D)	Shielded
M-113A2GE PzMors	\$225,356	D, A	813 kg	12.5 tons	5	9	Passive IR (D)	Shielded
M-113G3 PzMors	\$232,075	D, A	836 kg	12.5 tons	5	9	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-113G PzMors	150/105	30/21/2	303	110	Std	T2	HF6 TF4 TR4
M-113A1G PzMors	128/89	26/18/2	360	78	Std	T2	HF6 TF4 TR4
M-113A2GE PzMors	164/115	33/23/2	360	111	Std	T2	HF6 TF4 TR4
M-113G3 PzMors	180/126	36/25/3	360	124	Std	T2	HF6 TF4 TR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-113A3G/M-113A1G/M-113A2GE PzMors	None	None	MG-3 (C)	2000x7.62mm, 63x120mm
M-113G3	None	None	M-2HB (C)	2000x.50 BMG, 63x120mm

Rheinmetall Wiesel 2 Mortar Carrier

Notes: This is a Wiesel 2 with an externally mounted 120mm mortar, and with a special soft recoil system designed for use with the light Wiesel chassis. The Wiesel 2 Mortar Carrier is very useful in adding heavy bombardment capability to Airborne, Airmobile, and Light Divisions. The Wiesel 2 Mortar Carrier will fit inside the cargo bay of almost any heavy or medium transport aircraft, as well as a CH-53 helicopter. It can be parachuted to the ground, or delivered by LAPES. Making the Wiesel 2 Mortar carrier into a heavy mortar carrier, and it took a lot of research and testing to do it. Though design work began in 1984, it was not until 1988 that deliveries (in small numbers) took place, and then some problems cropped up. The Wiesel 2 Mortar Carrier and its mortar quickly developed materiel fatigue, including cracks in the metal of the mortar tube and rear parts of the vehicle. These problems took until 1997 to fix, and then the German Army tested a few vehicles again. However, budgetary problems with the German Army and German government further delayed full production until 2002. There is still a controversy among technical design experts and in the German Army itself, centering around whether it is even possible to mount a long-barreled 120mm mortar on such a light vehicle without undue or early wear and tear. This has further delayed full deployment; until 2011, only eight of these vehicles were put into service. The Wiesel 2 Mortar Carrier, however, has been used in most of the recent NATO interventions, including Somalia, Bosnia, Kosovo, Macedonia, and Afghanistan.

The Wiesel 2 Mortar Carrier has a body that is specialized for use with the Tampella mortar it carries. The sides and front of the

rear compartment have been raised almost a full meter, and the rear compartment has been heavily modified for its mission. The rear of the vehicle is not raised, and there is only a small door in the rear which is difficult to use due its size and the position of the mortar when it is in transport position. The driver is in the front right side, with the engine, transmission, and cooling system next to the driver on the front left. The commander and ammunition handler are seated on the left of the vehicle and the commander has a hatch on the roof with the hatch having all-around vision blocks, with the front block having an infrared viewer. The hatch is mounted on a ring and can be moved around to allow the commander to scan other places with his IR viewer. On the center of the right side is a somewhat small hatch. There is also a hatch on the roof near the rear of the vehicle. The engine of the Wiesel 2 Mortar Carrier is an Audi 2.1-liter turbocharged diesel which develops 109 horsepower. The transmission is automatic, with the driver using a yoke for steering and pedals for driving and braking. The armor is steel and noting to write home about – it can be penetrated by some 7.62mm rounds or just about any autocannon, and of course, a hit by a tank gun will completely trash the vehicle. This choice of light armor was deliberate; the Wiesel 2 family are meant to be small, lightweight vehicles which are agile and fast. The Wiesel 2 Mortar Carrier can raise some extra protection with its four smoke grenade dischargers on either side of the front of the vehicle. The crew can protect themselves in an NBC environment using a collective NBC system; the mortar is, like most mortars, muzzleloaded, but the mortar moves into a horizontal position to receive another round of ammunition, and then moves back to the firing position (or travel position if desired). This does not break the NBC seal, allowing the crew to work in their normal uniforms instead of roasting in MOPP suits. Normally, the driver stays put during a fire mission so the Wiesel 2 Mortar Carrier can quickly “shoot and scoot.” He can, however, slip into the combat compartment and help with the ammunition handling or operate equipment.

Before the mortar can be fired, hydraulic cylinders must move the mortar out to its firing position. The mortar has a specially designed baseplate; between the hydraulic cylinders, the baseplate, and a pair of shock absorbers, the mortar system can absorb 25 tons of force from the mortar firing. This is more than enough to keep the mortar from damaging the Wiesel 2 when it is fired. The mortar is also of the recoiling type, which further reduces the shock of firing to the vehicle. The deployment of the mortar is automatic, and the crew simply has to push a button to get the mortar in firing position or travel position after its fire mission; this takes under a minute. After deployment, the Wiesel 2's crew becomes a mortar crew. Initially, the Wiesel 2 Mortar Carrier can use its onboard ammunition, but in a lengthy fire mission, the mortar carrier must be fed from an accompanying ammunition-carrying vehicle. The Wiesel 2 Mortar Carrier is normally accompanied by an FDC based on the same Wiesel 2-based vehicle. The Wiesel 2 Mortar Carrier is also equipped with GPS, a mortar fire control computer, and a limited mapping computer.

The special recoiling mortar system was designed especially for the Wiesel 2 chassis. Rheinmetall based the mortar on a Tampella design, but highly modified the mortar for the very light Wiesel 2 chassis.

Twilight 2000 Notes: It is possible that the Wiesel 2 Mortar Carrier could be present in the German Army in small numbers in the Twilight 2000 timeline. If so, it will not have the mapping computer and will have to rely on the Wiesel 2 FDC for coordinates to its target. The Wiesel 2 Mortar Carrier could also use coordinates from a unit requesting fire support, but the mortar crew would have to use paper maps or FDC vehicle can give the mortar crew the correct fire information. The GM will have to take into account that a Wiesel 2 Mortar Carrier is not a perfected vehicle in the Twilight 2000 timeline, and damage to the mortar and the vehicle may result over time.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$118,739	D, A	300 kg	4.62 tons	3	4	Passive IR (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
162/113	38/25/3	80	17	Std	T2	HF4 HS3 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	120mm Rheinmetall Recoiling Mortar	25x120mm

Rheinmetall Wiesel 1 BTM-263 Mortar Vehicle

Notes: This version of the Wiesel 1 is still experimental, despite having been first displayed about 25 years ago (under the MaK name), and Rheinmetall still offers it for sale. The BTM-263 mortar vehicle (PzDkMors, or Armored Direct-Fire Mortar) is topped with the French SAMM BTM-263 turret, hence the name. It is not designed as a bombardment vehicle, like most mortar vehicles, but it can be used as such. Instead, the BTM-263 mortar vehicle is meant to be a reconnaissance vehicle, with a secondary role as a fire support vehicle. The BTM-263 mortar vehicle was in fact designed to provide scouting capability and rapid, mobile fire support to Airborne, Air Assault, and light Infantry Divisions. Like the standard Wiesel 1, the BTM-263 mortar vehicle can be air-dropped, deployed by LAPES, carried in heavy-lift helicopters like the CH-53 and CH-47, sling-loaded by any helicopter able to lift 6 tons, or have several of them loaded onto a C-17, C-130, or C-160.

The BTM-263 turret is light in weight – little more than 300 kilograms. The one-man turret is armed with a Brandt 60mm long-range gun/mortar capable of flat firing like a conventional light cannon or as a standard, if breech-loaded, 60mm mortar. The barrel is a long 1.8-meter barrel capable of long-range fire in either mode of use. The mortar (and its coaxial machinegun) has an elevation range from -7 to +70 degrees. The BTM-263 turret has conventional fire control systems for direct fire as well as conventional mortar-sighting controls as well as a mortar ballistic computer. The turret is also armed with an MG-3 machinegun (MAG for export models) for direct defense against infantry or light vehicles, or to use in covering fire. On each side of the glacis near the bottom is a cluster of four smoke grenade launchers on each side. The turret also provides the Commander/Gunner with night vision sights.

The lack of large amounts of ammunition limits the BTM-263 mortar vehicle in a long bombardment, but if accompanied by a vehicle or trailer, that can carry additional ammunition, it can fulfill this role. For the most part, however, it is meant for immediate fire support and reconnaissance.

The BTM-263 mortar vehicle is otherwise the same as its Wiesel 1 chassis. Originally, the Wiesel 1 was supposed to have an Audi 100-horsepower gasoline engine, but this was changed to an 86-horsepower VW turbocharged diesel which, while it provided less horsepower, provided more torque and improved performance over rough ground, and gave the Wiesel 1 some towing capability. (I have this version below, but note that the gas-powered early version does not have a mortar ballistic computer.) The driver has conventional driving controls, and the transmission is automatic. The brakes are power brakes (hydraulically-boosted) and can bring a Wiesel from full speed to a stop in almost no time. Pivot steering is possible, and depending upon the Wiesel 1's speed at the time, turn radii can range from 0 (turning in place under pivot steering) to a mere 2.3 meters. Originally, the tracks were completely of rubber, but current tracks are light steel with rubber track pads. The armor is thin, but adequate for the BTM-263 mortar carrier's role; nonetheless, the Wiesel 1 should stay away from circumstances that would subject it to more than assault rifle fire or shell fragments. The fuel tank is interesting – it is a flexible rubber bag inside of a plastic containing tank, and between the plastic containing tank and the rubber bag is a polyethylene foam that makes the fuel source self-sealing.

Twilight 2000 Notes: The German Army often deployed these vehicles in scout elements of up to six vehicles; in addition, they performed their intended role as fire support vehicles for Airborne, Air Assault, and Light Infantry units. The scout vehicles often had night-capable video cameras and even shotgun microphones, which were recorded on an early digital system and then burst-transmitted to higher headquarters. (The digital storage on the BTM-263 in the scout role was limited to 30 GB, so frequent transmission bursts were essential, and recording was done only when necessary.) The long-range radio was, by necessity, data-capable, and the burst transmission was done via a relatively small (but visible) antenna. The scout BTM-263s also had an inertial navigation system with a mapping computer (again, this was limited to the area they were expected to operate plus a little extra). KSK sometimes “borrowed” one or two to take along during certain raiding operations. Each of the six US Ranger Battalions were equipped with two of these vehicles in the Twilight 2000 timeline; they had in fact been testing their use in their operations since 1992. The Army designation was the M-1012, though it was still called the Weasel, or “Ranger Fire Support Vehicle.” A common nickname for this enhanced Wiesel, both in the German Army and among the Rangers, was the “Electric Weasel” (“Elektrisch Wiesel”).

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PzDkMors (Original)	\$75,480	G, A	300 kg	2.86 tons	2	4	Passive IR (D), Passive IR, Image Intensification (C)	Shielded
PzDkMors (Current)	\$87,800	D, A	300 kg	2.91 tons	2	4	Passive IR (D), Passive IR, Image Intensification (C)	Shielded
PzDkMors (T2K Scout Variant/M-1012)	\$270,950	D, A	300 kg	2.98 tons	2	6	Passive IR (D), Image Intensification, Thermal Imaging (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor			
PzDkMors (Original)	210/147	53/37/4	80	38	Trtd	T2	TF2	TS2	TR2	HF4 HS2 HR2
PzDkMors (Current)	181/127	45/32/3	80	26	Trtd	T2	TF2	TS2	TR2	HF4 HS2 HR2
PzDkMors (T2K Scout Variant/M-1012)	177/124	44/31/3	80	27	Trtd	T2	TF2	TS2	TR2	HF4 HS2 HR2

Vehicle	Fire Control*	Stabilization*	Armament	Ammunition
PzDkMors (Original)	+1	Basic	Brandt 60mm LR Gun/Mortar, MG-3	24x60mm, 200x7.62mm
PzDkMors (Current)	+2	Fair	Brandt 60mm LR Gun/Mortar, MG-3	24x60mm, 200x7.62mm
PzDkMors (T2K Scout)	+3	Fair	Brandt 60mm LR	24x60mm, 200x7.62mm

Variant/M-1012)

Gun/Mortar, MG-3**

*The Fire Control and Stabilization modifiers apply only to direct fire from the gun/mortar or coaxial machinegun; they cannot be used during indirect fire.

**The M-1012 used by US Army Rangers has an M-240 as a coaxial machinegun instead of an MG-3.

Precizios Mechanika 2B9M/ACRV Mortar Carrier

Notes: The 2B9M/ACRV is, as the nomenclature indicates, a heavily-modified version of the ACRV (itself a modified MT-LB) with a 2B9M Vasilek mounted in the rear of the vehicle. The sides of the modified ACRV drop from their positions about a meter behind the commander's and driver's positions; the sides drop until they are straight out from the vehicle, where they are caught struts that are extended before the sides are dropped. The rear of the vehicle also drops far enough so that the Vasilek can fire straight out and the dropped hatch extends straight out from the bottom of the crew compartment; it is also kept in a straight-out position by struts that are extended before the sides are dropped. *In extremis*, the sides and rear may be allowed to completely dropped without the struts being extended, but this is not recommended except for a short time as doing this places a lot of stress on the hinges of the dropped sides and rear. The drop sides allow the Vasilek to perform indirect fire missions, firing over either side of the vehicle. By use of the drop rear, the Vasilek may also perform indirect fire missions, but it can also conduct direct fire missions. The crew must exchange the sighting mechanism from one designed for indirect fire for one that is made for direct fire, in order to perform direct fire (or vice versa). The vehicle's turntable mechanism is also precise enough to allow the crew to "wing it," in direct fire, sort of aiming and adjustment of aim by moving the turntable.

For direct fire, the vehicle uses the PAN-1 sight, which has an 18-degree field of view with a magnification of 2.5x and a 9-degree view using a magnification of 3x. The vehicle has an automatic fire control system that includes corrections for the gun for cant and height with a maximum of 10 degrees back or front for the vehicle, as well as a side slope of 10 degrees. (Any more leaning will require the crew to move the vehicle to a more level position.) The vehicle has an instrument to measure the effects of weather on a fire mission, a mortar ballistic computer, and inertial navigation with a computerized mapping system. All functions, as well as fire coordinates from FISTs and FDCs, are tied together by the main computer. The mortar ballistic computer also has enough power and storage space for it to act as a secondary, low-power, conventional computer. The main computer has standard operating controls including a keyboard with extra keys specific to the vehicle's mission, and a trackpad. The mortar gunner normally operates the ballistic computer, the keypad and readout for which is mounted on the left side of the hull below the front of the drop side. For direct fire, the Vasilek is partially stabilized and has the use of a laser rangefinder. The crew can also use the laser rangefinder to perform indirect fire by direct lay. It should be noted that 2 minutes are required to fire the first round after a stop; part of this time is taken up by the computer, inertial navigation system, and mapping system synchronizing the vehicle's position with that in the mapping computer, and the main computer digesting this computer. (It's a robust computer system, but not necessarily state-of-the-art.)

The interior of the 2B9M/ACRV is rather cramped; the computers and positions for their operator, the mortar crew, the Vasilek itself, and racks for a huge enough of mortar rounds take up a lot of room, especially since most of the mortar rounds are pre-loaded into the standard four-round clips that a Vasilek feeds from.

It should be noted that the 2B9M/ACRV is not designed for fire on the move, even with the Vasilek in direct fire mode; for fools who try it, there are Fire Control and Stabilization figures below, and if the 2B9M/ACRV is moving at more than one-quarter speed with the sides and rear dropped, there is a 10% chance per turn of movement that one of the hinges will be damaged enough that the hatch in question cannot be closed again. Generally, when on the move, the 2B9M/ACRV has its drop sides pulled in and over the top of the vehicle, and the dropping rear pulled up and locked. The Vasilek is turned so that it is facing straight left and locked in place.

Being made from an ACRV chassis, the 2B9M/ACRV has much in common with the standard ACRV. Of course, a standard ACRV does not have drop surfaces for its rear compartment, and the 2B9M/ACRV has an interior which is heavily modified for its role. However, there are some differences between Hungarian-built ACRV vehicles and Russian ACRV vehicles. Russian ACRVs use a YaMZ-238 engine developing 300 horsepower; Hungarian ACRV-based vehicles use a locally-produced JAMZ-238, a derivative of the Russian engine; this is a V-8 diesel developing 296 horsepower. The transmission – indeed, the entire powerpack and power train – are locally-built instead of using Russian equivalents. The transmission is manual; the Hungarian-built transmission has 6 forward and 1 reverse gear; while the Russian equivalent has 5 forward and 1 reverse gear. Most other aspects are as a standard ACRV, except in minor details such as locally-built parts. The driver is on the front right side with a large hatch over him; this hatch has a small slit with a spring-loaded cover. At night, an IR vision block may be slid into the slit. The engine is to the left and below the driver. On the left is the commander; he has a rotating cupola with all-around vision blocks, but on the 2B9M/ACRV, the commander has no weapon. The commander and the driver both have large bullet-resistant windshields to their front; armored screens may be dropped over the windshield from inside the cab, with small vision slits. He has a manual transmission, as does the standard ACRV.

The 2B9M/ACRV was designed primarily for the export market, but Precizios Mechanika has yet to see any international interest, except from the Ukraine. The Hungarian Army itself, however, is reportedly interested in buying a small run of these vehicles (or the BMP-based one, below).

The 2B9M/BMP-1 Mortar Carrier

This variant is almost identical in fit and function to the 2B9M/ACRV carrier above, except for the BMP-1 (1976) chassis, and different mounting of the Vasilek. Thusfar, only a few prototypes have been produced (probably five or less). The vehicle *is* on the market, though so far only the Hungarian Army is reportedly interested in the vehicle.

The 2B9M/BMP-1 has the basic BMP-1 chassis. Instead of having a turret, the turret has been removed and a large superstructure installed at the rear of the vehicle. The Vasilek is installed under this superstructure, along with other mortar equipment (as the 2B9M/ACRV above). The superstructure is closed by sliding a hatch on either side which slides shut, and opens into a wide firing area. There is a small drop hatch at the rear of the superstructure, though this is more to increase work area, as the

Vasilek cannot be turned to fire through this opening. Unlike the 2B9M.BMP-1, the Vasilek fires to the front of the vehicle, including in direct fire. In most other details, the Vasilek and its firing details remain the same as those of the 2B9M/ACRV, though the mortar must be moved back a short distance and to the rear to secure it for travel, and vice versa for firing.

Another big difference is that Precizios Mechanika has managed to stuff even more mortar rounds into the vehicle. (This is also because of, while the 1B9M/ACRV has smaller exterior dimensions, The BMP-1 has larger interior dimensions.) The top deck hatch is deleted (its former position now taken up by the superstructure, and the commander moved to a small semi-triangular hatch in the left roof of the superstructure. The cupola has all-around vision blocks, though the hatch does not rotate. The front vision block is removable to be replaced by a night vision hatch, but the commander has no mounted weapon or even a mount. The driver has his station on the left front, just ahead of the superstructure. He has the standard BMP-1 hatch, with three vision blocks, one of which may be removed and replaced with a night vision block. The front of the 2B9M/BMP-1 is virtually unchanged from the BMP-1; the rear doors are also retained, as they contain 66.5 liters of the fuel and there is a useful space behind them for gear. The door firing port is deleted, as are the side firing ports. The front clamshell doors and the small rear superstructure door can remain open while the vehicle is moving, even at full tilt, with damage to the doors. The vehicle is powered by a locally-built version of the Russian UTD-20 300 horsepower diesel engine, along with a locally-built version of the Russian manual transmission. Like the BMP-1, the 2B9M/BMP-1 has an NBC Overpressure system with a collective NBC backup, but it has the same ventilation problems when the hatches are closed. The interior, while cramped, is not *quite* as cramped as the BMP-1, though that is a qualified, relative statement.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
2B9M/ACRV	\$271,819	D, A	315 kg	16.35 tons	4	11	Passive IR (D), Passive IR (C)	Shielded
2B9M/BMP-1	\$1,400,161	D, A	375 kg	14.21 tons	4	7	Passive IR (D), Passive IR (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
2B9M/ACRV	107/75	27/19/2	550	57	Std	T3	HF4 HS2 HR2
2B9M/BMP-1	139/98	35/25/3	462	142	Std	T3	HF8 HS4 HF4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
2B9M/ACRV	+2*	Basic*	82mm Vasilek Automortar	128x82mm
2B9M/BMP-1	+2*	Basic"	82mm Vasilek Automortar	

*These apply only when the vehicle is at a halt and in direct fire position; this vehicle is not capable of fire on the move, and can use direct fire for only a 40-degree arc to the rear of the vehicle or front of the vehicle (as applicable).

DRDO Sarath Mortar Carrier

Notes: This mortar carrier based on the BMP-2 ICV is known officially by the Indian Military as the "Carrier, Mortar, Tracked" or simply "CMT." Like the Sareth itself (the Indian designation of the BMP-2S), the CMT is not regarded as having a bright future in the Indian Army. The Indian Army has several problems with the BMP-2; chief among these is the relatively weak armor and the position of the fuel tanks. Like the BMP-2, 61.5 liters of the fuel supply are inside tanks that are set within the doors, and the rest is in a large fuel tank in the centerline of the crew compartment. The Indians are currently considering a new base IFV, currently referred to as the FICV (Future Infantry Carrier Vehicle). The CMT will probably last longer, though it has its own problems, such as the short-range in comparison to other 81mm mortar carriers and especially, 120mm mortar carriers.

The 81mm mortar mounted in the CMT is a mid-range model, the IOF 81mm Mortar Type 1F. This is licensed copy of an Israeli-made mortar, the B-455. Like most such mortar carriers, the mortar must be lowered to a traveling position for major movements and then raised and locked in firing position again. The modified baseplate for use in the CMT built on top of the centerline fuel tank; a second baseplate is carried on the side of the vehicle, along with aiming stakes. The CMT also carries a standard aiming circle, along with grease pencils, rulers, protractors, etc., to be used if there is no FDC to provide firing coordinates or is no mortar ballistic computer is available. Part of the space where the turret used to be is covered (primarily a small section at the front of the circle where the turret was and at the rear), has hatches which open to the left and right. The mortar fires through this hatch space. The mortar can be fired with an angle of 40 to 85 degrees, and traverse 24 degrees on either side without having to actually move the entire vehicle. The mortar can be fired within 23 seconds of a halt, and brought back into traveling order within 30 seconds. A mortar ballistic computer is provided, allowing the CMT to provide its own fire solutions. However, the CMT can digitally transmit firing information, as well as the coordinates of the target, to other vehicles and mortar emplacements. The CMT has a long-range data-capable computer and a short-range computer. The mortar crew is separate from the driver and commander, instead of the commander and driver being part of the standard mortar crew of the CMT.

Like the Sareth/BMP-2, interior space is limited, though this partially offset by the CMT not having a turret or ammunition for the turret armament. However, the CMT does have copious ammunition space, including the associated racks for the ammunition. More space is taken up by the mortar itself. The commander has a hatch on the front right, which is usually armed with an IOF MG-6A (license-produced version of the MAG-58 designed specially as a commander's machinegun). The commander's hatch is surrounded by vision blocks, and has electric traverse (with manual backup). The commander has a reticle on the forward vision block; this block can show the view using an image intensifier. The MG-6A can also be aimed and fired (but not reloaded) from under armor and with the hatch closed. The commander also triggers the smoke grenade launchers on the glacis (there are four on either side instead of the standard three). The driver is in the normal Sarath driving compartment on the front left above the glacis plate; he has vision blocks to his front and left side, as well as one that looks partially to the right side. He can remove and replace his front vision block with a night vision block.

Other than removal of the turret, the CMT has other differences between it and the Sareth. All firing ports and associated vision blocks are deleted. However, the twin rear doors, complete with fuel tanks, remain in place. The commander's periscope is omitted. The CMT, like the Sareth, is powered by a locally-produced version of the UTD-20/3 turbocharged diesel providing 300 horsepower. The driver and commander have use of a gyrocompass to help them navigate; this can also be of use when pointing the vehicle for proper employment of the mortar. The transmission is semiautomatic instead of being fully manual. Some sources say the Sareth 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 Sareth is propelled by waterjets, they must be of low power, since the swimming speed reported in Sareths with waterjets is not as high as most vehicles equipped with waterjets – indeed, no higher than standard Sareth reported as being propelled by their tracks. Amphibious operations can be dangerous in the Sareth, particularly in a strong current; and the suspension's bearings are not airtight, and freeboard is not great. The CMT has an NBC overpressure system for use when the vehicle is buttoned up and a collective NBC system for use otherwise.

Twilight 2000 Notes: CMTs provided less than 1/10th the mortar fire support for the Indian Army in the Twilight 2000 timeline.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$247,093	D, G, AvG, A	750 kg	14.48 tons	6	10	Passive IR (D), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
139/98	35/25/3	462	159	Std	T2	HF9 HS5 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm IOF E-1 mortar, MAG (C)	108x81mm, 2350x7.62mm

ASCOD Mortar Carrier

Notes: This is an ASCOD IFV chassis fitted with a turret mounting a 120mm breech-loading mortar. There is a mount by the commander's hatch for a weapon. The vehicle is equipped with a fire control computer and GPS to allow the vehicle to fire accurately at targets within 3 phases of a halt as long as the target's location is known. As of 2003, this vehicle was being aggressively marketed to countries who had bought the ASCOD APC, but none had been sold as of yet.

Twilight 2000 Notes: A rare vehicle, the ASCOD Mortar Carrier was considered a delight to its crews, as it is easy to maintain and allows the crew to fire from under armor protection, as well as conduct some limited direct fire and self-defense against armored targets and light vehicles.

Merc 2000 Notes: This vehicle was generally passed on, even by countries using the other vehicles in the ASCOD range; conventional mortar vehicles were simply cheaper.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$210,895	D, A	500 kg	25 tons	4	9	Thermal Imaging, Image Intensification	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
128/90	25/20	860	213	Trtd	T3	TF14 TS7 TR6 HF18 HS5 HR4

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	120mm gun/mortar, MG-3, MG-3 (C)	78x120mm, 2900x7.62mm

RN-94 Mortar Carrier

Notes: This is an RN-94 armored personnel carrier modified for the Turkish Army to carry an 81mm mortar. The mortar is usually a long-barreled long-range model (normally the TDA MO 81 LP, though others can be fitted), and fires through the rear deck, which is fitted with long hatches to allow this. There is no turret, but the commander's hatch has a machinegun mount.

Twilight 2000 Notes: This vehicle does not exist.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$76,612	D, A	900 kg	10.93 tons	5	4	Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
173/104	40/25/5	325	88	Std	W(4)	HF6 HS4 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm TDA MO 81 LP mortar, M-2HB (C)	90x81mm, 1700x.50

T-55/160mm

Notes: This Iraqi modification of the T-55 tank is the T-55 chassis with a large circular superstructure that protects an M-160 160mm mortar. The superstructure is not a turret and does not rotate, but does have a limited traverse of 25 degrees from the center. Access doors are in the sides and rear of the superstructure.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$122,731	D, A	400 kg	32.46 tons	5	12	Active/Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
121/85	25/20	812+380	215	Trtd	T6	TF6 TS6 TR6 HF67 HS16 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	M-160 160mm Mortar, PKT (C)	50x160mm, 3000x7.62mm

IMI M-3/M-9 Half-Track-based Mortar Carriers

Notes: For most of the active Israeli-Arab Wars, the Israelis used many mortars based upon the US Half-Track (both M-3 and M-9 versions), which were suitably modified for their role. The first of such vehicles were little more than standard M-3A1 Half-Tracks with a mortar and the associated equipment added in, as well as ammo and equipment racks. The mortars were quickly replaced by mortars of Israeli design, and ammunition storage rearranged. In this guise, the vehicle was known as a Half-Track Mk C. Later, after considerable redesign work, the M-3 and M-9 were able to be equipped with a 120mm Soltam mortar. These vehicles were used by the Israelis from near the beginning of the country's existence, and well into the 1980s. They were the recipients of numerous upgrades, maintenance work, and repair work. Ultimately, they were replaced by US-built M-125 and M-106 mortar carriers (with the latter mounting a Soltam 120mm mortar instead of the M-106's standard 4.2-inch mortar).

Early Israeli Half-Track Mortar Carriers and the Mk-C Series

Used from the 1950s until the 1980s, the original Israeli Half-Track Mortar Carrier was, had, as stated above, the minimum of modifications to turn it into a medium mortar carrier. For a while, these mortar carriers were equipped with the US-designed 81mm M-29 mortar; as Israeli arms production got underway, these were replaced by short or long-barreled versions of the Soltam 81mm mortar series were mounted. Unfortunately, the mechanical design and layout of the Half-Track meant that a proper vehicle-mounted baseplate could not be used; instead, the baseplate was welded directly to the floor of carrier, with several points around the rear of the mortar to allow large deflection changes to be made by picking up the mortar, swinging it in the direction necessary, then locking the feet of the mortar's bipod into the floor of the Half-Track.

Though these early IDF Half-Track mortar carriers may have been based on M-3s, M-3A1s, M-5s, or M-5A1s, by the time they went through the upgrades to turn them into Mk-Cs, they were all essentially the same vehicles and had the same specifications. Pretty much, except for IDF-specific modifications, they were all equivalent to M-5A1s.

The First Step: The Mk-C

When the new mortars were mounted on the Half-Track, the new vehicle was called the Mk-C, as it also had several modifications to help the protection picture and to increase automotive reliability. Engines were tuned up or replaced, suspensions were made capable of better cross-country, and a new transmission made driving the half-tracked vehicle easier (though the transmission was still manual, one did not need to worry about the gearing to the front wheels as well as to the rear track). Externally, the use of appliqué armor is obvious; some Mk-Cs even have track skirts and wheel protectors. The bullet-resistant glass of the cab was made stronger, as strong as that of the rest of the vehicle, and Israeli Mk-Cs generally did not use armored shutters. The door in the rear of the Half-Track was retained, as was the ring mount over the commander's seat. Sometimes the side-mounted M-1919A4 (later MAG-58) were retained, but not all Israeli Half-Track mortar carriers had them. (I have included them below.) The rear machinegun mount interfered with the mortar (especially if a long-barreled mortar was used) and was generally omitted. Internally, the rear section of the Half-Track was crammed full with racks for mortar rounds, fuzes, and a few spare charges; it also had two long-range radios and a shorter-range radio for communication with vehicles and personnel who are closer to the carrier. These radios were carried internally. Though in most cases, the mortar carrier would get its instructions from an FDC, Israeli mortar gunners, like most Western mortar crews, could aim their fires with a decent degree of accuracy using the old-fashioned plotting circle, protractor, map, and grease pencils. Crew personal equipment were mostly carried in racks along the side of the vehicle.

Mk-Cs could be powered by the White 160AX 147-horsepower gasoline engine of the M-3 or the IHC RED 450B 143-horsepower liquid-cooled engine of the M-5; most used the higher-horsepower, lighter, and mechanically-simpler White engine, and that what the stats below show. Most of these vehicles' drive train displayed numerous repairs, upkeep, and general maintenance, as well as some jury-rigged repairs. Starting with the Mk-C, driving the vehicle became easier due to the transmission modifications noted above. (It might be difficult to simulate this in game terms, though one possibility is to assign fractional levels of work each period spent driving the Half-Track.) Most crew seats are deleted, though they still have the under-seat stowage; in addition, the equivalent of two seats on each side also retain the stowage bins, though there is no actual seat there. Israeli Half-Track mortar carriers also sometimes had their M-2HBs exchanged for M-1919A4s or MAGs; this allowed the vehicle to carry the same amount of machinegun ammunition, but cut down on the weight of ammunition carried and the space it takes up in the vehicle.

The Half-Track Mortar Carrier Improved: The Mk-C2

By the 1973 War, the Israelis managed to come out with a kit that changed earlier versions of the Mk-C into a vehicle that was largely based on the M-9A1 Half-Track. However, the Mk-C2 has a much better suspension than the US-designed M-9A1. In addition, the gasoline engines of the earlier versions were pulled and replaced with the same Detroit Diesel 6V53 212-horsepower as used in the M-113-series APCs of the period. The M-113s Allison TX-100N automatic transmission was also fitted to the Half-Track. Internal ammunition stowage was rearranged to allow the Mk-C2 that allowed the vehicle to carry more mortar shells and fuzes as well as more machinegun ammunition and a small box of grenades (not included below). Thicker appliqué armor was fitted; experiments were done in the late 1970s, trying to fit the ERA of that period to the sides and front of the vehicle' however, it was judged that an ERA panel explosion would injure or possibly kill crewmembers, and often, the frontal ERA glazed or shattered the bullet-resistant windshield. The ERA experiments were quickly dropped.

The Mk-C2 gave the commander or gunner a hand-held laser rangefinder to assist in positioning the vehicle and in cases of firing by direct lay. (And remember how big "hand-held" laser rangefinders were at the time...) In the early 1980s, at nearly the end of their service lives, the Mk-C2s had mortar ballistic computers installed in them; these MBCs were new tech, relatively large, and

prone to failures, but allowed the gunners to accurately fire support missions given their map coordinates and those of the target.

Half-Track Mortar Carrier to the Max: the Mk-D

The 1956 War revealed an unexpected problem with the Mk-C; though it could carry enough rounds for a good bombardment, the 81mm shells lacked the power to produce a really heavy, nasty shelling of the target. This led the IDF to begin experimenting with a 120mm mortar carrier. At first, the Israelis experimented with the use of an AMX-13 base vehicle; this chassis proved to be problematic for the task it was given. As with the Mk-C, the AMX mortar carrier prototype had a baseplate welded directly to the floor of the vehicle. This meant that the AMX-13's suspension would have to take up the entire shock of the mortar's recoil, which amounted to an astounding 120 tons of force. The AMX-13's suspension simply was not up to the task, and due to the AMX-13's suspension design, it could not be beefed up enough to handle the task. The IDF would also have problems getting enough AMX-13 chassis from France for the task. The M-113 series, which would later see heavy use with the IDF, was still being developed in the US. Most other countries simply didn't want to sell arms to Israel.

It looked bad for the IDF, but then several things came together. Soltam developed a new 120mm mortar which not only had effective shock absorbers of its own, but also had a baseplate platform that meant that the mortar did not have to be welded to the floor of the Half-Track. The Half-Track proved to take to beefing up very well, and able to take up much of the recoil forces. And more Half-Tracks were gotten from several countries, including the US, through back channels.

The resulting vehicle was known as the Mk-D (and later, the Mk-D2). Of course, the Mk-D could not carry as many shells and fuzes as the Mk-C, the 120mm shells being much bigger and heavier than the 81mm shells. Thus, the Mk-Ds were almost always accompanied by trucks or armored load carriers with more ammunition. Generally, machinegun ammunition was reduced to make way for a little more 120mm ammunition, though most Mk-Ds mounted the M-2HB at the commander's station to somewhat increase the defensive firepower.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Early IDF Half-Track Mortar Carrier (M-3-Based)	\$305,152	G, A	200 kg	9.91 tons	2+4	9	Headlights	Open
Early IDF Half-Track Mortar Carrier (M-3A1-Based)	\$306,830	G, A	150 kg	10.01 tons	2+4	9	Headlights	Open
Early IDF Half-Track Mortar Carrier (M-5-Based)	\$305,142	G, A	200 kg	10.11 tons	2+4	9	Headlights	Open
Early IDF Half-Track Mortar Carrier (M-5A1-Based)	\$306,820	G, A	150 kg	10.31 tons	2+4	9	Headlights	Open
Mk-C (Light Mortar)	\$315,517	G, A	250 kg	10.36 tons	2+4	9	Headlights	Open
Mk-C (Long-Barrel Mortar)	\$327,667	G, A	250 kg	10.38 tons	2+4	9	Headlights	Open
Mk-C (Long-Range Mortar)	\$327,701	G, A	250 kg	10.39 tons	2+4	9	Headlights	Open
Mk-C2 (Light Mortar)	\$516,562	D, A	300 kg	10.66 tons	2+4	9	Headlights	Open
Mk-C2 (Long-Barrel Mortar)	\$528,659	D, A	300 kg	10.67 tons	2+4	9	Headlights	Open
Mk-C2 (Long-Range Mortar)	\$528,706	D, A	300 kg	10.68 tons	2+4	10	Headlights	Open
Mk-D	\$392,383	D, A	200 kg	12.46 tons	2+4	9	Headlights	Open
Mk-D2	\$510,524	D, A	200 kg	12.69 tons	2+4	10	Headlights	Open

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp*	Armor**
Early IDF Half-Track Mortar	117/82	19/12	230	89	Std	T2/(W)1	HF3 HS2 HR2

Carrier (M-3-Based) Early IDF Half-Track Mortar	116/81	19/12	230	90	Stnd	T2/(W)1	HF3 HS3 HR2
Carrier (M-3A1-Based) Early IDF Half-Track Mortar	113/79	18/12	230	88	Stnd	T2/(W)1	HF3 HS2 HR2
Carrier (M-5-Based) Early IDF Half-Track Mortar	112/78	18/12	230	89	Stnd	T2/(W)1	HF3 HS3 HR2
Carrier (M-5A1-Based) Mk-C (Light/Long-Barrel/Long-Range Mortar)	114/80	18/12	230	91	Stnd	T2/(W)1	HF4 HS4 HR2
Mk-C2 (Light/Long-Barrel/Long-Range Mortar)	139/97	23/14	230	102	Stnd	T2/(W)1	HF5 HS4 HR3
Mk-D	119/83	20/12	230	120	Stnd	T2/(W)1	HF5 HS4 HR3
Mk-D2	117/82	20/12	230	122	Stnd	T2/(W)1	HF5 HS5 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Early IDF Half-Track Mortar Carrier (M-3/M-3A1/M-5/M-5A1-Based) Mk-C (Light/Long-Barrel/Long-Range Mortar)	None	None	81mm M-29 or Soltam Light Mortar, M-2HB (C) and M-1919A4 (L, Rt) or M-1919A4 (C, Rt, L), or MAGs instead of M-1919A4s	105x81mm; 525x.50 and 5800x.30-06 or 7.62mm; or 6700x.30-06 or 7.62mm
Mk-C2 (Light/Long-Barrel/Long-Range Mortar)	None	None	81mm Soltam Mortar; M-2HB (C) and 2xMAG (Rt, L); or 3xMAG (C, Rt, L)	105x81mm; 525x.50 and 5800x7.62mm; or 111x81mm, 6325x7.62mm
Mk-C (Long-Range Mortar)	None	None	81mm Soltam Long-Range Mortar; M-2HB (C) and 2xMAG (Rt, L); or 3xMAG (C, Rt, L)	105x81mm; 525x.50 and 5800x7.62mm; or 111x81mm, 6325x7.62mm
Mk-D/Mk-D2	None	None	120mm Soltam K-6; M-2HB (C) and 2xMAG (Rt, L); or 3xMAG (C, Rt, L)	71x120mm; 525x.50 and 5800x7.62mm; or 78x120mm, 6325x7.62mm

*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.

Makmat

Notes: The Makmat consists of a heavily-modified M-7 Priest (itself a heavily-modified M-4 Sherman tank), with the modifications designed to allow the Makmat to carry the Soltam 160mm mortar (an improved version of the old Soviet 160mm mortar). Though there were not many built, the Makmat mortar does fire a satisfying-heavy charge of explosives, and throws general mayhem downrange. Most of these vehicles are now museum pieces or have been sold to other countries; the last combat use of the Makmat by the Israelis occurred in 1982 in Lebanon. In addition to fire support, one of the primary missions of the Makmat was to provide

battlefield illumination. This was especially important during the 1967 war, as most Israeli vehicles and troops did not have night vision equipment. They should perhaps get the title of “unsung hero,” as the illumination (and fire support) they provided made many of their night victories possible in that war.

The M-7 Priest base vehicle is essentially stripped down to its chassis; when the body is finished, the Makmat has a moderately-sloped glacis. The driver is behind this glacis, with the driver in the front of the vehicle near the bottom of the glacis. The driver has a hatch which locks open slightly above horizontal, or closes with the driver looking out through a vision slit near the top of his hatch. (Note that while the hatch is open, he is vulnerable to small-arms fire and shell fragments, particularly in the head, torso, and arms.) The commander is essentially in the same place he would be on a Priest, except that the pulpit-like stand is replaced by a more conventional hatch and stand. The commander's position has fittings for a machinegun, and there is a ring mount, but in practice this is often not mounted. Instead, a pintle is mounted on either side of the rear gun space. The rest of the crew have seats in the rear; the rear area, behind the commander's position, is open-topped. The back of the rear area is normally locked straight out to provide more space for the crew to work in when using the mortar; a ladder is mounted on this folding rear deck, and when the deck is folded up and closed for traveling, the ladder folds flat against the outside of the deck plate.

The suspension remains typical of a Sherman-series vehicle; however, the gasoline engine and manual transmission have been replaced with a 430-horsepower Cummins turbocharged diesel engine and an automatic transmission, with the driver having a conventional brake and gas pedal, a steering yoke, and a gearshift that can be used on the fly and allows operation in reverse, in the lower range of gears for steep hills or very rough terrain, or the upper range of gears for maximum speed. Essentially, the entire drive train has been removed in favor of the more modern drive train.

The Makmat mortar uses a heavy-gauge steel smoothbore barrel. The Makmat mortar is breech-loaded; loading such a large-caliber mortar by dropping heavy 160mm rounds down the barrel would be impossible to sustain in a tactical situation. To load the mortar, the barrel is lowered under by virtually the entire crew into its traveling position, opening the breech and allowing a round to be loaded. The mortar is then raised again, and the mortar is fired by lanyard. Raising the mortar back to firing position is relatively easy, as the mortar strut has a spring-loaded counterbalance mechanism. When the mortar is in the Makmat carrier, the baseplate's traveling wheels are locked into the vehicle's baseplate, with the offside wheel being used to allow rotation of the mortar. The mortar fires over the rear of the vehicle, but can be rotated through 360 degrees, with elevation and depression being from +70 to +43 degrees. When mounted in the carrier, the mortar's baseplate is locked into the floor, and the baseplate can be readily removed if necessary. The mortar is supplied with two sights; one has less precise adjustments and is used for general bombardment; the other is used for more pinpoint bombardment, such as in MOUT fighting.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological*
\$460,067	D, A	500 kg	36 tons	8	22	Headlights	Open

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor**
107/75	27/11	700	154	Std	T5	HF27 HS8 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	160mm Soltam M-66 mortar, 2xMAG or 2xM-2HB (Rt, L)	56x160mm, 2000x7.62mm or 1000x.50

*The two-thirds of the vehicle that is the fighting compartment is open topped and is considered “Open” against NBC attack. The front one-third, with the commander's and driver's positions, is considered “Enclosed.”

**As above, note that the rear two-thirds of the Makmat is open topped and therefore can be fired into without difficulty (assuming you are high enough to shoot into the fighting compartment or have a weapon that can take advantage of the open top). In other words, the rear two-thirds of the Makmat have a roof AV of 0.

Keshet

Notes: The IDF has been using the US-designed M-125 (81mm), and M-106 (with the 4.2” mortar replaced with a Soltam K-6 120mm mortar); the M-1064A3 was therefore desirable, as the crews were already familiar with the M-113 series. Externally, the Keshet is virtually identical to the M-1064A3; internally, the Keshet is heavily modified from the M-1064A3, to serve the Cardom (Hatchet) mortar, Israeli radios, ammunition storage, and in general to have the Keshet conform to IDF needs and standard. (The Cardom mortar can also be mounted with minimal modifications to any M-1064A3-series vehicle; with more extensive modifications, the Cardom can also be mated to M-113A3 and MTVL-based vehicles; Soltam has not shown many prototypes or mock-ups of the Keshet mating to wheeled armored vehicles, but Soltam says they can also mate the Keshet mortar to several wheeled armored vehicles.) The Keshet was first deployed to IDF units in 2011, and the US Army is partially replacing its M-1064A3s with Keshets (I have not been able to discover the nomenclature for the Keshet in US service). The US Army has also tested the Cardom on a modified Stryker mortar carrier, and will almost certainly be part of a Stryker Brigade's lineup. Other interested parties include several NATO countries.

The Cardom is a heavily-modified Soltam K-6 120mm mortar; however, the K-6 base weapon is almost unrecognizable under the modifications that produce a Cardom mortar. One of the most obvious modifications are the heavy-duty recoil-dampening shock absorbers on either side of the barrel, necessary to allow firing some of the new 120mm mortar ammunition, to keep from damaging sites, protect the electronics and carriage system, and to keep the vehicle or the mortar from movement and ruining the Keshet crews' fire solution during recoiling when fired. Another heavy modification is the loading system; the Cardom is breechloaded, but is in

addition, using a trigger on the barrel and manual loading allow the crew to engage in short but high-speed bursts of shelling. (Up to 16 rounds per minute 1 minute can be achieved with a good crew, and the Cardom's normal rate of fire is only 4 rounds per minute.) Though the Cardom mortar system is rather heavy (about 750 kilograms), In addition, the Mortar Ballistic Computer and other subsystems allows the crew to conduct its fire missions while the crew is entirely inside the armor envelope of the Keshet, requiring only that the rear overhead hatch remain open. The Cardom can fire any sort of 120mm smoothbore rounds, newer rounds developed for the 120mm mortar over the past 10 years or so, and most types of smart 120mm mortar munitions. The Cardom can be brought to its traveling position in less than 5 seconds; it folds down and forward. The baseplate system allows the Cardom to be rotated and fired through 360 degrees, and has an elevation range of +40 to +85 degrees. Though Soltam is exploring ground-mounted versions of the Cardom, the Keshet and the Cardom currently do not allow the Cardom to be removed and ground-mounted.

Of course, the IDF would have been fools to not include to compliment the Cardom. This includes an MBC which is slaved to the Cardom and the GPS system, allowing the crew to generate highly-accurate fire solutions by themselves without input from an FDC, and to take instructions from the unit needing fire support in a hurry. The Cardom's GPS can use the Keshet's data-capable radio to pass target information fire solutions to other Keshets and battlefield control units, or receive information as needed from other units similarly-equipped. The fire solutions can be punched into the MBC and other electronics, and since the MBC, GPS, and tactical computer are slaved to the mortar, the Cardom will automatically slew and elevate/depress to the proper position inside the Keshet, and the crew only needs to put a round in the carriage or manually load the Cardom. (The GPS/map system may be substituted or assisted by a very accurate inertial navigation; both have access to the computer's mapping system, and both can assist the Cardom in calculating fire solutions.)

The Cardom essentially has the same range when using conventional ammunition as the Soltam K-6 mortar. The MBC is advanced and made by Elbit; it is little larger than a cell phone. The Keshet also has a ruggedized laptop computer, and the radios have mounts to help further shield them from recoil. The radio setup includes a short-range computer which may be removed and manpacked if necessary; other radios include a medium-range radio, and two data-capable long-range radios. The Keshet has a GPS system, which, in addition to its input to the Cardom, provides position information and driving instructions. The Cardom is equipped with small flat-panel displays (one for the driver, and one at the commander's position), with the driver's screen displaying position coordinates, speed, fuel consumption and range based on those consumption figures, as well as fuel onboard and readings and any problems with the vehicle's drive train. The commander's flatscreen displays that information and the state of the Cardom mortar and ammunition display.

The Keshet is, after all a modified M-1064A3, and they have many features in common. The driver has a conventional brake and gas pedal, as well as a steering yoke. This greatly reduces the fatigue on the driver. The Keshet has an automatic transmission and is powered by a 275-horsepower turbocharged diesel, which is a Detroit Diesel 6V53T engine. Some other components of the RISE 2 upgrades have been used, such as a more-reliable drive train and an improved suspension. The standard M-113-series inability to pivot steer safely has been improved, allowing IDF units to again pivot steer, even at 3/4s its full speed. Like the M-1064, the Keshet has its fuel tanks removed to fuel tanks mounted externally above the rear fenders. The Keshet is not amphibious; it is too heavy and not sufficiently balanced for swimming. Because of this, the trim vane has been removed. Kevlar anti-spalling panels have been added to the surfaces of the interior as well as the inside of the fuel tanks. The glacis, sides, and rear has been improved, providing more protection. If desired, ERA, conventional appliqué, or MEXAS-type composite appliqué can be used. The driver has a front vision block which may be replaced by a night vision block; this vision block is a thermal viewer instead of the more standard passive IR viewer.

The commander's station is in the same position as on the M-1064A3, and the driver is also in the same position as on the M-1064A3. The other crewmembers have seats at the front of the fighting compartment with underseat storage. Though other compartments exist in the Keshet, they are necessarily small, and four large lockets are mounted on its sides. Unlike its M-113-based brethren, the Keshet normally has a MAG machinegun instead of an M-2HB as a commander's weapon. A limited amount of maps, as well as a protractor, aiming circle, and some grease pencils and colored wipe-away alcohol markers are also carried in case the electronics suite is down or not working to its full potential. The normal crew compliment is four, with all crewmembers working the Cardom on a fire mission. However, one or two additional crewmembers may be added, depending upon mission requirements.

Compared to the M-1064A3, the Keshet has more armor plating than the M-1064. The fuel tanks, should they be penetrated, are self-sealing. On the front fenders are found four smoke grenade launchers per fender; the Israelis are known to use IR screening smoke, and even fragmentation or concussion grenades from those launchers. As noted above, the Keshet has a large two-piece hatch over the mortar to allow it to fire, and the rear ramp with the smaller door in it is retained. In addition, over the rear crewmembers there are small hatches, which are surrounded by vision blocks.

Twilight 2000 Notes: The Keshet mortar carrier does not exist, though limited amounts of Cardom mortars are available, and usually transported towed behind another vehicle. The MBC is retained in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Keshet	\$457,419	D, A	890 kg	14.39 tons	2+4	10	Thermal Imaging (D)	Shielded
Keshet w/Appliqué	\$460,058	D, A	860 kg	14.81 tons	2+4	10	Thermal Imaging (D)	Shielded
Keshet w/ERA	\$472,419	D, A	845 kg	15.11 tons	2+4	11	Thermal Imaging (D)	Shielded
Keshet	\$473,860	D, A	675 kg	15.25 tons	2+4	10	Thermal	Shielded

w/MEXAS	tons	Imaging (D)
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Keshet	124/88	28/19	360	159	Std	T2	HF9 HS7 HR5
Keshet	120/85	27/18	360	164	Std	T2	HF11 HS9 HR5
w/Appliqué							
Keshet	118/84	27/18	360	167	Std	T2	HF9 HS7 HR5
w/ERA							
Keshet	117/83	26/18	360	169	Std	T3	HF11Cp HS9Cp
w/MEXAS							HR5

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Keshet (All Variants)	None	None	120mm Cardom mortar, MAG (C)	54x120mm, 3335x7.62mm

Komatsu Type 96 Mortar Carrier

Notes: The Type 96 Mortar Carrier was developed at the same time as the Type 96 APC, and is a Type 96 APC with modular modifications to outfit it for its role as a mortar carrier. As stated, the modifications are modular; the modifications may be removed easily, replaced with APC-type components, and be turned back into a Type 96 APC. This marks the first time that the JGDSF has fielded a mortar carrier in large numbers since World War 2. It has not been exported, like most Japanese weapons, but has seen combat service in Afghanistan and Iraq during Japan's short-lived participation in ISAF.

Since it is modular-fit mortar carrier, the Type 96 mortar carrier retains many of the same components as the Type 96 APC. The Type 96's mortar is the Israeli Soltam K-6 (actually, it is the US version of the K-6, the M-120), which is license-produced in Japan. (Sort of a double license there; the US has permission to build mortars for Japan, who license-produce them from the US.) Unlike previous Japanese mortar carriers, the Type 96 carries a decent amount of ready ammunition for its mortar. The chassis and hull of the type 96 APC remains largely the same; the firing ports of the Type 96 are retained, though the rearmost ports are blocked by mortar ammunition storage. The overhead hatch for the mortar is the same hatch used by the APC version, and the Type 96 Mortar Carrier retains the power-operated rear ramp with a smaller door set in it. As with the APC, the Type 96 Mortar Carrier has numerous tie-down points for troop, supply, or combat equipment strapped to the sides of the vehicle. The driver is in the front right side of the vehicle at the top of the glacis, and has three vision blocks to his front. (Early photos show the driver of the Type 96 with a fourth vision block to the right of the driver, but Type 96s used by Japanese troops in Iraq and Afghanistan have only the three frontal vision blocks.) The center vision block can be removed and replaced with a night vision block. For service in Afghanistan, a bullet-resistant windshield was fitted to the driver's position that covered the front and sides of the driver's position, allowing him to drive with his head out of the vehicle in relative safety. (This windshield has AV 4). The engine is to the left of the driver. The commander is behind and to the right (centered) of the driver; he may be armed with a Type 96 AGL (Type 96A) or an M-2HB fitted with a QCB kit (Type 96B). The commander can aim and fire his weapon (though not reload it) while ducked down into the hatch or while the vehicle is buttoned up. The commander's weapons can be aimed using a simple 1x reticule with illumination; this reticule is superimposed on the commander's front vision block. The commander's front vision block can also be overlaid with one of two night vision devices. The crew in the rear can use the front-most firing ports. Though Komatsu and the JGDSF insist that the rear ramp has two firing ports in it, photographic evidence (taken in Iraq, Afghanistan, Japan, and in Defense Exhibits) says otherwise, though it's possible that Komatsu intends to add them later. The smoke grenades, four per side, are found on each side of the forward side of the vehicle. The fighting compartment includes three seats for the rest of the mortar crew. (The standard Type 96 APC infantrymen's seats remain, though most of the length is folded up and strapped in the up position.)

The armor of the Type 96 Mortar Carrier is of all-welded steel, but it is a bit more advanced than older APCs, and the Japanese are considering adding MEXAS-type appliqué composite armor to the Type 96 in the future. The vehicle uses a Komatsu 6D40 turbocharged diesel developing 640 horsepower coupled to an automatic transmission, and is reportedly quite easy to drive. The suspension is 8x8 and of the off-road-type, and steers with the front set and rear set of wheels steering independently to tighten the turning radius. Tires are both run-flat and puncture-resistant. A mortar ballistic computer is standard on the Type 96 mortar carrier, as is a GPS and a self-surveying unit. Another small computer is carried, allowing it to generate its own fire solutions and containing a mapping program. The Type 96 Mortar Carrier can also serve as a faux FDC if necessary. The Type 96 Mortar carrier has a medium-range radio for general use, and a long-range data-capable radio for use if range is a problem or to receive and transmit information.

Twilight 2000 Notes: Though in the Twilight 2000 timeline, the Type 96 APC and Type 96 Mortar Carrier entered production earlier than in real life (in 1994), only 60 examples of the Type 96 (40 APCs/Subtypes and 20 Mortar Carriers) were produced. In the Twilight 2000 timeline, these vehicles are called the Type 94.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 96A	\$508,908	D, A	650 kg	15.5 tons	5	10	Passive IR (D, G), Image Intensification (G)	Shielded
Type 96B	\$491,991	D, A	650 kg	15.5 tons	5	10	Passive IR (D, G), Image Intensification (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 96A/B	183/92	42/22	360	204	Std	W(6)	HF12Sp HS6Sp HR6

Vehicle	Fire Control*	Stabilization*	Armament	Ammunition
Type 96A	+1	Basic	120mm M-120 Mortar, Mk 19 (C)	45x120mm, 375x40mm
Type 96B	+1	Basic	120mm M-120 Mortar, M-2HB (C)	45x120mm, 1200x.50

*These modifiers apply only to the commander's weapon, and not to the mortar.

Mitsubishi SU-60-Based Mortar Carriers

Notes: Soon after the SU-60 APC went into production in the 1950s, the Japanese began development of mortar carriers based on the SU-60. This had mixed results; it produced viable self-propelled mortar carriers, but the base SU-60 chassis is small and there

isn't a lot of room for ready operation or for the crew to operate the mortar, not to mention much room for ready ammunition. This makes ammunition-hauling vehicles vital to these mortar carriers' operations, as they carry virtually all the ammunition, fuzes, and charges for the mortar carriers' bombardments. As a result, the two SU-60-based mortar carriers that were built were small (only 18 of each were produced), and until the mid-1990s, the JGSDF for the most part operated without mortar carriers, using ground-mounted mortars instead or relying on howitzer fire.

The two mortar carriers were developed and built in tandem. The SV-60 variant is armed with an M-29 81mm mortar. The mortar is mounted in the same manner as most such vehicles, facing to the rear and firing over the back of the vehicle. The SV-60 provides the mortar with elevations from +40 to +85 degrees, and traverse of 40 degrees to either side of the centerline. The interior of the SV-60, despite the small amount of on-board ammunition, is quite cramped, and though there are seats in the rear for two of the crewmembers, there is little room for much else; as with most such vehicles, the outside of the vehicle becomes festooned with crew, spare, and combat equipment. The bow machinegun and gunner are retained, though the gun barbette and the vision blocks are basically surrounded by the bipod and baseplate used for ground-mounting the mortar away from the vehicle.

The SX-60 is the same basic idea as the SV-60, but it is armed with an M-30 4.2" (107mm) mortar. More modifications were required to mate the M-30 with the SU-60 chassis; inside the vehicle, the floor slopes somewhat, and externally, the rear of the vehicle also angles down. This was done to ensure the M-30 has enough room when it is dropped into carry position, and to ensure that the crew isn't in danger from muzzle blast when the mortar is firing. The mortar has elevation ranges from +37 to +65 degrees, and a traverse of 40 degrees to the right or left. The SX-60 also carries a baseplate and bridge for ground-mounting; these are mounted (like the SV-60) on the glacis. Unfortunately, these items, especially the baseplate, are so large that the bow machinegun had to be eliminated. The seat remains, though the seat is simply another crewmember's seat. Instead of the standard two hatches in the rear face, the SX-60 is equipped with a power-operated ramp which makes feeding the SX-60 with 4.2" ammunition easier. The SX-60 has the same problems with cramped onboard conditions as does the SV-60.

In both cases, the mortar carriers have the same thin welded steel armor as the SU-60 APC. The driver is in the same position on the front right, with three vision blocks to the front and a hatch above him. The bow machinegunner of the SV-60 has a hatch overhead and spotting sight to aim the machinegun which is integral to the machinegun ball mounting. The SX-60's equivalent position simply has the overhead hatch; the machinegun and its ball mount are plated over and nothing like a vision block or suchlike has been provided for his position. Both versions also retain the commander's position behind and center of the driver's and bow machinegunner's positions. The commander's position also retains the all-around vision blocks and the pintle-mounted machinegun, along with its distinctive frontal gun shield (equivalent to AV 2). The rear deck hatch is slightly enlarged, and consists of two pieces opening to the right and left. The SV-60 has the same two hatches in the rear face as the SU-60; the SX-60 has a ramp, as noted above. These mortar carriers are equipped with a Mitsubishi 8 HA 21 WT turbocharged diesel, and a manual transmission. Suspension consists of conventional torsion bars, with three out of the five roadwheels on each side having shock absorbers. The SV-60 and SX-60 are not amphibious.

In general, the SV-60 and SX-60 were sort of "neglected" by the JGSDF; they received very little in the way of upgrades and most of those upgrades were done to maintain and keep the vehicles running and the mortars they carried operational.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
SV-60	\$99,918	D, A	300 kg	21.1 tons	5	5	Headlights	Enclosed
SX-60	\$92,151	D, A	290 kg	21.9 tons	5	11	Headlights	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
SV-60	143/100	33/23	370	123	Std	T2	HF5 HS3 HR3
SX-60	138/96	32/22	370	128	Std	T2	HF5 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
SV-60	None	None	81mm M-29 or M-29A1 Mortar, Type 62 (F), M-2HB (C)	24x81mm, 435x.50, 2200x7.62mm
SX-60	None	None	4.2" M-30 Rifled Mortar, M-2HB (C)	8x4.2" Shells, 435x.50

Armored Mortar System (AMS)/M-113

Notes: This is the same turret as on the Saudi AMS/LAV-25, mounted on an M-113 chassis. Only Kuwait uses this vehicle.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$163,590	D, A	1 ton	12.2 tons	3	6	Passive IR, Thermal Imaging	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
113/79	25/15	360	77	Trtd	T2	TF8 TS5 TR5 HF6 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	120mm gun/mortar, MAG (C)	55x120mm, 1000x7.62mm

Chaimite V-600 Mortar Carriers

Notes: Though Portugal's Chaimite-based vehicles are already beginning their replacement by the Pandur, and full replacement is expected to take place as soon as 2016, it is most likely will take longer than is expected. In addition, Libyan Chaimite mortar carriers will almost certainly soldier on for a while.

Most Chaimite mortar carriers carry the designation V-600, regardless of the type of mortar they carry and which Chaimite chassis they are built upon. The basic form of this vehicle is a Chaimite V-200 (four-wheel version) with an 81mm or 82mm mortar fitted in the passenger compartment, firing to the rear. The 81mm mortar is fitted to most of these vehicles; the 82mm mortar equips the V-600s used by Libya. The actual mortar used varied with time. The mortar fires through two overhead hatches, with the interior filled primarily with racks for mortar ammunition and fuzes. Some other countries using the V-600 include Peru, Philippines and Peru; mounted mortars are weapons made except for Libya, who chose to mount Soviet-designed mortars they already owned in their V-600s.

Most users of the V-600 also used 6-wheeled V-600s which mounted heavier mortars. For most of it's career, these 6x6 Portuguese vehicles carried US-designed M-30 4.2" (107mm) mortars. In the 1990s, however, Portugal replaced these with TDA 120mm mortars.

The Libyans mounted Russian-designed 120mm M-43's on these vehicles. Once again, the interior is basically full of racks for the mortar rounds and the mortar itself.

It is rumored that about half-a-dozen 8x8 versions were made for Libya. These larger chassis were requester to supply mobile platforms for some of Libya's 160mm M-1953 mortars. A more powerful 210-horsepower engine was installed to cope with the additional weight, and the suspension beefed up. These vehicles were not found during or after the recent action in Libya, and it is uncertain as to what happened to them, but it is certain that only one small batch was produced. Commander's machineguns on these Libyan vehicles are Italian-made MG-44/59s.

The V-600s have an additional long-range radio; late in their career, all versions except Libyan versions received a mortar ballistic computer and the long-range radio was made data-capable. Like other Chaimites, the V-600 was originally powered by a Chrysler gasoline engine, but these were quickly replaced by a 155-horsepower Cummins diesel engine. Transmission is manual. Suspension is of off-road-type, with number of wheels depending on the mortar carrier type. A spare tire normally mounted at the front of the vehicle. The front of the hull has a winch with a capacity of 4.53 tons, with 38.1 meters of cable. The Chaimite is amphibious, propelled in the water by its wheels; however, with the mortar fit, swimming a V-600 can be dangerous due back-heaviness. Armor is painfully light.


Just to the front of and above the side door is a station for the vehicle commander; he is armed with a machinegun (several sizes possible). His position is ringed by all-around vision blocks. There is no provision for aiming and firing when buttoned up, and the V-600 has no form of turret. The mortar fires from enlarged overhead hatches on the rear of the roof. The driver remains on the front left side. There are the usual clamshell doors on either side of the vehicle. The driver and commander have small bullet resistant windows to the front and sides of them, and hatches above them. The driver and commander have firing ports directly in front of them and to the sides of them, but these are only shutters with armored covers and not sealed firing ports. The standard firing ports in the sides are plated over, but the one on the rear left remains. (This is in the rear door.)

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
V-600 81/82mm	\$134,228	D, A	600 kg	7.71 tons	4	6	Passive IR (D)	Enclosed
V-600 120mm	\$207,397	D, A	700 kg	8.22 tons	4	7	Passive IR (D)	Enclosed
V-600 160mm	\$326,199	D, A	800 kg	10.01 tons	6	8	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
V-600 81/82mm	244/148	61/37/6	300	71	Stnd	W(3)	HF3 HS2 HR2
V-600 120mm	229/139	57/35/6	350	76	Stnd	W(4)	HF3 HS2 HR2
V-600 160mm	252/153	63/38/6	450	101	Stnd	W(6)	HF3 HS2 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
V-600 81/82mm	None	None	MAG (C) or M-2HB (C) or M-249 (C); 81mm or 82mm mortar	2400x7.62mm or 1700x.50 or 3200x5.56mm; 50x81mm or 82mm
V-600 120mm	None	None	MAG (C) or M-2HB (C) or M-249 (C); 120mm TDA or Bloc mortar	2800x7.62mm or 2000x.50 or 3700x5.56mm; 40x120mm
V-600	None	None	MG-44/59; 160mm mortar	3200x7.62mm; 35x160mm

160mm



Ratmil MLVM AR Mountaineers' Fire Support Vehicle

Notes: This vehicle is an MLVM Mountaineers Combat Vehicle with a turntable mounting a 120mm mortar in the rear instead of troop seats. The vehicle also carries a baseplate and bipod for firing the mortar away from the vehicle, along with aiming stakes. The roof of the MLVM is slightly raised to allow the rear deck hatches to be closed over the mortar barrel, as the MLVM is small, with low sidewalls and the mortar could be closed completely over the top of the mortar unless the vehicle was raised. The roof was raised only about 100mm, though the raised section is obvious, as are the enlarged roof hatches. MLVM ARs are built both in early and upgraded forms. As the MLVM itself was rare, the MLVM AR was exceedingly rare – of the 73 MLVMs still in service in 2005, only six are MLVM ARs. It appears that they will be replaced by RN-94-based vehicles and possibly Patria or Saab-based NONA-carrying vehicles.

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 AR is not related to the BMP series and has no turret. 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 MLVM AR has a cupola instead of the turret of the MLVM, with a pintle-mounted weapon. 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. An additional long-range radio is fitted.

In the same way that the MLVM was upgraded for the modern battlefield, an upgrade program was begun for the MLVM AR. In addition, the upgraded MLVM AR was fitted with a laser warning system, linked to the smoke grenade launchers on the lower glacis of the vehicle. The system also provides target information (distance, range, and estimated time of weapon impact if applicable). The MLVM AR has clusters of five smoke grenades on the upper front hull. The commander's periscope is fitted with an image intensifier. A major upgrade is in the powerpack – the MLVM AR received 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. The extra radio as mentioned above is data-capable, the vehicle has a mortar ballistic computer, and a mapping computer is fitted. It should be noted that on an MVLM AR, the mortar fires over the rear of the vehicle; on the Upgraded model, the mortar fires over the front of the vehicle. A package of appliqué armor has been devised for the MLVM AR, consisting of bolt-on spaced steel plates. The extra weight is a problem for the basic MLVM AR, but for the upgraded model, the extra engine power makes the appliqué armor package less detrimental to performance.

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

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MLVM	\$144,696	D, A	480 kg	12.26 tons	4	8	Passive IR (D)	Enclosed
MLVM w/Appliqué	\$147,627	D, A	453 kg	12.99 tons	4	9	Passive IR (D)	Enclosed
MLVM (Upgraded)	\$795,041	D, A	480 kg	12.65 tons	4	10	Passive IR (D)	Shielded
MLVM (Upgraded, Appliqué)	\$797,972	D, A	418 kg	13.38 tons	4	10	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
MLVM	96/58	24/15/3	480	69	Std	T2	HF7 HS3 HR3
MLVM w/Appliqué	90/55	23/14/3	480	73	Std	T2	HF11Sp HS5Sp HR3
MLVM (Upgraded)	116/71	29/18/5	480	161	Std	T2	HF7 HS3 HR3
MLVM (Upgraded, Appliqué)	110/67	28/17/4	480	171	Std	T2	HF11Sp HS5Sp HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
MLVM / w/Appliqué	None	None	120mm M-1982 Mortar, PKT (C)	56x120mm, 2500x7.62mm
MLVM (Upgraded)	None	None	120mm M-1982	56x120mm, 2500x7.62mm

RATMIL TAB-71AR

Notes: Sometimes referred to as the TAB-73, this is a mortar carrier version of the standard TAB-71 armored personnel carrier. Though there a number of differences between the TAB-71AR and the TAB-71, the primary differences arise from the installation of the 82mm mortar and the internal and external design modifications necessary for that installation. The TAB-71AR was never upgraded; the only work that was done was that needed to keep the vehicle functioning until something new came along. The TAB-71 is no longer marketed, nor are any upgrades (by the Romanians); production stopped in the 1980s. However, they will probably be updated more in the future and soldier on.

Internally, what is normally the rear troop area is largely occupied by the mortar (at roughly the center of the vehicle), ammunition, and fuzes. Unusually for such a vehicle, the TAB-71AR retains it's turret. The front of the vehicle has a boat-shaped nose, and the driver on the left and commander on the right have bullet-resistant windshields to their front and small windows to either side. The windshields have armored shutters which may be closed over the windshields with vision slits in them. The commander has a hatch overhead which opens forwards, but no sort of weapon mount. The driver does have hatch on the TAB-71AR hatch, and retains the head for a night vision block in the hatch. At the rear corners of the TAB-71AR are small hatches, and each of these have a pintle mount with a machinegun mounted. There are no firing ports and no special provisions for fire other than manual fire extinguishers. The crew and troops have a collective NBC system to plug into. A front-mounted winch is mounted for self recovery; this has a capacity of 5.5 tons and 60 meters of cable. The "suicide hatches" of the TAB-71 remain, but due to the mortar and associated equipment, are even more difficult to use than on the TAB-71 APC.

The mortar used on the TAB-71AR is based on a positively ancient Soviet design. The TAB-71AR uses old-style "fire control," consisting of maps and markers, a plotting board, aiming stakes, and the standard mortar sight. (TAB-71ARs were never equipped with an MBC or a navigation system; they rely on fire coordinates from an FDC). The effective width of fire from the mortar is 135 degrees on either side of the vehicle; unusually, the mortar fires over the front of the TAB-71AR. Atop the TAB-71AR is a pair of hatches comprising a large circular hatchway; this roughly in the center of the vehicle, and replaces the TAB-71's normal roof hatches. Upon a fire mission, the crew becomes the mortar crew.

Like the TAB-71, the TAB-71AR is powered by twin Saviem SR-225 gasoline engines each developing 140 horsepower. The vehicle is very difficult to drive, as transmission is manual with the driver having to shift each engine individually in gear simultaneously in order for the vehicle to continue to operate smoothly. The vehicle is amphibious with minimal preparation (a trim vane must be erected from the driver's compartment and bilge pumps turned on), requiring 4 minutes. Once in the water, the TAB-71AR is propelled by the motion of its wheels. Suspension is 8x8 and of the off-road-type, with central tire pressure regulation.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$246,365	G, A	350 kg	11.86 tons	5	7	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
132/80	35/20/2	290	111	Std	W(4)	HF3 HS3 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	M-1938 82mm mortar, 2xPK (Rear)	110x82mm, 2000x7.62mm

RATMIL TAB-79AR

Notes: The TAB-79AR is the mortar-carrier version of the ABC-79M Family of Vehicles. The member of the family that looks closest to the TAB-79AR is the TAB-79M turretless APC variant. The TAB-79AR, however, has received heavy modification inside to accommodate the mortar and its ammunition and fuzes, as well as ancillary equipment. The TAB-79AR (and indeed, the entire ABC-7M) family are used solely by Romania, and have recently been used by the Romanian Army in Afghanistan. The TAB-79AR uses several common components with the TAB-77 APC, though some have upgraded.

What is normally the rear troop area has, of course, been given over primarily to the mortar and its ammunition and gear. Actual equipment room is on the short side, though there are positions for every crewmember during a march. The normal ABC-79M turret is removed; in its place is a large, round, two piece hatch for use with the mortar. In front of that hatch are two smaller hatches, one for the driver on the left and for the commander on the right. The commander and driver also have four vision blocks, three up front and one to the left side (for the driver) and right side (for the commander). Both can also remove the center front vision block and replace it with a night vision block. The commander has a pintle mount outside his hatch for a light weapon; on the roof behind his hatchway, he also has an IR searchlight. The commander and driver have a windshield to the front that may be covered by an armored shutter (they then use vision blocks); they also have hatches above their positions. At the rear of the vehicle is another small hatch; the gunner or ammo bearer mans this position when the vehicle is not stopped for bombardment. The TAB-79AR has hatches on either side of the vehicle between the wheels, and another door on the rear; the side hatches are small, similar to the "suicide hatches" of the TAB-71M; it has a rear door, but it is cramped and narrow, and weapon racks mean that the rear hatch is not useful for much more than mortar ammunition restocking. The TAB-79 has a collective NBC system for the crew and troops. Protection also includes an automatic fire detection and suppression system. The passengers have firing ports, two to a side and two

in the rear. The TABC-79 has a 5.5-ton winch on the front with 50 meters of cable.

The mortar is once again a Romanian development of an earlier Soviet design and fires over the front of the vehicle. It has a muzzle device which prevents double-loading and also acts as a muzzle brake, reducing the stress on the suspension. Some ergonomic thought has been given to how mortar operations will have to be conducted in the vehicle, meaning that it is not as hard work and that work flows evenly in long bombardments. The TABC-79AR is powered by a single Savia 798.05N2 154-horsepower turbocharged diesel engine, with an automatic transmission. The driver has conventional controls. The engine is relatively compact, allowing for that small hatch in the rear, though it is mounted at the rear of the vehicle. The TABC-79AR is amphibious without preparation, requiring only that a waterjet be switched on when the vehicle begins floating. Suspension is 4x4 and of the off-road-type. Armor is a little better than most mortar carriers of this type, particularly from the front arc.

An upgraded version, the TABC-79ARM, is in existence; it will not be until Romania has upgraded all of its TABC-79ARs to this standard. The primary improvements are automotive and in the suspension; the entire drive train is more reliable, and the now-unitary powerpack is much easier to service or remove and replace if desired. The engine has been replaced by a Diesel Euro Type 3 turbocharged engine with 160 horsepower. This version of the TABC-79AR is equipped with a second long-range radio; this one is data-capable. The Upgrade includes a mortar ballistic computer and a second computer to accept digital transmissions from the second radio. The TABC-79ARM has a mapping computer linked to the primary computer (which is more of a small laptop, like a Toughbook), along with an inertial navigation system. (The Romanian Army is mulling over permanently mounting GPS or GLONASS and integrating it with the TABC-79AR's mapping computer, but no hard decisions have been made.) Likewise, a variety of appliqué and ERA packages are being considered, but no final decision has been made.

Twilight 2000 Notes: the Upgraded TABC-79 does not exist in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
TABC-79AR	\$339,537	D, A	318 kg	10.35 tons	4	8	Passive IR (D, C)	Enclosed
TAC-79AR (Upgraded)	\$909,931	D, A	268 kg	11.5 tons	4	10	Passive IR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
TABC-79AR	114/57	23/12/2	200	89	Std	W(3)	HF7 HS3 HR3
TAC-79AR (Upgraded)	103/51	21/11/2	200	99	Std	W(3)	HF7 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
TABC-79AR	None	None	82mm M-1983 Mortar, 2xPKT (C, Rear)	56x120mm, 2500x7.62mm

Kharkov MT-LB Mortar Carrier

Notes: This is a rather common mortar vehicle in Russian service, former Soviet Republics, and former Soviet client states, though in Russian service it is primarily found in Category 3 and Mobilization-Only units. It is an MT-LB armored personnel carrier with an 82mm or 120mm Pact mortar mounted in the passenger area (the exact type depends on the country of service). Several countries have built similar vehicles, whether *ad hoc* or with more purposeful modifications. These vehicles can therefore be found in almost all corners of the globe. However, a more common "MT-LB Mortar Vehicle" is actually a mortar or Vasilyek that is towed by the MT-LB (though this is not what is discussed here).

Whether armed with an 82mm or 120mm mortar, some features of the MT-LB Mortar Carriers are common, as are design features dictated by the MT-LB chassis. A baseplate for ground-mounting of the mortar is carried on the lower nose of the vehicle; unfortunately, the size of a 120mm mortar's baseplate is such that the MT-LB is too nose-heavy to swim and the vehicle is robbed of its amphibious capability. Strapped to the sides of the carrier are a bipod, and aiming stakes, and until the 1990s, the MT-LB Mortar Carrier carried a selection of maps and plotting boards to calculate coordinates and settings. The mortar fires over the rear of the vehicle, though the mortar can be rotated up to 60 degrees right or left. For the most part, the interior of the MT-LB is filled with ammunition racks, though there is no autoloader. The mortar is fired it's out a rectangular, two-part hatch on the rear deck. The commander's station is generally a skate mount on a circular hatchway which unfortunately has only two wide-angle vision blocks front and rear, though he can also see out of the small vision block on the right side of the MT-LB. The commander's hatch is above a seat which has a windshield in front and can have a shield lowered over it to increase protection. The commander has a vision block that contains a night vision device, and can be used if he is in his seat. The commander is normally armed with an NSVT, DShK, or Kord heavy machinegun, but some MT-LB Mortar Carriers have been seen with a ZU-23 as commander's armament.

The driver of the MT-LB Mortar Carrier has the same position in the front left of the vehicle, with three vision blocks to his front. The middle vision block can be removed and replaced with a night vision block. A small aisle between the commander and driver gives access to the mortar compartment. The mortar compartment has two large doors in the rear face, generally used for ammunition replenishment, and four firing ports, one of which are in each side and one of which is in each rear door. These firing ports are difficult to use due to limited space, and as a result MT-LB Mortar crews are normally issued AKSs, AKMSs, or AKS-74s, with the folding stock being easier to use within the confines of the mortar carrier. MT-LB Mortar Carriers also have a very good heating system, as one of the roles the MT-LB series was designed for was to replace several over-the-snow vehicles used in Arctic and Siberian conditions. The crewmembers in the rear have modest seats in rather cramped spaces. The MT-LB Mortar Carrier has a cluster of four smoke grenade launchers on the lower glacis above the front fenders.

The MT-LB Mortar Carrier is powered by 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 Mortar Carrier is capable of towing 3.3 tons. An engine upgrade in the early 1990s gave the MT-LB series 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. Other improvements include a mortar ballistic computer and a data-capable long-range radio, along with maps kept on a minicomputer instead of having the collection of paper maps. Like most Soviet-designed vehicles of the period, the MT-LB Mortar Carrier's suspension is of conventional torsion bars and has shock absorbers on the first and last set of roadwheels. Construction of the MT-LB Mortar Carrier is largely of steel and armor is rather thin, especially on the sides and rear.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
82mm Mortar Carrier	\$152,255	D, A	500 kg	12.38 tons	4	7	Passive IR (D, C)	Shielded
120mm Mortar Carrier	\$177,727	D, A	500 kg	12.48 tons	5	7	Passive IR (D, C)	Shielded
82mm Mortar Carrier (Upgraded)	\$186,089	D, A	500 kg	12.48 tons	4	9	Passive IR (D, C)	Shielded
120mm Mortar Carrier (Upgraded)	\$211,561	D, A	500 kg	12.58 tons	5	9	Passive IR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
82mm Mortar Carrier	142/100	35/22/4	450	104	Std	T3	HF5 HS2 HR2
120mm Mortar Carrier	141/99	33/21/4	450	105	Std	T3	HF5 HS2 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
82mm Mortar Carrier	None	None	82mm Mortar, NSVT or DShK or Kord or ZU-23	120x82mm, 2000x12.7mm or 1100x23mm
120mm Mortar Carrier	None	None	120mm Mortar, NSVT or DShK or Kord or ZU-23	68x120mm, 2000x12.7mm or 1100x23mm

Motovilikha 2S9 NONA-S Anona

Notes: The Anona (Anemone) is intended for indirect and direct fire support for Airborne, Air Assault, and Naval Infantry; it was first seen by the West in 1985. NONA-S is the name of the turret and mortar system; the entire vehicle together is the 2S9 Anona. The 2S9 is primarily in use by former Soviet Republic and Russia; few of the Afghani Anonas are still functional. (Right now, the international arms market is saturated with turreted mortar vehicles; sales of them are difficult.) The Anona's parent chassis is the BTR-D, and it shares many of the characteristics of that vehicle. Motovilikha has indicated they are able to mate the turret to many other AFVs, though only this vehicle and the 2S23 actually use these turrets. A modified form of the turret on the 2S9 is mounted on the BTR-80-based 2S23 mortar vehicle; the two turrets primarily in the fit of the turret to each vehicle.

The Anona is essentially a BTR-D airborne combat vehicle topped with a large turret mounting a 120mm breech-loading mortar. The traverse of the turret is limited to 35 degrees left or right of center and the mortar may be fired in direct fire or indirect fire modes, though the sights and computers/software are more suited for indirect fire roles. The driver is in the front center of the vehicle with the commander to his left. The turret has a hatch for the gunner; this hatch sometimes has a weapon mount, but this is a rare modification. The gunner and loader can use the loader's hatch. The interior is almost painfully cramped; in addition, ammunition storage is quite small, and the Anona absolutely relies upon support vehicles to conduct anything more than a small bombardment. The Anona is reloaded from the ground or a support vehicle through a small spring-loaded hatch behind the turret, and the Anona carries a conveyor system which can be set up to quickly replenish the Anona's ammunition supply or keep up a sustained bombardment. Once emplaced, the vehicle can fire at 6-8 rounds per minute, but with few electronic or mechanical aids, getting into or out of action takes 30 seconds with a trained crew. The Anona uses a medium-length barreled breech-loaded mortar which is manually-fed, and uses rounds designed specifically for the 2A60 gun/mortar. When firing, the Anona's suspension is raised to its highest level to provide a more stable firing platform.

The crew is protected by an NBC overpressure system with a collective NBC backup. The driver is in the center front hull, with the engine in the rear. The Anona does not have all the machineguns of the BTR-D, but it does retain most of the BTR-D's mechanical attributes. Night vision is provided for everyone except the loader. The engine is 270-horsepower 5D-20 diesel engine, giving the Anona good power for its light weight; the transmission is manual. Armor protection is surprisingly good given the light weight; however, since the base chassis is a BTR-D, the Soviets used magnesium alloy for the armor, which could go up like a Roman candle when hit. The suspension is the same as on the BTR-D; it is a variable-height hydropneumatic suspension that allows the Anona 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 Anona 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.

Twilight 2000 Notes: Small quantities of the Anona were also sold to Vietnam, North Korea, Myanmar, and Iran in the years before the Twilight War.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$320,359	D, A	750 kg	8.7 tons	4	7	Passive IR (D, G), Image Intensification (G, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
192/135	47/29/6	300	116	Trtd	T4	HF8 HS4 HR4 TF4 TS4 TS4

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	120mm 2A60 gun/mortar	25x120mm

Motovilikha 2S23 NONA-SVK

Notes: The 2S23 is a turret almost identical to that of the 2S9, but placed on chassis of the BTR-80 wheeled APC instead. The 2S23 was first revealed in international arms shows near the end of the Cold War in 1990. The 2S23 is meant to be a battalion-level asset in both wheeled and track-mobile formations. The turret of the 2S23 is updated from that of the 2S9, and it is a somewhat more capable vehicle for both direct and indirect fires. However, the Russians, who are undertaking production at a low rate, primarily assign their 2S23s to Air Assault formations, and they are also capable of being airdropped. The Chinese have also taken delivery of

a number of 2S23 (NONA-SVK) turrets, mounting them on variants of their own vehicles. The Russians have had the 2S23 in service since 1990; the Chinese were taking deliveries of NONA-SVK turrets in 2010. The Venezuelans are also in the process of receiving a force of 2S23s, and these have a number of extra features over a standard 2S23. The future of the 2S23 may be in doubt, however, as there is presently a glut of such mortar vehicles.

The NONA-SVK turret is not a heavy turret as turrets go, nor are the internal modifications necessary for its use, and the resulting 2S23 is not greatly heavier than the base BTR-80. Equipped with a 2A60 gun/mortar, the 2S23 is capable of both direct and indirect fire. The 2S23 has more advanced fire control for both direct fire and indirect fire roles. The gun is capable of firing any of its rounds in direct fire, to provide quick cracking of strongpoints or other targets. The rounds used by the 2S23 are generally designed for use with the NONA-SVK gun, but Western 120mm mortar ammunition can also be fired if they can be fired from a rifled tube. The NONA-SVK, like the NONA-S of the 2S9, does not carry a large onboard amount of ammunition, and is dependent upon ammo support vehicles for most purposes. Replenishing the 2S23 goes through a small, spring-loaded hatch directly behind the turret; the 2S23 carries a conveyer system to allow it to feed from a ground pile of a vehicle (though troops must put the rounds on the conveyer manually). The 2S23 has a semiautomatic autoloader; the autoloader delivers the rounds to a forward chute end, which must then be manually loaded into the breech-loading NONA-SVK. The 2S23 has somewhat better electronics and sighting gear, including a mortar ballistic computer, equipment to receive (and send, if necessary) encrypted positional and enemy position data, as well as general firing and movement commands. Maps are handled through a mapping computer that can keep track of where the vehicle is (using a minor variant of inertial navigation).

Unlike the 2S9, the commander has a cupola which mounts a light machinegun, though the machinegun cannot be aimed and fired when buttoned up. The other crewmembers have no way to provide fire except by popping up with their assault rifles from two rear deck hatches. Firing ports are removed, as are the left and right hatches. The 2S23 has the same laser-detection and defense gear; the smoke grenade launchers, however, are in an unusual position, being on the right side of the turret roof with two clusters of four as well as a line of four underneath those two clusters. The windows and windshields, as well as vision blocks, are twice as strong as normal, being equivalent to the AV of the part of the in question. The armor is a little heavier, especially in the floor, which is reinforced against mines and the wheels and suspension, which are likewise strengthened. The front of the vehicle has spaced armor, and the nose is a little longer as a result. Perhaps the greatest change is in the powerplant; the 2S23 is powered by a single KamAZ-7403 260-horsepower turbocharged diesel engine, which, though the 2S23 has a manual transmission, greatly decreases the difficulty of the driver's task as well as greatly simplifying the transmission and drive train, and increasing reliability. Suspension is 8x8 and of the off-road-type, with run-flat tires. The 2S23 is amphibious with preparation; when floating, a waterjet at the rear is turned on, though it is a bit more dangerous than swimming a BTR-80 due to the greater weight and higher center of gravity. The BTR-80 has an NBC overpressure system with collective NBC backup, and radiological shielding. The BTR-80 has a winch in the front with a capacity of 4.5 tons and 60 meters of cable.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$417,721	D, A	586 kg	14.5 tons	4	5	Passive IR (D, G), Image Intensification (G, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
136/68	32/16/4	300	145	Trtd	W(4)	TF9Sp TS5 TR4 HF6Sp HS4 HR3

Fire Control	Stabilization	Armament	Ammunition
Fair	+2	120mm 2A60 gun/mortar, PKT (C)	30x120mm, 2000x7.62mm

*Floor Armor for the 2S23 is 4.

Motovilikha 2S31 Vena

Notes: This is a 120mm mortar/howitzer vehicle based on the BMP-3C chassis. (Motovilikha states that it is capable of mating the Vena's turret to a wide variety of other vehicles, but so far they have shown the Vena system only with a BMP-3 chassis.) The Vena is currently offered both for domestic military use and for export, though the Russian and Ukrainian Armies have only bought enough for field testing as of March 2013, and the few export sales have been similarly small.

The Vena fires mortar ammunition of either Bloc or NATO-compatible types; the gun fires new ammunition as well as the ammunition of the 2S9 and 2S23 and ammunition of Western make. The Vena's mortar/howitzer is unusual for its type in that it is equipped with a fume evacuator. The standard turret of the BMP-3 is removed and replaced with a much larger one mounting the mortar/howitzer. The vehicle has an automatic survey and orientation system, and the vehicle can fire accurately without input from an FDC if the target location is known, within 7 minutes of a halt. The Vena also has a GPS with inertial navigation backup as well as a mapping computer. Once the coordinates of the target are inputted, the vehicle's weapon automatically lays itself on target, waiting for a fire command. Modes of fire such as traversing fire or bracketing may also be inputted into the fire control computer, with the mortar/howitzer relaying itself between shots. The vehicle is equipped with all the sensors of the BMP-3 and uses them for direct fire purposes. The Vena also has a laser detection system that automatically launches smoke grenades in the direction of the enemy laser; there are clusters of six smoke grenade launchers on the left and right front of the turret for this purpose and for general

screening. The commander's machinegun may be aimed and fired from under armor. It should be noted that the Vena does have an autoloader, though only one type of ammunition (HE, WP) can be hooked up to the autoloader at any one time. The Vena does not have the bow machineguns of the BMP-3.

The roof hatches have been removed, and the rear hatches are replaced with a single downward-opening hatch on the left rear. There is also a hatch in the rear of the turret for ammunition loading, and a commander's cupola on the right side of the turret. The cupola gives the commander 360-degree vision blocks as well as one in the center front which has a wide-angle view and has an independent image intensifier and IR viewer. The gunner and loader use the commander's hatch or the rear hatch to enter and exit the Vena. The Vena has an NBC overpressure system with a collective NBC backup, and also has an air conditioner and heater. The standard ventilation system also filters out particles like dust and smoke. The driver of the Vena 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. The engine of the Vena is a 500-horsepower UTD-29M turbocharged diesel. Each roadwheel on the Vena has separate hydropneumatic suspension elements, giving the Vena a ride that is remarkably smooth compared to most Russian tracked vehicles. The Vena 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. The Vena shares the BMP-3's lack of freeboard when swimming, as well as the lack of maneuverability while swimming. The long barrel of the mortar/howitzer simply makes this worse, as it tends to cause the Vena to tip forward. The Vena can employ the Drozd, Shtora-1, or Arena APS, as well as appliqué armor or ERA. The Vena also has the luxury in a combat zone of a chemical toilet inside the vehicle, something normally found only in high-level command vehicles.

Twilight 2000 Notes: This vehicle does not exist.

Merc 2000 Notes: This vehicle did not fare well in the budget-conscious Merc 2000 Russia.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$640,776	D, G, AvG, A	800 kg	19.5 tons	4	12	Passive IR (D, G, C), Image Intensification (G, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor**
158/112	39/24/6	690	259	Trtd	T3	TF11 TS4 TR4 HF8 HS4 HR4

Fire Control*	Stabilization	Armament	Ammunition
+2	Fair	120mm 2A80 Mortar/Howitzer, PKT (C)	80x120mm, 1000x7.62mm

*Belly armor for the Vena is 6.

Uraltransmash SM-240 (2S4) Tyul'pan

Notes: These heavy self-propelled mortars have been in service with the Russian Army since 1975, and later with Iraq and Lebanon. The Czechs used them until 1991, when they retired them; in most cases, their 2S4s were scrapped. After the invasion of Iraq and before that, the 1991 Gulf War, all Iraqi 2S4s have been destroyed and/or scrapped. The Syrians received possibly as many as 64 of these mega-mortars, and have been using them lately on the populace in their terror campaign/civil war. The Russians still have them in active service, but expect to retire them by 2016. The simple fact is that the 2S4s glacial rate of fire (1 round per minute, corresponding to 1 round per *twelve* phases in T2K v2.2), and the relative level of warhead power it can bring to the fight (modern mobile 120mm mortars can produce as much fire power due to their much higher rates of fire), and its lack of mobility, mean that the 2S4 is out of date. The 2S4's only real capability that the other mortars don't have is the dubious capability to fire a small tactical nuclear weapon (I've heard ranges from 0.1 kT to 10 kT). The capability of firing a nuclear warhead is the primary reason that the 2S4 is regimental and higher command asset; a sergeant on a Russian equivalent of a FIST team can't expect to receive fire support from a 2S4. When first seen by the West, it was given the NATO designation of M-1975 (at the 2S7 Pion were also given the designation M-1975 at about the same time, the 2S4 was changed to SM-240).

The chassis is a modified version of the chassis used for the SA-4 SAM and the 2S3 howitzer. The driver is seated to the front left, the driver in front and commander behind him in a cupola with a light machinegun. As a 2S4 crew does not normally expect enemy ground attack (as they are far from the front and are a part of a unit that includes plenty of supporting troops), machinegun ammunition is lacking. The two other crewmen are seated in the rear. (Five other crewmen are transported in another vehicle, usually an MT-LB configured to carry ammunition.) The 2S4 commander has no night vision except for a pair of goggles, but he does have an IR searchlight. Both positions have all-around vision blocks. The 2B8 mortar is carried over the deck of the vehicle when traveling and is lowered to the rear before firing (getting a SB8 mortar into action can take as much as 10 minutes, and out of action again as much as 15). The mortar is breech-loaded from two 20-round magazines by an automatic loader.

The mortar component of the 2S4 is the 2B8 240mm mortar, with a length of 27 calibers. That is so large that it must be carried folded and lowered over the top of the vehicle, and raised to firing position. Then the magazines must be rotated into position (provided that they are loaded; reloading an empty 2B8 magazine can take 15 minutes with an experience, trained crew). Few warheads have been designed for the 2B8, and they are essentially sledgehammers, HE-FRAG shells and HE-FRAG-RAP rounds, or large chemical shells. (The other possible round is, as mentioned, a Nuclear round of various yields.) The 2B8 can also fire the Smel'chak GAMP using a specially-designed sabot. The 2B8 has elevation ranges from +50 to +80, with a traverse of 10 degrees left or right.

Twilight 2000 Notes: The Soviets maintained their inventory of 2S4s as much as possible; though the 2B8 has its limitations, the 2S4 is easy to build. However Soviet production, as well as the mortars themselves, were targeted early on for NATO airstrikes, usually by stealth aircraft. Most Iraqi 2S4s were destroyed by special operations units, often by the simple expedient of firing .50 caliber sniper rifles several times through the barrels, magazines, and breeches. Lebanese 2S4s typically suffered from attrition due to lack of care. The Czech continued with their retirement plans and started the war without any Czech 2S4s.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$935,516	D, A	500 kg	27.5 tons	4 (+5)	24	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
106/64	27/16	850	233	Std	T6	HF6 HS3 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	240mm 2B8 mortar, PK (C)	40x240mm, 1500x7.62mm

Kader Al-Fahd Mortar Carrier

Notes: This version of the Al-Fahd is a mortar carrier topped by a turret containing a 120mm breechloaded mortar. Though the Saudis have built quite a few of these mortar vehicle versions, they have now essentially stopped production of them, in order to provide as many APCs, IFVs, and Command Vehicle variants as possible. The LAV II-based AMS is now the primary turreted mortar in Saudi service.

This vehicle is a variant of the basic Al-Fahd APC. Essentially, the turret is similar to those built for various LAV II and LAV III vehicles as mock-ups. The interior is, as most such vehicles, full mostly of ammunition and an autoloader for the mortar. The gun is fed by an autoloader, but any special rounds or types of rounds out of sequence require the autoloader to be stopped and the special round to be loaded by hand. This can require good timing during a long bombardment. The Mortar Carrier is fully equipped for its mortar mission, including automatic survey and virtual aiming stakes. A mortar ballistic computer provided, along with GPS and a computer which can be used as a map box and to provide blue force and red force information. For direct fire necessities, the Mortar Carrier has a fire control computer, a laser rangefinder, and stabilization for the mortar. On the rear deck of the mortar is a small hatch to load rounds and equipment or discard items; however, the primary loading and unloading is anticipated to be done by the rear ramp. On each side of the turret are a cluster of four smoke grenade launchers.

The driver is in the front of the hull; the driver has a night vision block in addition to his conventional vision blocks. The hatch may be locked partially open (so it are elevated straight out from the hull), or locked open completely. The engine is at the center, behind the driver. Though firing ports can be fitted, there are none on the Saudi National Guard version. The normal commander's station on the right front of the hull is deleted, and replaced with additional storage for equipment and ammunition. The commander is in the turret, along with the gunner, with the two loaders in the hull behind/in the turret as necessary. The commander's cupola has all-around vision blocks, and is manually rotatable (rather like an M-113's cupola), as well as a separate night vision device (integrated with a wide-angle vision block) and a reticle rangefinder.

The Mortar Carrier has a Deutz 10 400-horsepower diesel. The transmission is automatic, and driver's controls conventional. The suspension is 8x8 and of the off-road-type, with the drive being switchable to 8x4 for road use (the four middle wheels being the drive wheels in this case). The front four wheels are independently steerable from the rear four vehicles, giving the Mortar Carrier a tight turning radius. The suspension incorporates conventional hydraulic shock absorbers along with a nitrogen gas spring system which gives the AF-40-8-1 a very smooth ride. The nitrogen gas spring system automatically adjusts to smooth out recoil when weapons are being fired, especially when they are fired on the move. The Mortar Carrier has an automatic fire detection and suppression system. Armor is of aluminum (and quite decent); lugs for ERA are optional, but not standard. Also not standard is amphibious capability though it is available; in addition, the Mortar Carrier has the capability of mounting virtually any form of appliqué armor. The vehicle has NBC overpressure with a collective NBC backup, and air conditioning.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$629,642	D, A	800 kg	15.51 tons	5	13	Passive IR (D,G,C), Thermal Imaging (G), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
195/94	43/22/4	550	235	Trtd	W(6)	TF10Sp TS6Sp TR4 HF12Sp HS5Sp HR3

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	120mm Lockheed/Soltam Cardom Gun/Mortar, MAG, MAG (C)	60x120mm, 2150x7.62mm

*The Fire Control bonus for the commander's machinegun is +1, while the Stabilization is basic.

Kader/GDLS Armored Mortar System (AMS)/LAV

Notes: The AMV is a vehicle with the same chassis as the LAV-25/LAV II and the same turret as that of the Al-Fahd Mortar carrier. The AMS has increased greatly in number in the Saudi National Guard; the Saudis decided to use their Al-Fahds for other purposes, and it was also felt that a mortar vehicle did not need to be protected or as large as the Al-Fahd. The idea was, in essence, that a mortar vehicle would be behind the main fighting forces and not as subject to direct combat as other vehicles. So far, only the Saudis use the AMS; they are being made in Canada to Saudi specifications.

As the AMS has virtually the same turret as the Al-Fahd Mortar carrier, it shares the same features in the turret as that vehicle. The turret also incorporates an attitude sensor to detect vehicle cant when firing. The interior is, as most such vehicles, full mostly of ammunition and an autoloader for the mortar. The gun is fed by an autoloader, but any special rounds or types of rounds out of sequence require the autoloader to be stopped and the special round to be loaded by hand. This can require good timing during a long bombardment. The Mortar Carrier is fully equipped for its mortar mission, including automatic survey and virtual aiming stakes. A mortar ballistic computer provided, along with GPS (along with an inertial navigation backup) and a computer which can be used as

a map box and to provide blue force and red force information. For direct fire necessities, the Mortar Carrier has a fire control computer, a laser rangefinder, and stabilization for the mortar. On the rear deck of the mortar is a small hatch to load rounds and equipment or discard items; however, the primary loading and unloading is anticipated to be done by the rear ramp. On each side of the turret are a cluster of four smoke grenade launchers. The commander and gunner have hatches on the turret roof, The commander's cupola has all-around vision blocks, and is manually rotatable (rather like an M-113's cupola), as well as a separate night vision device (integrated with a wide-angle vision block) and a reticle rangefinder.

The driver is in the front of the hull; the driver has a night vision block in addition to his conventional vision blocks. The hatch may be locked partially open (so it are elevated straight out from the hull), or locked open completely. The engine is at the center, behind the driver. Though firing ports can be fitted, there are none on the Saudi National Guard version. The normal commander's station on the right front of the hull is deleted, and replaced with additional storage for equipment and ammunition. The commander is in the turret, along with the gunner, with the two loaders in the hull behind/in the turret as necessary. The commander's cupola has all-around vision blocks, and is manually rotatable (rather like an M-113's cupola), as well as a separate night vision device (integrated with a wide-angle vision block) and a reticle rangefinder. Unlike the LAV-25, the AMS has full overpressure with a vehicular NBC system for backup.

The LAV II hull has an 8x8 suspension with front and rear sets of wheels with independent steering, giving the LAV-25 a surprisingly small turning radius. For standard road use, the LAV-25 normally uses only the four rear wheels as drive wheels, switching to 8-wheel drive off road. The LAV-25 is amphibious with a minimum of preparation (about 2 minutes), and is propelled in the water by propellers and steered by rudders. Power is provided by the standard LAV II engine, the Detroit Diesel 6V53T 275-horsepower turbocharged diesel. This is coupled to an automatic transmission and the driver has a conventional drive control setup. The rear ramp is retained, and is used not only for crew entry and exit, but for ammunition replenishment. A small hatch on the roof can be used to fight from or to load gear, or to replenish ammunition more directly. The AMS can take virtually form of appliqué and reactive armor.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$519,020	D, A	400 kg	14 tons	3	13	Passive IR (D,G,C), Thermal Imaging (G), Image Intensification (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
176/106	38/22/4	300	190	Trtd	W(6)	TF10Sp TS6Sp TR4 HF6 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	120mm Lockheed/Soltam Cardom gun/mortar, MAG, MAG (C)	50x120mm, 1620x7.62mm

*The Fire Control bonus for the commander's machinegun is +1, while the Stabilization is basic.

Casspir Mortar Carrier

Notes: As it sounds, this is a version of the Casspir APC carrying an 81mm mortar and its crew and ammunition. The Casspir Mortar Carrier has the same level of mine protection as the APC version. This vehicle has no overhead protection for the fighting compartment.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$97,953	D, A	750 kg	11.04 tons	5	4	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
145/87	33/20	220	62	Std	W(3)	HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm mortar, SS-77 (C)	192x81mm, 1000x7.62mm

Ratel Mortar Carrier

Notes: The Ratel mortar carrier has its turret removed, and instead has a cupola to the rear of the driver which has a machinegun mount. The mortar is on a turntable which may be rotated a full 360 degrees, and fires through a two part hatch. This mortar carrier version has only two firing ports. The mortar carrier has its own fire-direction computer with a GPS system that allows the vehicle to "shoot-and-scoot." The first projectile can be fired within 10 seconds of a halt.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
81mm	\$119,077	D, A	300 kg	16.6 tons	4	6	Passive IR	Enclosed
120mm	\$127,914	D, A	300 kg	16.8 tons	6	6	Passive IR	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
81mm	113/68	30/17	430	79	Std	W(6)	HF11 HS6 HR4
120mm	113/68	30/17	430	79	Std	W(6)	HF11 HS6 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
81mm	None	None	81mm mortar, MAG (C)	150x81mm, 2000x7.62mm
120mm	None	None	120mm Mortar, MAG (C)	46x120mm, 2000x7.62mm

Daewoo (Doosan) KIFV Mortar Carrier

Notes: Like the KIFV, these two mortar carriers are related to the European AIFV and have the same chassis and hull as the KIFV. Though the AIFV does have mortar-carrier variants, the South Koreans started from scratch with their KIFV-based mortar carriers; however, they ended up about the same in design. So far, no overseas of the KIFV mortar carriers have been made nor offered. The KIFV mortar carriers are based on the latest A1 build. As with most such vehicles, the fighting compartment is quite cramped, taken up mostly with the mortar and its rounds.

The K-242A1 is a carrier for a heavy mortar based on the KIFV chassis. In this version, the passenger compartment is taken up by ammunition and an M-30 4.2" mortar, and the turret is deleted. There is a large, three-part hatch over the mortar compartment, similar to that on the US M-106A2; the left hatch folds in half instead of opening completely. The firing ports are retained, though the two in the sides are moved forward from their normal positions so the crew does not have to fight while twisting around the mortar or staying out of its way. The vehicle has a machinegun mount for local and anti-aircraft protection. A bipod, bridge, and baseplate are carried to allow the mortar to be deployed away from the vehicle. The vehicle is equipped with an MBC as well as a mapping computer and inertial navigation; legacy equipment is provided to use if the MBC and mapping/coordinate computer is not working up to snuff. (Under normal circumstances, a KIFV mortar carrier can operate as its own FDC, though Korean doctrine is to have an FDC with a mortar battery.)

In recent years, the K-242A1 has its mortar replaced with the US-built M-120 mortar, the resulting vehicle designated the K-220A1.

The K-281A1 is a variant of the KIFV, carrying an 81mm mortar in the back along with ammunition. A bipod and baseplate is carried to allow the mortar to be operated away from the vehicle. The turret is deleted, but the firing ports are retained. There is a large, three-part hatch over the rear compartment to allow the mortar to be fired. This vehicle is similar to the K-242A1, but uses an 81mm mortar, and is rather less common than that vehicle. Most of the details of the K-281A1 are the same as on the M-242A1, with the computers modified for use with the 81mm mortar.

The KIFV mortar carrier's gunner's cupola is the same as that mounted on the standard KIFV, though it is mounted a little forward from the position on the KIFV. 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 cupola hatch is specially reinforced and the gunner has an effective AV of 2 from the rear. To the right of the gunner is the commander's hatch; it does not have a cupola, though it has all-around vision blocks around his hatch. To the commander's front is the driver, with vision blocks to his front and right side and a hatch which has a special spring-loaded hinge opening that allows the driver to mount a night vision device. The mortar carriers are 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.

Bring based on the A1 upgrade, KIFV mortar carriers have the engine, transmission, armor, and suspension upgrades of that version of the KIFV. The engine is a D-2848T 350-horsepower turbodiesel design, though it can also run off of JP8 (primarily for interoperating with US forces. design licensed from MAN for production by Daewoo. The transmission is an Allison X200-5K automatic transmission, which was produced by Daewoo (and later Doosan) under license.

Twilight 2000 Notes: In the T2K timeline, most South Korean units are still equipped with American-made or license-produced versions of standard US-built mortar carriers. Perhaps one-fourth of Korean mortar units are KIFV-based. The M-220A1 does not exist in the Twilight 2000 timeline. South Korean vehicles are largely running on diesel, though a few (such as their jeeps) are running on gas.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
K-242A1	\$318,153	D, A, JP8	300 kg	13.83 tons	4	8	Passive IR (D)	Shielded
K-281A1	\$281,918	D, A, JP8	350 kg	12.93 tons	4	8	Passive IR (D)	Shielded
K-220A1	\$387,178	D, A, JP8	350 kg	13.38 tons	4		Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
K-242A1	210/147	52/31/6	400	164	Std	T3	HF11 HS7Sp HR4
K-281A1	225/157	56/38/6	400	153	Std	T3	HF11 HS7Sp HR4
K-220A1	217/151	54/32/6	400	158	Std	T3	HF11 HS7Sp HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
K-242A1	None	None	M-30 4.2" mortar, M-2HB (C)	88x4.2", 1000x.50
K-281A1	None	None	81mm M-252 Mortar, M-2HB (C)	114x81mm, 1000x.50
K-220A1	None	None	120mm M-120 Mortar, M-2HB (C)	88x120mm. 1000x.50

Santa Barbara BMR-PM

Notes: The BMR-PM is a mortar-carrier variant of the BMR-600 armored personnel carrier. Externally very similar to the BMR-600 in appearance, the PM is very different internally. The PM comes in two versions, the BMR-PM-81 with an 81mm mortar, and the BMR-PM-120 with a 120mm mortar. Upgraded versions include the BMR-PM81-M1 and the BMR-PM120-M1. The BMR-PM supplements modified M-113s mortar carriers in the Spanish Army. The BMR-600 is also in service with Saudi Arabia, Egypt and Peru; I have not been able to determine whether any of those countries uses the BMR-PM.

In both cases, the BMR-PM is mounted on an integral turntable in the floor of the compartment which fires over the rear and allows a 45-degree traverse in either direction. They fire through large hatches on the rear deck; this replaces hatches that may be on a BMR-600's rear deck. The interior fighting compartment is taken up by the usual mortar and ammunition, along with legacy equipment. Outside, on the sides of the rear hull, are a ground baseplate, bipod, and aiming stakes.

The driver of the BMR-PM is on the front left in a separate cabin which projects forward of the glacis plate. The driver has a large bullet-resistant windshield with armored shutters to his front and smaller windows to each side. The driver has a hatch atop his position, and in this hatch is a port for a night vision block. The commander is directly behind him; he mans an RWS with an M-2HB and has all-around vision blocks. To the rear of this on the deck are two more hatches, opening right and left. At the rear of the troop compartment is a powered ramp with a door in it. There is one firing port on each side of the hull near the front of the fighting compartment, and two in the rear in the ramp. The firing ports allow the crew to fight from the inside. The two other firing ports normally on this chassis are plated over; ammunition storage and radios cover their position.

The BMR-PM uses a Pegaso 9157/8 306-horsepower diesel engine, coupled to an automatic transmission. The BMR-PM has 6x6 drive, and all wheels have independent suspension making it quite adept off-road. The transmission further has a limited-slip differential, and the tires are run-flat. The BMR-PM has a winch at the rear which can be led out the front, and has a 4.5-ton capacity with 50 meters of cable.

The BMR-PM-M1 upgraded version have new Scania DS9 61A 24S 310-horsepower turbocharged diesel engines, which run cleaner and are easier to service, and smaller in size. They are fitted with additional appliqué armor and air conditioning units. They have been made amphibious, and have had waterjets installed at the rear to help in this capacity. The BMR-PM-M1 also has a number of automotive and electrical system upgrades and fixes, and has been equipped with puncture-resistant, run-flat tires. They have a new Dragar-derived one-man turret with heavier armament. Radiation shielding has been fitted. The driver's steering wheel is adjustable for height, and the BMR-PM-M1 has an automatic fire detection and suppression system, as well as self-sealing fuel tanks. Three smoke grenade launchers have been added to either side of the turret. The BMT-PM-M1 is equipped with a GPS/Inertial Navigation/mapping computer cluster, as well as an MBC and a more general use computer used to store target information, positions of friendly and enemy forces as well as target information. Unfortunately, the BMR-PM81-M1 (and the 120-M1) are even more jam-packed than the standard BMR-PM.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BMR-PM81	\$303,041	D, A	500 kg	14.83 tons	5	7	Passive IR (D)	Enclosed
BMR-PM120	\$391,435	D, A	500 kg	15.14 tons	5	11	Passive IR (D)	Enclosed
BMR-PM81-M1	\$1,107,545	D, A	550 kg	16.43 tons	5	12	Passive IR (D, C), Image Intensification (C)	Shielded
BMR-PM120-M1	\$1,108,167	D, A	550 kg	16.49 tons	5	12	Passive IR (D, C), Image Intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
BMR-PM81	167/84	39/19	400	172	CiH	W(4)	TF2 TS2 TR2 HF8 HS4 HR4
BMR-PM120	164/82	37/18	400	175	CiH	W(4)	TF2 TS2 TR2 HF8 HS4 HR4
BMR-PM81-M1	154/80	35/18/4	400	173	Trtd	W(5)	TF4 TS4 TR3 HF10Sp HS6 HR4*
BMR-PM120-M1	152/79	35/18/4	400	174	Trtd	W(5)	TF4 TS4 TR3 HF10Sp HS6 HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BMR-PM81	None	None	81mm EXPAL Model LL Mortar, MG-3 (C) or M-2HB (C)	107x81mm, 1800x7.62mm or 1100x.50
BMR-PM120	None	None	120mm EXPAL M120-15 Mortar, MG-3 (C) or M-2HB (C)	72x120mm, 1800x7.62mm or 1100x.50
BMR-PM81-M1	+2**	None	81mm EXPAL Model LL Mortar,	107x81mm, 375x40mm Grenades,

Spanish Mortar Carriers

BMR-PM120-M1	+2**	None	LAG-40 AGL, MG-3 120mm EXPAL M-120-15 Mortar, LAG-40 AGL, MG-3	2100x7.62mm 72x120mm, 375x40mm Grenades, 2100x7.62mm
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*Roof AV is 3; Floor AV is 4.

*The Fire control bonus does not apply to the mortar.

Hagglunds Bv-206 Mortar Carrier

Notes: The near-ubiquitous Bv-206 light tracked vehicle is built in a bewildering variety of variants, one of which is a mortar carrier for either an 81mm, 4.2", or 120mm mortar. (Note that the M-30 4.2" Mortar is no longer used by any country.) So far, the mortar-carrying variant is used only by Sweden, Britain, and the US (in small numbers), though it is still offered on the international market. These mortar carriers are quite useful by arctic units, regardless of the army involved. Soft-skinned and armored variants (of the Bv-206S version) are offered and used by Sweden and Britain.

Bv-206-based Mortar Carrier

The soft-skinned Bv-206-based version has a front module essentially identical to that of a standard Bv-206, at least externally. The driver remains on the front left side, using conventional foot pedals and a steering wheel. The commander is to the right; he has a hatch over his position with a pintle-mounted weapon. The mortar crew is also in the front module, along with the mortar-specific gear and, if equipped with an MBC, it is kept in the front module as well. Personal gear is also kept in the front, often strapped to the sides or top.

The heavily-modified rear module contains the mortar and its ammunition. The module has special beefed-up suspension and roadwheel elements to take the recoil of the mortar, especially that of the 4.2" or 120mm mortars. The ammunition is also kept in racks on both sides of the mortar. The gunner (normally the vehicle commander) and assistant gunner stand on the mortar platform to fire the mortar; the ammunition bearers normally stand beside the module. The module itself is only about half the height of the front module. Reloading of the ammunition can be done through double doors on each side of the module. Part of the crew's additional small arms ammunition and items like rocket launchers and grenades may also be kept in this rear module. The rear module is otherwise a low metal box with a down-angled section at the front of the module. On each of the front fenders is a cluster of 3 smoke grenade launchers.

Mechanically, the Bv-206 Mortar Carrier follows closely with its Bv-206 counterpart. The suspension is surprisingly good at smoothing out the ride, and the vehicle can traverse deep snow, mud, swamps, and bogs without sinking inordinately. The front section and rear section are connected by two hydraulic cylinders for steering and braking purposes, with an extension of the drive train giving power to the rear section. The engine is under the driver and commander, and is a 134-horsepower Mercedes-Benz OM 603.950 diesel engine. The suspension is fully automatic and has a surprising amount of torque; the Bv-206 Mortar Carrier can actually tow a 1-ton trailer behind its rear module.

Bv-206S-based Mortar Carrier

The BV-206S-based Mortar Carrier is very similar to its Bv-206-based brother, except that the BV-206S Mortar Carrier has light armor protection. 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. 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. 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.

Upgraded Versions

In the late 1980s and early 1990s, the Bv-206 (including the Bv-206S) Mortar Carrier crews were given a Mortar Ballistic Computer (MBC), which calculates mortar coordinates and the required elevation, deflection, and direction that the mortar must fire. This is a large leap in capability (to all vehicles which have an MBC), and the manual equipment is not required (unless it goes down). The vehicles were also given a long-range data-capable radio, which can also wirelessly transmit coordinates of the target to the MBC.

Twilight 2000 Notes: Bv-206S versions are extremely rare; used only by Sweden, only 10% of the Bv-206 Mortar Carrier force are Bv-206S Mortar Carriers. Appliqué armor exists for both versions and is used liberally by the British and Swedish (with the US opting out on the appliqué).

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Bv-206 Mortar Carrier (81mm)	\$188,982	D, A	500 kg	7.14 tons	4	8	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (4.2")	\$198,220	D, A	468 kg	7.46 tons	5	8	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (120mm)	\$203,475	D, A	458 kg	7.48 tons	5	8	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (81mm w/Appliqué)	\$189,559	D, A	366 kg	7.68 tons	4	8	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (4.2" w/Appliqué)	\$198,797	D, A	334 kg	8 tons	5	8	Passive IR (D)	Shielded

Swedish Mortar Carriers

Bv-206 Mortar Carrier (120mm, Appliqué)	\$204,052	D, A	324 kg	8.02 tons	5	8	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (81mm) w/MBC	\$250,150	D, A	500 kg	7.14 tons	4	10	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (4.2") w/MBC	\$259,388	D, A	468 kg	7.46 tons	5	10	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (120mm) w/MBC	\$264,640	D, A	458 kg	7.48 tons	5	10	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (81mm w/MBC w/Appliqué)	\$250,724	D, A	366 kg	7.68 tons	4	10	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (4.2" w/Appliqué) w/MBC	\$259,962	D, A	334 kg	8 tons	5	10	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (120mm, Appliqué) w/MBC	\$265,217	D, A	324 kg	8.02 tons	5	10	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (81mm)	\$94,167	D, A	503 kg	7.36 tons	4	8	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (4.2")	\$203,374	D, A	471 kg	7.69 tons	5	8	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (120mm)	\$209,129	D, A	470 kg	7.71 tons	5	9	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (81mm w/Appliqué)	\$190,790	D, A	475 kg	8.16 tons	4	9	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (4.2" w/Appliqué)	\$204,528	D, A	455 kg	8.53 tons	5	9	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (120mm, Appliqué)	\$210,283	D, A	454 kg	8.56 tons	5	9	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (81mm) w/MBC	\$155,335	D, A	503 kg	7.36 tons	4	10	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (4.2") w/MBC	\$264,542	D, A	471 kg	7.69 tons	5	10	Passive IR (D)	Shielded
Bv-206S Mortar Carrier w/MBC (120mm)	\$270,297	D, A	470 kg	7.71 tons	5	11	Passive IR (D)	Shielded
Bv-206 Mortar Carrier (81mm w/MBC w/Appliqué)	\$251,958	D, A	366 kg	7.68 tons	4	11	Passive IR (D)	Shielded
Bv-206S Mortar Carrier (4.2" w/Appliqué,	\$265,696	D, A	455 kg	8.53 tons	5	11	Passive IR (D)	Shielded

w/Appliqué) Bv-206S Mortar Carrier (120mm, Appliqué, MBC)	\$271,451	D, A	454 kg	8.56 tons	5	11	Passive IR (D)	Shielded
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Bv-206 Mortar Carrier (81mm)	126/72	32/16/2	285	53	Std	T2	HF1 HS1 HR1
Bv-206 Mortar Carrier (4.2")	121/69	31/15/2	285	55	Std	T2	HF1 HS1 HR1
Bv-206 Mortar Carrier (120mm)	121/69	31/15/2	285	55	Std	T2	HF1 HS1 HR1
Bv-206 Mortar Carrier (81mm w/Appliqué)	117/67	30/15/2	285	57	Std	T2	HF2 HS2 HR2*
Bv-206 Mortar Carrier (4.2" w/Appliqué)	113/64	39/14/2	285	59	Std	T2	HF2 HS2 HR2*
Bv-206 Mortar Carrier (120mm, Appliqué)	113/64	39/14/2	285	59	Std	T2	HF2 HS2 HR2*
Bv-206S Mortar Carrier (81mm)	162/113	40/15/2	285	75	Std	T2	HF3 HS2 HR2
Bv-206S Mortar Carrier (4.2")	155/108	38/14/2	285	78	Std	T2	HF3 HS2 HR2
Bv-206S Mortar Carrier (120mm)	155/108	38/14/2	285	78	Std	T2	HF3 HS2 HR2
Bv-206 Mortar Carrier (81mm w/Appliqué)	153/107	38/14/2	285	80	Std	T2	HF5 HS3 HR2**
Bv-206 Mortar Carrier (4.2" w/Appliqué)	146/102	36/13/2	285	84	Std	T2	HF5 HS3 HR2**
Bv-206S Mortar Carrier (120mm, w/Appliqué)	146/102	36/13/2	285	84	Std	T2	HF5 HS3 HR2**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Bv-206 Mortar Carrier (81mm)	None	None	81mm L-16 Mortar, MAG (C)	100x81mm, 2000x7.62mm
Bv-206 Mortar Carrier (4.2")	None	None	M-30 4.2" Mortar, MAG (C)	60x4.2", 2000x7.62mm
Bv-206 Mortar Carrier (120mm)	None	None	m/41 120mm Mortar, MAG (C)	50x120mm, 2000x7.62mm

*While the appliqué armor for this version gives a hull floor AV of 2, the hull deck armor is not part of the appliqué armor package and is only 1.

**The appliqué armor package for this version gives a floor AV of 4 and a deck AV of 2.

Hagglunds CV-90 AMOS (Grkbv)

Notes: Based on the chassis of the CV-9040 IFV, the CV-90 AMOS is heavily modified from the base vehicle for its role. The most obvious modification is the replacement of the CV-9040 turret with the AMOS turret armed with twin 120mm AMOS mortars. Internally, the modifications are even heavier to accommodate the new turret, the ammunition racks, and the entire AMOS system. Though the CV-90 AMOS is not used outside of Sweden, the AMOS turret is a big seller worldwide, and has been adapted to a number of chassis by different countries.

As with other mortar vehicles that use the AMOS turret (or its single-barreled cousin, the NEMO turret), the CV-90 AMOS chassis and turret are essentially containers for the high-tech AMOS mortar system. The barrels are long enough to make one wonder if they are short-barreled howitzers at first glance, and the AMOS turret is much larger than the CV-9040 IFV's turret. The mortars can fire any sort of Western 120mm mortar rounds (as of the time of this writing in mid-May 2013), including the most up-to-date smart rounds and some decidedly low-tech rounds (with varying performance, of course; most countries are not going to waste their high-tech AMOS mortars by shooting ammunition from the 1960s). The AMOS turret is so large that it almost appears to be too large for the CV-90 chassis. Though the mortars have no stabilization system, they can be fired in direct fire mode with high accuracy from a halt or slow move, and thus the CV-90 AMOS can have a viable antivehicle role as well as operating in direct fire support of friendly units. (New rounds were developed by several ammunition manufacturers to take advantage of this capability.) The AMOS system is known for its comprehensive fire control system in both indirect and direct fire modes, including the ability to generate its own fire

missions with the proper information. The system is highly computer-controlled/assisted, including GPS navigation and plotting with inertial/computer backup, an enhanced MBC, mapping computer, and mission generator computer.

The chassis, therefore, exists to move the mortar system. The turret mounts the firepower part of the system, including the mortars, the commander and gunner, and most of the fire control equipment and fire control system. The commander and gunner have hatches on the roof of the turret, though they are not typically armed positions. The commander, however, has a cupola with a night vision front block as well as all-around vision blocks. The night vision block for the commander uses a channel from the gunner's equipment, but in most cases, the commander can fire the mortars and coaxial machinegun from his position. Inside, the fighting compartment is virtually chock-full of the ammunition racks and the feed chutes and loading systems for regular rounds and special-use rounds (or rounds that cannot use the autoloading system). The rear door remains, but is used primarily for reloading rounds from a ground pile of support vehicle. The driver remains in the same place as in the CV-9040 chassis, on the front left; the position is basically identical to the CV-90 driver's position, with three vision blocks to the front, one of which may be removed and replaced with a night vision block. The driver has a conventional steering yoke with a gas and brake pedal. The CV-90 AMOS has heating and air conditioning systems for crew comfort, as well as an NBC overpressure system with a collective NBC backup system. The gunner has the full benefits of his and the vehicle's sensors, and has use of a variety of night vision, telescopic, direct fire and indirect fire sights and fire control systems. Older CV-90 AMOSs have a cluster of three smoke grenade launchers on either side of the turret; newer ones have four or five in a cluster.

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.

Though I have not been find any information about this, there is no reason that the CV-90 AMOS could receive most of the upgrades that the CV-9040 received. I have included these below in the next block.

Hypothetical CV-90 AMOS with CV-9040 Upgrades

These are termed hypothetical since I have never heard of the CV-9040 upgrades being applied to the CV-90 AMOS. I should be noted that the designations I use here are made up by me for clarity and convenience in referring to them, and *are not real designations*.

The first of these upgrades gave the CV-90 AMOS 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 coaxial machinegun, and mortars stabilized in one plane for direct fire purposes only. A US-designed FLIR system was also fitted, again applicable to the mortar direct fire and coaxial machinegun sights, though the commander can tap into the FLIR. The thermal imager was also shifted to the commander. A laser warning system was added to the defensive suite. I have designated this version the CV-90B AMOS. Some CV-90 AMOSs were equipped with a battlefield management system, though the resulting vehicle was still called the CV-90B AMOS.

The upgrades which produce what I have designated the CV-90C AMOS 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).

Of course, the MEXAS ceramic spaced armor package, as well as any number of appliqué passive armor plates, can be applied. Versions of the CV-90 AMOS with MEXAS are designated C-90D AMOS below; with appliqué passive armor plates, it is designated CV-90 AMOS w/Appliqué.

Twilight 2000 Notes: Sweden and Norway were the only countries to field the CV-90 series in the Twilight War. Most of Sweden and Norway's CV-90 AMOS fleet, 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. Use the CV-90 AMOS w/Appliqué to simulate the version of the CV-90 AMOS used during the Twilight War.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
CV-90 AMOS	\$2,777,765	D, A	400 kg	26 tons	4	20	Passive IR (D, G, C), Thermal Imaging (G), Image Intensification (G)	Shielded
CV-90 AMOS w/Appliqué	\$2,784,002	D, A	400 kg	27.7 tons	4	20	Passive IR (D, G, C), Thermal Imaging (G), Image Intensification (G)	Shielded
CV-90B AMOS	\$2,887,877	D, A	666 kg	26 tons	4	24	Passive IR (D, G, C), Image Intensification (G), FLIR (G), Thermal	Shielded

Vehicle	Price	Com	Arm	Weight	Capacity	Count	Range	Capabilities	Protection
CV-90B AMOS w/BMS	\$3,061,328	D, A	A	666 kg	26.1 tons	4	22	Imaging (C) Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Shielded
CV-90B AMOS	\$2,894,114	D, A	A	604 kg	27.7 tons	4	20	Passive IR (D, G, C), Image Intensification (G), FLIR (G), Thermal Imaging (C)	Shielded
w/Appiqué CV-90B AMOS	\$3,067,565	D, A	A	604 kg	27.8 tons	4	24	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Shielded
w/Appiqué & BMS CV-90C AMOS	\$2,859,778	D, A	A	541 kg	29 tons	4	26	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Shielded
CV-90C AMOS w/BMS	\$3,033,229	D, A	A	541 kg	29.1 tons	4	26	Passive IR (D, G, C), Image Intensification (G, C), FLIR (G), Thermal Imaging (C)	Shielded
C-90D AMOS	\$2,786,511	D, A	A	300 kg	28.4 tons	4	24	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-90 AMOS	124/86	22/18	525	283	Trtd	T4	TF7 TS4 TR4 HF18 HS7 HR4
CV-90 AMOS	116/81	21/17	525	301	Trtd	T4	TF17Sp TS10Sp TR7 HF21Sp HS9Sp HR4**
w/Appiqué CV-90B AMOS	142/99	25/21	525	325	Trtd	T4	TF14 TS8 TR6 HF18 HS7 HR4
CV-90B AMOS w/BMS	141/99	24/21	525	326	Trtd	T4	TF14 TS8 TR6 HF18 HS7 HR4
CV-90B AMOS	133/93	23/20	525	346	Trtd	T4	TF17Sp TS10Sp TR7 HF21Sp HS9Sp HR4**
w/Appiqué CV-90B AMOS	132/93	23/20	525	347	Trtd	T4	TF17Sp TS10Sp TR7 HF21Sp HS9Sp HR4**
w/Appiqué & BMS CV-90C AMOS	127/89	22/19	525	362	Trtd	T4	TF18Sp TS11Sp TR8 HF23Sp HS11Sp HR5**
CV-90C AMOS w/BMS	126/89	22/19	525	363	Trtd	T4	TF18Sp TS11Sp TR8 HF23Sp HS11Sp HR5**
C-90D AMOS	113/79	20/16	525	309	Trtd	T4	TF17Cp TS10Sp TR7 HF23Cp HS10Sp HR4**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
CV-90/CV-90D AMOS	+3	None	Twin 120mm AMOS Mortars, MAG	66x120mm Mortar Shells, 3000x7.62mm
CV-90B/CV-90C AMOS	+1/+4*	Basic/Good*	Twin 120mm AMOS Mortars, MAG	66x120mm Mortar Shells, 3000x7.62mm

*The first set of fire control and Stabilization modifiers apply to the mortars in direct fire. The second applies to the coaxial machinegun.

**This version has a hull and turret deck AV of 3, and a hull floor AV of 4.

***The CV-90C AMOS with its appliqué armor kit has a hull and turret deck AV of 3, and a hull floor AV of 5Sp.

FNSS ACV-15 SPM

Notes: The ACV-15 SPM (formerly known in development as the TIFV SPM) is a mortar-carrying version of the ACV-15 IFV. The SPM uses the hull and chassis, deleting the turret of the IFV. Instead of this turret-mounted armament, the SPM has large hatches on the rear deck for operation of the mortar; the mortar, in either case, fires over the rear of the vehicle and can be rotated up to 30 degrees left or right of center. The interior is filled largely with the mortar and its ammunition and fuzes, along with equipment to use if the MBC fails and fire must be plotted manually such as an aiming circle, equipment like rulers and protractors, grease pencils, etc. The vehicles also carry aiming stakes; the 81mm version has a baseplate and bipod mounted outside on the left side near the rear to use if the mortar must be ground-mounted. (The 120mm mortar used cannot be ground mounted or dismounted without major work.) The vehicles include a Mortar Ballistic Computer and a ruggedized laptop to keep mapping information in. Also included is a GPS device and secure long-range data-capable radio linked to the laptop. The combination of computers and GPS allows this vehicle to act without an FDC if necessary. On the front right side is a cupola with a weapon mount (normally armed with a heavy machinegun, though other weapons may be mounted).

As a variant of the ACV-15, the SPM 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-300 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. Three seats for the mortar crew are found near the front of the fighting compartment, two on the left and one on the right. The rear of the vehicle has a powered ramp with a door in it; on the SPM, this is normally used for ammunition resupply, with the crew going out of the roof hatches. This is especially true in the case of the 120mm mortar version, as the mortar used is quite large (and advanced). The 120mm version, using the 120R 2M recoiling semiautomatic mortar, has a beefed suspension in the center and rear of the roadwheels to help take up the firing shock that the mortar's own shock absorbers do not. (The 120R 2M also requires a lot more space in the fighting compartment, due to its huge size.) The SPM has four smoke grenade launchers on either side of the glacis plate near the front fenders; these are mounted in clusters. The SPM has two long-range radios, one a data-capable radio which is hooked into the laptop.

81mm SPMs are not as common as the 120mm SPM, due to the heavier bombardment the 120mm mortar is capable of; however, the SPM 81mm can produce more fire without needing a resupply.

Twilight 2000 Notes: This vehicle was the bane of Greek, Iraqi, and Russian infantry formations, able to provide a large amount of fire support in a short amount of time.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ACV-15 SPM 81mm	\$439,552	D, A	467 kg	15 tons	5	12	Passive IR (D)	Shielded
ACV-15 SPM 120mm	\$561,077	D, A	449 kg	15.59 tons	5	14		

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
ACV-15 SPM 81mm	132/80	40/15/4	416	112	Std	T2	HF10Sp HS7Sp HR6*
ACV-15 SPM 120mm	127/77	38/14/4	416	116	Std	T2	HF10Sp HS7Sp HR6*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
ACV-15 SPM 81mm	None	None	81mm MKEK UT-1 Mortar, M-2HB (C)	60x81mm, 1800x.50
ACV-15 SPM 120mm	None	None	120mm TDA 120R 2M Mortar, M-2HB (C)	41x120mm, 1800x.50

*The ACV-15 SPM has a belly AV of 4.

Otokar Cobra Mortar Carrier

Notes: This is a light mortar carrier built on the chassis of the APC variant of the Otokar Cobra. The mortar is lighter than it's ACV-15 or M-113-based counterparts, as the Cobra chassis itself is smaller than those vehicles. The turret of the Cobra APC is deleted, and the roof hatches replaced with a new arrangement that has two large hatches in the roof stretching from the rear to the center deck for the mortar to fire out of. The mortar is mounted on a turntable, and the mortar fires over the rear of the vehicle; the turntable can turn 45 degrees to either side. The wide suspension of the Cobra means that no stabilizing legs or jacks are necessary, though the suspension is beefed up with additional shock absorption over the APC version of the Cobra. The commander does have a manually-rotating cupola armed with a light weapon, though the on-board ammunition supply is limited and the weapon is strictly for

defense (and careful bursts in most cases). Alternatively, the weapon can be aimed and fired remotely from inside the hull. To the rear of the turret are two small hatches on the rear deck.

The Cobra Mortar Carrier has a baseplate and aiming stakes strapped to the right rear side to allow for off-vehicle fire of the mortar; the aiming stakes are to be used if the MBC fails. Despite its small size, the Cobra Mortar Carrier carries a GPS receiver and laptop computer (with maps and some other specially-chosen programs, and it is rumored, even a few games for crew downtimes). As well as two long-range radios, one of which is data-capable and linked to the laptop. Also carried strapped to the side is a tripod for off-board use of the commander's machinegun. The driver and commander ride up front, behind bullet-resistant windshields. They have one bullet-resistant windshield on each side of them. They have no separate doors; they enter and exit through the crew compartment or the commander's cupola. There are doors on either side of the hull for crew access, and a large door in the rear of the hull for exit and entrance or replenishment of ammunition. There are two firing ports in either side of the passenger compartment.

The Cobra Mortar Carrier is powered by a 190-horsepower turbocharged diesel, coupled to a manual transmission. The Cobra Mortar Carrier is amphibious, powered by propellers in the water; the driver controls these propellers via joysticks, and can turn them 180 degrees. The frontal armor is sharply-raked, and the side armor and rear armor is moderately sloped, providing better protection than might be expected from such a light vehicle. The Cobra has an MRAP hull. With all hatches closed, the Cobra Mortar Carrier is NBC sealed; with them open, a collective NBC system is used.

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

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$470,727	D, A	400 kg	6.64 tons	5	6	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
209/106	49/24/5	145	104	Std	W(3)	HF5 HS3 HR3*

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm mortar, MAG (C)	42x81mm, 425x7.62mm

*Floor AV is 4Sp, and has an MRAP hull.

Arrowpointe Dragoon 300 AMC (Armored Mortar Carrier)

Notes: The Dragoon 300 AMC is a light mortar carrier based upon the Dragoon multipurpose chassis. The Dragoon 300 Mortar Carrier has had some small sales to a variety to foreign customers, but no big sales or use by the large countries that arms dealers covet.

As a mortar carrier, the Dragoon's turret is removed, and a pair of bi-fold hatches is installed to allow the mortar to fire. The mortar is mounted on a turntable which is capable of 360-degree fire. Stops can also be set in the turntable to allow the crew to quickly shift fires to pre-determined azimuths. The interior, like most mortar carriers, is largely taken up by the mortar and its installation, ammunition, and fuzes, as well as legacy fire control equipment like plotting boards, protractors, grease pencils, maps, etc. However, one might find more space inside than in most mortar carriers. The 81mm mortar can operate with a crew of four or five.

The driver and commander are in the front, with the driver on the right and commander beside him. They have a small bullet-resistant windshield in front of them, and vision blocks to the sides. Vision blocks are also present in front of the hatches for use when the vehicle is buttoned up. They have hatches above them and can also reach their stations trough the troop compartment. Their hatches have night vision blocks, which can be removed and replaced with an armored block. The driver has a conventional control set, though he has power brakes. The driver and commander have electrically-powered raising and lowering of their seats. The crew has three seats in the rear, simple fold-down pads on metal seats. The wide doors on either side are retained in the Mortar Carrier, and the firing ports on either side and the one in the rear are also retained. (The rear firing port is a bit difficult to fire from due to lack of space.) There is no gunner's station, but the commander is armed with a pintle-mounted machinegun (though little ammunition for the machinegun is carried as part of the basic load). In the 1990s, Arrowpointe began offering Mortar Ballistic Computers with the Mortar Carrier. At the same time, data-capable long-range radios which could pass information to the MBC were added for customers who bought the MBC for their Dragoon-300 Mortar Carriers.

The Dragoon-300 MC borrows the starter, vision blocks, bilge pumps, control knobs and electrical and hydraulic components from the M-113A2 APC; automotively, many components are the same as on the M-809 medium truck, particularly in the suspension. The engine of the Dragoon-300 MC is a Detroit Diesel 6V-53T 300-horsepower turbocharged diesel engine (again, a modified version of that of the M-113), coupled to an automatic transmission. The Dragoon-300 MC has a flood-type Halon fire suppression system, but this must be manually triggered. There is one for the troop/front compartment and one for the engine compartment. The suspension is 4x4 and of the off-road-type, and the Dragoon-300 has run-flat tires and central tire pressure regulation. Armor is moderate, but angling of the front and sides helps the situation, giving it protection greater than might be expected for such a vehicle. Armor is acceptable for such a vehicle, though appliqué armor kits are available. All Dragoon-300 MCs and variants have a front-mounted winch with a capacity of 5 tons and 53.34 meters of cable. The Dragoon-300 MC is amphibious, powered by wheel rotation in the water, and steered by the front wheels as if on land. Bilge pumps must be turned on before entering the water, but other than that, there is no preparation required for amphibious operations (and turning on the bilge pumps only requires the flipping of a switch by the driver). The driver may also fully inflate the tires using the central tire inflation system before amphibious operations to increase flotation, an operation that requires only 15 seconds. Amphibious speed is slow, and steering response is sluggish.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Dragoon Mortar Carrier	\$235,599	D, A	1.2 tons	11.28 tons	4 or 5	8	Passive IR (D, C)	Enclosed
Dragoon Mortar Carrier (w/Appliqué)	\$256,805	D, A	800 kg	11.68 tons	4 or 5	8	Passive IR (D, C)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Dragoon Mortar Carrier	192/102	47/24/3	350	164	Std	W(4)	HF8 HS4 HR4
Dragoon Mortar Carrier (w/Appliqué)	185/99	45/23/3	350	170	Std	W(4)	HF10Sp HS4 HF4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Dragoon Mortar Carrier	None	None	81mm M-252 Mortar, M-2HB (C)	60x81mm, 600x.50

*Floor AV is 4Sp.

Cadillac-Gage LAV-150 Mortar Carrier

Notes: A mortar carrier version of the V-150/LASV-150 light APC, the mortar carrier variant was designed to provide a modicum of

mobile fire support without being prohibitively expensive to countries who do not have a big defense budget. As such, many of the countries operating the V-150/LAV-150 also bought the mortar carrier version. In addition, there were other smaller countries who bought small amounts for general fire support. (Though the US employed the V-100 and later the V-150 during the Vietnam War, they did not use the mortar carrier variant; however, the South Vietnamese Army did, and for a while these were used by Vietnamese forces.)

The design of the LAV-150 Mortar Carrier follows most such vehicles – the turret is removed and large bi-fold hatches are installed on the rear deck to allow firing of the mortar. Most other aspects of the vehicle remain virtually unchanged from the LAV-150 APC. The internal installation of the mortar is almost identical to that of the Dragoon-300 Mortar Carrier, and the turntable allows 360-degree traverse and fire. Stops can be preset to allow the crew to quickly switch to previously defined targets (normally useful only in long bombardments). The presets can also be used to lock the turntable, which helps to keep the mortar from drifting off target. The LAV-150 Mortar Carrier can mount up to four light or medium machineguns for local self-defense; two may be mounted at the rear corners of the deck hatch, one may be mounted at the front right corner of this hatch, and one is normally mounted at the commander's position at the front left of the vehicle. Two tripods are carried to allow ground-mounting of some of these machineguns. A baseplate and bipod are also carried strapped to the right rear side should the mortar have to be ground-mounted. The Mortar Carrier is equipped with a Mortar Ballistic Computer, as well as a data-capable long-range radio to allow fire information to be transmitted and input into the MBC. Again, like most such mortar carriers, the interior is cramped due to the mortar installation, ammunition, and fuzes, as well as legacy fire control equipment.

The driver of the LAV-150 Mortar Carrier is on the front right, and commander beside him on the left. As stated above, the commander's overhead hatch has a pintle-mounted machinegun; this is on a manually-operated cupola. The commander and driver are equipped with special, high-protection vision blocks; both can see to the front, and the driver has vision blocks to the right side, while the commander has all-around vision blocks built into his cupola. The driver has essentially conventional controls in his compartment, as well as controls for the bilge pump. Above the driver's and commander's position are two hatches; the commander and driver may raise their seats to see out of the hatches. The gunner's position of the LAV-150 APC has been deleted in the mortar carrier variant. A seat for crewmembers is found on each side at the front of the fighting compartment, and at the front in the center is another seat. (These are simple fold-down seats with a pad strapped to metal seats.)

Power for the LAV-150 Mortar Carrier is a Cummins V-8 diesel engine; this engine is a derivative of the same engine that powers the M-113A2. This engine develops 202 horsepower. An Allison-made automatic transmission is installed. The axles were taken from the M-44 2.5-ton truck. The tires were specially designed by Cadillac Gage and are run-flat and designed to run even in heavy mud without bogging down. The tires are also puncture resistant. The front has a 10-ton-capacity winch in it, and the vehicle carries a 5-ton snatch block to increase the winching power. The vehicle is fully amphibious, requiring only that bilge pumps be turned on.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$65,753	D, A	400 kg	11.4 tons	5	8	Passive IR	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
148/75	43/24/4	303	101	Std	W(3)	HF7 HS4 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm M-252 mortar, MAG (C, RF, RR, LR)	62x81mm, 4800x7.62mm

Cadillac-Gage LAV-300 Mortar Carrier

Notes: Though the LAV-300 is not merely a larger version of the LA-150, the LAV-300 Mortar Carrier *is* conceptually almost identical to the LAV-150 Mortar Carrier. Like the LAV-150 Mortar Carrier, the LAV-300 Mortar Carrier has its turret removed, and defensive armament is similar to that of the LAV-150 Mortar Carrier. A large amount of LAV-300s, including the Mortar Carrier, but these sales have been in dribs and drabs, and Textron (who bought Cadillac Gage in the mid-1990s) keeps open an assembly line big enough for one vehicle, and another line which produces spare parts for the LAV-300 family already being used in the world.

Some experimentation of the LAV-300 has been made by the US Army, including when the 9th ID was a test division, and again when the Stryker was still the Infantry Armored Vehicle and the design was as yet not finalized. Currently, no new LAV-300s of any sort are being produced, though spare parts are still being made for countries who cannot produce their own spare parts or have vehicles damaged beyond the capability of local repair facilities.

The LAV-300 Mortar Carrier, in an effort to increase its utility, can mount either a Western-type 81mm in the rear, or a Russian/Eastern-type 82mm mortar (though NOT a Vasilek). For local defense up to four machineguns may be mounted; these are mounted in the same manner as those of the LAV-150 Mortar Carrier. Though the LAV-300 base is quite a bit larger than the LAV-150, more attention has been paid to internal stowage of crew equipment, more maps, and enhancements like an MBC, a ruggedized laptop, a data-capable long-range radio, and a GPS with a small computer of its own primarily containing maps. Versions mounting 81mm or 82mm mortars have 360-degree turntables and can fire in any direction. The 120mm mortar version can rotate 160 degrees (80 in each direction from the centerline), and greatly reduces the amount of space available to the crew and their gear. A bipod and baseplate for the mortar are carried on the right rear side in case the mortar must be ground-mounted; in addition, three tripods are carried in case the machineguns must be ground mounted.

The LAV-300 has a driver's position on the front right, with a hatch above him and three vision blocks to the front and one to each side. The center front vision block can be replaced with a night vision block. On the basic APC, the commander's position is to the rear of the driver's position and in the center of the vehicle, and has a simple cupola with a pintle mount. The firing ports are retained, though the two rear side firing ports are VERY difficult to access due to the vehicle's mortar ammunition and storage for maps and legacy fire control equipment being in the same area. The three firing points in either side of the front "cab" are also retained. In the right side of the hull is a small door; using this is made a little more difficult due to the size and position of the mortar installation. Three members of the mortar crew sit back in the fighting compartment – one in each side and one in the center front. There are strapdown points for crew gear (with plenty more on the outer hull).

The LAV-300 is powered by a 270-horsepower Cummins VT-504 turbocharged diesel engine, coupled to an automatic transmission. The suspension is 6x6 and of an off-road type, with puncture-resistant tires (though they are not run-flat). Ground clearance is decent and the floor armor is strengthened as a measure against mines, though it is by no means an MRAP of spaced armor-type of floor protection. The LAV-300 can have added appliqué armor. The LAV-300 is amphibious after turning on bilge pumps and erecting a trim vane (5 minutes), but speed is quite slow in water.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
LAV-300 Mortar Carrier (81mm)	\$530,080	D, A	650 kg	16.1 tons	5	12	Passive IR (D)	Enclosed
LAV-300 Mortar Carrier (81mm) w/Appliqué	\$536,430	D, A	525 kg	16.5 tons	5	12	Passive IR (D)	Enclosed
LAV-300 Mortar Carrier (82mm)	\$534,451	D, A	500 kg	17.3 tons	5	12	Passive IR (D)	Enclosed
LAV-300 Mortar Carrier (82mm) w/Appliqué	\$540,801	D, A	400 kg	17.7 tons	5	12	Passive IR (D)	Enclosed
LAV-300 Mortar Carrier (120mm)	\$583,857	D, A	315 kg	17.57 tons	5	14	Passive IR (D)	Enclosed
LAV-300 Mortar Carrier (120mm) w/Appliqué	\$593,318	D, A	215 kg	17.97 tons	5	14	Passive IR (D)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
LAV-300 Mortar Carrier (81mm)	141/72	33/17/1	200	151	Std	W(3)	HF8 HS5 HR4*
LAV-300 Mortar Carrier (81mm) w/Appliqué	138/71	32/17/1	200	154	Std	W(3)	HF10Sp HS6Sp HR4**
LAV-300 Mortar Carrier (82mm)	135/70	31/17/1	200	157	Std	W(3)	HF8 HS5 HR4*
LAV-300 Mortar Carrier (82mm) w/Appliqué	132/69	30/16/1	200	160	Std	W(3)	HF10Sp HS6Sp HR4**
LAV-300 Mortar Carrier (120mm)	130/68	30/16/1	200	163	Std	W(3)	HF8 HS5 HR4*
LAV-300 Mortar Carrier (120mm) w/Appliqué	127/67	29/15/1	200	167	Std	W(3)	HF10Sp HS6Sp HR4**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
LAV-300 Mortar Carrier (81mm)	None	None	81mm M-252 mortar, MAG (C, RF, LR, RR)	62x81mm, 4800x7.62mm
LAV-300 Mortar Carrier (82mm)	None	None	82mm 2B14 Podnos Motor, MAG (C, RF, LR, RR)	62x82mm, 4800x7.62mm
LAV-300 Mortar Carrier (120mm)	None	None	120mm Soltam K-6 Mortar, MAG (C, RF, LR, RR)	42x120mm, 4800x7.62mm

*Floor AV is 4.

**Roof AV is 3; Floor AV is 5Sp.

M-113-Based Mortar Carriers

Notes: The M-125A2 was introduced shortly after the M-113A2 version of the M-113 APC. Most potential customers opted to wait the few months for the M-106A2 with its heavier mortar, or use the M-113A2 as a base chassis and arm it with a 120mm mortar. The US used the M-125A2 as a lighter companion vehicle to the M-106A2, but by the time I went to my first AIT in 1984, we were told that the M-125A2 was almost totally phased out in active duty and that about half of the Guard and Reserve's M-125A2 had also been phased out. Training new mortarmen to use a vehicle-mounted mortar was one of the few uses that made heavy use of the M-125A2, but now, they have been phased out even in this role. The M-125A2 and M-106A2 have been almost totally replaced by M-125A2s and M-106A2s that have been modified into M-1064A3s.

The M-125A2 is an M-113A2 which has been modified to carry an 81mm mortar as its primary armament. In this role, the modifications to the 81mm mortar actually has few modification to itself; perhaps the biggest modification is the replacement of the baseplate with one built into the floor. A standard baseplate is strapped to left side during on the bumper to allow ground mounting of the mortar. The bipod in this role is unmodified; it just has an unusual installation. It can be removed from the vehicle installation and used during ground-mounting. The vehicle fires out of the hatches on the rear deck, which have been modified to be larger. Most of the room inside the fighting compartment is taken up by the M-125A2's copious supply of ammunition for the mortar. Like most military vehicle, personal gear ends up strapped to the outside of the vehicle. Originally, the M-125A2 was armed with an M-29 mortar, but this was quickly switched to the M-252 when it became available. There are seats in the fighting compartment for the mortar crewmember; these are shorter versions of those in a standard M-113.

About the time that the M-125A2 was being developed, the US Army was developing a successor to its World War 2-vintage 4.2" (107mm) mortars; the 4.2" mortar had proved useful for heavy organic fire support during World War 2, Korea, and Vietnam. Of course, the new M-30 mortar was a large, heavy mortar (nearly 275 kilograms), and the ammunition was also heavy. The US Army quickly looked to its M-113 and M-125A2 to develop a mobile version of the M-30. This led to the M-106A2. The installation of the M-30 mortar in the M-106 is tailor-made for the vehicle; the turntable, bridge, and monopod are all vehicle-specific. To allow ground mounting, the M-106A2 carries a baseplate (and it's a mother-f getting that baseplate off the vehicle, it's so heavy), a bridge, and a monopod, on the right side of the vehicle. The ammunition takes much of the internal volume of the fighting compartment, and the mortar installation just about the rest, so like most fighting vehicles, the exterior becomes strewn with personal gear and other gear found useful. The deck hatches are similar to those on the M-125A2, and the rear ramp is retained, largely to allow the crew more space when the mortar is in use. Crew seating is similar to those of the M-125A2. It should be noted that, in an actual 4.2" platoon, four troops will often be split between the mortar tracks and used as ammunition bearers and messengers.

In the early 2000s, the US Army switched to a 120mm mortar, to make it easier to share ammunition with allies. They mounted this on a variant of their newest version of the M-113, the M-113A3, producing the M-1064A3. At the same time, the vehicle received an MBC, a small tactical laptop, and a GPS receiver. This allows them to act as their own FDC is necessary. The mortar, called the M-121 when mounted on the M-1064A3, might be seen as having less room for ammunition at first, but the movement of the fuel cells to the rear means that the fuel tanks are not carried in the walls of the vehicle, allowing for expanded ammunition storage while giving the crew more space to work in.

Twilight 2000 Notes: The M-1064A3 is not available in the Twilight 2000 timeline, except for five examples found with US Army units in the southwestern US.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-125A2 (M-29 Mortar)	\$223,759	D, A	500 kg	12.07 tons	5	7	Passive IR (D)	Shielded
M-125A2 (M-252 Mortar)	\$228,579	D, A	500 kg	12.09 tons	5	7	Passive IR (D)	Shielded
M-106A2	\$258,818	D, A	600 kg	11.94 tons	5	7	Passive IR (D)	Shielded
M-1064A3	\$587,827	D, A	220 kg	12.92 tons	5	10	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-125A2	128/70	28/14/2	360	132	Stnd	T2	HF6 HS4 HR4
M-106A2	129/71	29/15/2	360	131	Stnd	T2	HF6 HS4 HR4
M-1064A3	139/99	31/21/3	360	109	Stnd	T2	HF6 HF4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-125A2	None	None	M-29 or M-252 81mm Mortar, M-2HB (C)	114x81mm, 600x.50
M-106A2	None	None	81mm Mortar, M-2HB (C)	88x81mm, 600x.50
M-1064A3	None	None	120mm M-121 Mortar, M-2HB (C)	69x120mm, 600x.50