TRACKED ENGINEER VEHICLES

Steyr Daimler-Puch 4KH7FA-AVE Pionier Engineer Tank

Notes: This is a combat engineer vehicle based on the chassis of the 4K 7FA-KSPz armored personnel carrier. The Austrians currently have 19 in service; the only export customer has been Tunisia, who have two of them. This vehicle has been Austrian service since 1988, and have been subject to constant repairs and refurbishments to keep them in service. It is normally called the AVE or Pionierpanzer in Austrian service.

In this role, the APC has a raised superstructure in the front two-thirds of the vehicle, upon which is mounted a large digging bucket on the end of an extensible arm. This bucket may be removed and replaced with an earth drill with a 350mm wide bit, or a crane head. The digging bucket may dig into up to 2.2 meters of earth at a time; the crane head has a capacity of 8 tons. Either tool head may be pivoted on its arm up to 234 degrees. The vehicle has a dozer blade on the front (which doubles as a mine plow), and there is also a winch with a capacity of 8 tons and 60 meters of cable. Four smoke grenade launchers are mounted near the rear of the superstructure, firing over the back of the vehicle. The Engineer Tank typically carries construction tools, excavation tools, a chainsaw, welding equipment, and an air compressor. At the front of the hull, above the fenders, are 4-round clusters of smoke grenade launchers. The AVE can carry a trackway or two rolls of fascine, deploying the trackway from an automatic rolling device and the fascines using the boom arm.

This vehicle has all-welded steel armor which is relatively thin to keep weight down. The fire suppression system is unusual in that that it can be set to operate automatically, but can also be operated manually. Power is provided by a Steyr 7FA turbocharged diesel with 320 horsepower, coupled to an automatic transmission. Suspension is by torsion bars, but the AVE has an extra set of shock absorbers to help keep large cargos stable.

The normal means of entry to the crew compartment is via a two-piece hatchway on the left side, but there are also several hatches on the roof, one of which is the commander's position. He normally has a heavy machinegun on a pintle mount next to his hatch, but the mount will also take a grenade launcher, GPMG, or light machinegun or SAW. He also has a WL spotlight on a short pole. There is no air conditioning, but the AVE does have a forced air ventilation system that can cut the heat inside the crew compartment a bit, and it does have a heater.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$318,286	D, A	1 ton	19 tons	4	24	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
132/93	33/23	500	113	Stnd	T3	HF9 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	1050x.50

*The front dozer blade has an AV of 9. Depending on what the blade is raised to (or not raised), the blade gives the Pandur ARRV a bonus frontal AV of 9Sp.

Steyr Daimler-Puch 4KH7FA-SB 20 Greif

Notes: This is a recovery vehicle based on the SK-105 light tank chassis. It prototype was completed in 1974, with general production taking place in 1976-77. In 1999-2000, production of the Greif began again, both to replace worn out vehicles and to increase the amount of them on hand. In addition, export sales to Brazil and Botswana were made from this second production lot. (Tunisia has three made from the original production lot, and several South American and West African nations have substantial numbers of Greifs made from this production lot.) Austrian Greifs were designed specifically to recover and repair the SK-105 light tank and the 4KH7FA-series APCs. Austrian Greifs have been the subject of continual upgrading, depot-level repairing, and refurbishing.

The vehicle has a large raised superstructure over the front half of the chassis, while the back of the hull has a stand for an engine and transmission assembly for a light armored vehicle, or other spare parts. On the right front of the superstructure is a crane with a capacity of 6 tons with 42 meters of cable; it can reach 3.9 meters and pivot 234 degrees (it is a variant of the boom on the AVE above). The main winch leads out through the front of the hull and has a capacity of 20 tons, with 95 meters of cable. The Greif has a dozer blade at the front of the hull, normally used to brace the vehicle during winching and lifting operations, though it has a secondary role of digging fighting positions for vehicles and other large items of equipment. The Grief normally carries a wide selection of tools, including a welding set, an air compressor, and wheeled vehicle, tracked vehicle, excavating, small arms, and heavy ordinance tools. Power is provided by a 320-horsepower turbocharged diesel engine, the same as that on the AVE above. The transmission is automatic, and also the same as on the AVE.

At the front of the hull, above the fenders, are 4-round clusters of smoke grenade launchers. The commander is in a raised cupola on the front right portion of the crew compartment, and is armed the same as the AVE above. The driver is on the front left, with other crewmembers having seats in the crew compartment to the rear of the driver.

Note that the AVE above is based on the same chassis, and much of the vehicle is similar to the Greif.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$289,887	D, A	3 tons	19.8 tons	4	24	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor

129/90	32/23	400	113	Stnd	T3	HF9 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	1500x.50

*The front dozer blade has an AV of 6. Depending on what the blade is raised to (or not raised), the blade gives the Pandur ARRV a bonus frontal AV of 6Sp.

M-113A2 Recovery Vehicle

Notes: This armored recovery vehicle is based on the M-113A2 APC chassis. It is used by Brazil, Australia, Bahrain, Belgium, Egypt, Israel, Lebanon, Netherlands, and Sudan. The M-113A2 RV has a main winch with a capacity of 9.07 tons, and has 91.4 meters of cable. The winch's mechanism always makes sure the cable is wound around its drum as tightly and evenly as possible. Spades are lowered on each side of the hull during heavy winching operations and when using the crane. The crane is mounted on the left side of the roof, has a reach of 3 meters, and can lift 1.36 tons. The M-113A2 has been redesigned to provide extra buoyancy in areas necessary to counteract extra weight for its crane and winch mechanisms. Though some of these vehicles have been built in the US, none of them have been picked up for US Military service. (The remainder of these vehicles are built in Belgium.)

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$82,357	D, A	2 tons	11.64 tons	3	7	Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
120/84	25/20/3	360	117	Stnd	T2	HF6 HS4 HR4

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

Bernardini X-1A2 Recovery Vehicle

Notes: This is an X-1A2 light tank with the turret removed and replaced with an A-frame crane which may be raised over for front or back, with a capacity of 8 tons. The vehicle also has a front mounted winch with a capacity of 10 tons, and a rear winch with a capacity of 20 tons, each with 60 meters of cable. Also on the front end of the vehicle is a dozer blade; it is not meant for obstacle clearance as a primary role, but instead is meant to brace the vehicle when using crane or winch. (The winch cable actually hooks to the bottom of the blade when traveling.) The vehicle carries basic tools, tracked vehicle tools, wheeled vehicle tools, excavating tools, a tow bar, welding gear, an air compressor, and various ropes, chains, and pulleys for its tasks. An arc welder/cutter powered by the vehicle is also provided, as is a selection of spare parts for the X-1A2 or other light vehicles depending on what vehicles it is intended to recover. Typically, two X-1A2-type roadwheels, two short tread sections, and a sprocket and idler are carried, along with a small selection of spare parts for the X-1 series. The RV can also carry a complete X-1A2 engine and transmission on its rear deck.

As with the X-1A2, the recovery vehicle version is powered by a 300-horsepower Saab-Scania turbocharged diesel engine, coupled to a manual transmission. The suspension is comprised of three bogies (and an idler and drive sprocket); it is the same sort of suspension as used on early models of the M-4 Sherman tank. Torsion bars were also fitted, with a shock absorbers at the front and rear. As it uses an X-1A2 hull, it is lengthened as well.

As the X-1A2 is long out of service with Brazil, the X-1A2 RV is as well; however, many were bought by Paraguay for recovering their light vehicles.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$58,927	D, A	2.2 tons	19 tons	4	16	WL Spotlight	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
74/29	19/7	320	106	Stnd	T3	HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	600x.50

Bernardini XLP-10

Notes: This is a Brazilian armored vehicle launched bridge based on the chassis of the X-1A light tank. The bridge on the vehicle can span a gap of 10 meters and take a weight of 22 tons. The bridge itself weighs 4.7 tons, and takes 5 minutes to emplace or recover. The chassis has its turret removed, and replaced with machinery to carry and emplace the bridge. The commander is rather low in the vehicle, as is the driver, and the bridge operator is in the center front of the vehicle and sits the lowest within the vehicle, generally working through vision blocks.

The setup is otherwise similar to the hull of the X-1A, with the driver on the left front and the commander on the right front. The commander has a mount for a light weapon; the weapon has limited elevation and left traverse while the bridge is being carried; and the commander can only raise his head to about the head-and-shoulders level. The engine is the same 280-horsepower Saab-Scania turbocharged diesel as on the X-1A, with a manual transmission. It has the same sort of suspension as the X-1A2 RV: vertical volute with torsion bars and modernized shock absorbers.

As with the X-1A2 recovery vehicle, numbers of the XLP-10 were bought by Paraguay for its light vehicles and infantry forces.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$46,188	D, A	250 kg	14.7 tons	3	13	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor*
81/33	20/8	750	50	CiH	T3	TF4 TS4 TR4 HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	MAG (C)	1000x7.62mm

*The “turret” values are actually for the bridge, the “CiH” rating actually reflects the difficulty to hit the bridge and it’s machinery and do significant damage to it.

AEC FV-4003 Centurion AVRE

Notes: This is a CEV similar in concept to the US M-728, and also a variant of a main battle tank, in this case, the Churchill Mk VII. (In fact, the M-728 uses a modified version of the AVRE's gun.) It started trials in 1962 and entered service with the British Army in 1963. The last use of the AVRE was in Desert Storm, where it was put to use destroying obstacles and tank traps. The AVRE is heavily modified for its role as an AEV, particularly in the main gun and large forward dozer blade. The Chieftain AVRE was supposed to be replaced by the Vickers Trojan AVRE, but delays in the Trojan program as well as the spot-on demobbing of the AVRE has left the UK without any such vehicles.

The AVRE was modified first by replacing the turret with one designed to take the 165mm AVRE L-9A1 gun, firing a 29-kilogram HESH round. (Though effective range is short, and fire control sparse, the 165mm HESH can cause considerable damage to even the frontal aspect of a main battle tank.) This gun has a very abbreviated barrel with a fume extractor that takes up most of the gun barrel and a modicum of a flash suppressor. The gun is essentially used to fire a sort of tank shell version of a demolitions charge. The turret has large stowage boxes on either side, normally containing the large amount of block and tackle, ropes, wire ropes, and even hand-emplaced explosive charges. The gun has an L-8A2 coaxial machinegun, and an L-7A2 as a commander's machinegun. Each side of the turret has a bank of four smoke grenade launchers, at the point where the mantlet meets the gun. Another grenade installation is on the front turret, facing to the front sides of the vehicle, with a cluster of five on either side. An optional weapon, carried on the rear deck when used, is a Flexible Linear Demolition Charge, or line-charge thrower. Another possible weapon is a trailer carrying the Giant Python or Barmine or Giant Viper mine throwing system. One sighting device peculiar to such vehicles was the Type 2100 double-prism periscope, designed to produce a highly-magnified view at short range, to produce an enhanced sight figure of obstacles.

Behind the turret is a pair of hatches in the roof of the vehicle; normally a "penthouse," a structure to expand enclosed work area, is raised above the hatches. This generally covers the rear deck and is made of steel or aluminum plates, or Kevlar or Fiberglas boards. These are used for anything from the preparation of specialist equipment to troop living space when off-duty, and it simply folds away when not needed.

The driver is at the front center of the vehicle, behind the glacis, under a hatch that gives the driver a wide-angle vision block and a night vision block. The commander and gunner also have a night vision channel, though their night vision is short-ranged, as long distance night vision was not deemed necessary. Likewise, the magnification of the gunsight for the main gun is also limited. Space in the turret is limited, but does include the requisite British hot-water heater for tea and rations. A vehicle collective NBC system is provided.

A large framework, called a "hamper" can be mounted above the AVRE, including the turret. This is used to carry more equipment if necessary. On the rear hull plate is a capstan winch, with 60 meters of rope and with a 10-ton capacity. The AVRE also has a crane, able to lift 13.6 tons. The frontal dozer blade has a secondary use of pushing mines aside, and as such has an AV of 8. Alternately, a Pearson Combat Dozer may be mounted, with an AV of 12. It can excavate 229 cubic meters per hour. In front is another winch, with a capacity of 50 meters (of cable) and 20 tons. Above the dozer blade on the glacis is a rack that is used to carry and deploy fascine mats; another one can be carried on the rear, or on a hamper.

Power for the Centurion AVRE is by a 650 hp Rolls-Royce Meteor diesel, along with a manual suspension. Like the Centurion tank, the Centurion AVRE is known to have a particularly balky transmission.

Prior to Desert Storm, AVRE's were given a small amount of spaced appliqué armor. While this increased the weight of an already-heavy vehicle, this was deemed acceptable for a vehicle that would be starting at the front or in follow-up forces, or brought up as a specialist asset and surrounded by dedicated fighting vehicles and infantry. Nonetheless, the AVRE with appliqué can barely move by today's terms.

Twilight/Merc 2000 Notes: These vehicles were never taken out of service – they were deemed too valuable in MOUT situations.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Centurion AVRE	$962,841	D, A	700 kg	51.81 tons	4	23	Passive IR (D, G)	Shielded
Centurion AVRE w/Appliqué		D, A	572 kg	54.3 tons	4	23	Passive IR (D, G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Centurion AVRE	132/54	33/14	1037	235	Trtd	T6	TF40 TS17 TR11 HF60 HS13 HR8
Centurion AVRE w/Appliqué	118/48	30/12	1037	246	Trtd	T6	TF45Sp TS17Sp TR16 HF70Sp HS13Sp HR13*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Centurion AVRE	+1	Basic	165mm Demolition Gun, L-8A2, L-7A2 (C)	30x165mm, 3000x7.62mm

*Floor AV is 6Sp.

AEC FV-4018 Centurion BARV

Notes: Most countries, when they need an engineer vehicle to aid amphibious landings, modify some already-in-use vehicles, and perhaps rig some purpose-built equipment for them. The British, however, modify and redesign a whole vehicle, turning it into something nearly perfect for its role. The first of the post-war BARVs (Beach Armored Recovery Vehicle) was the Centurion BARV. Other countries have also thought this a good idea, and they were bought by the Danish, Australians, and Israelis. Most have left service a while ago, either not replaced by a purpose-built vehicle or replaced with more up-to-date BARVs. The Royal Marines are known to have used 12.

Normally, the BARVs were attached to amphibious units, though the Israelis have also used them successfully in sandy terrain away from water. The BARV's Design has been called "functional but crude." They are normally (in British service) crewed by Royal Marine Commandoes, with one being diving instructor qualified, 2 cross-trained as mechanics, and a fourth as the driver. The Assault Squadrons they supported served aboard Royal Navy ships. The Centurion BARV was made by removing the turret of the Centurion and replacing it with a raised superstructure. The suspension is also raised and the track skirts removed, allowing wading of up to 1.75 meters and swimming with the aid of a floatation screen. This is meant to allow the BARVs to leave a ship and go ashore under their own power in light seas.

The primary, and by far most obvious difference is the large, tall superstructure which takes the place of the turret; the BARV is nearly 51 centimeters taller than a Centurion tank. It extends from the rear to about a third from the front. This contains a good portion of recovery equipment storage. Most TC weapons were magazine-fed Brens; though later they began to give way to L-7A2 MAGs, the Bren's were never completely replaced. The TC's position is at the front of the superstructure. Crewmembers were also originally issued Sterling submachineguns, but have been issued L-85s since the mid-1980s. The superstructure is specially shaped to take high surf. With the sides sloped inwards and the front and rear wedge-shaped.

The crew for the most part enters through a door in the rear superstructure, though they may also climb ladders on the sides to the top; there is one hatch up there (the TC's hatch), though the hatchway is large enough for two men to work comfortably. The driver's position is in the front, slung between the tracks. The driver can put an airtight plastic bowl over his position; this is often done, as the BARV often spends its time hull-down in water.

The hull is for the most part a Centurion hull. The engine was the Mk 3's Meteor Mk 4B, developing 650 horsepower. Due to the volume of recovery gear carried, and the fact that it would see only short blocks of action, the fuel tankage was drastically cut. The hull is cauterized by numerous tie-off points, rails, and tow points, as the BARV did not have winches. In fact, the glacis is cut down and replaced with the bumper mentioned above. The superstructure blends with the area formerly used by the turret basket.

Recovery equipment includes cables and ropes, block & tackle, and such recovery gear, but it's primarily role is to provide a high perch for recovery personnel. This is unfortunately not nearly as armored as a turret, so it is also a large, vulnerable section. Other differences include a driver's windshield, a large extended rope-coiled bumper to facilitate pushing, BARVs generally do not have track skirts, to keep wet sand from clogging the running gear. It also ensures that the BARV will not float, even in high tide conditions. A 1.5kW APU can run many of the recovery tools. Items and tools carried include basic, tracked vehicle, wheeled vehicle, and power tool kits; a removable gantry that is used as a rear facing crane with a capacity of 25 tons; two sets of block and tackle; six sets of shackles, three steel tow ropes and two hemp ropes; a large-capacity jack with a capacity of 35 tons, and assorted wood blocks, short sections of cable, and several fire extinguishers.. (This is in addition to the fire extinguishers carried for BARV vehicle fires.) Often, the BARV would have logs, poles, treadways, planks, fascines, and such items strapped top its sides.

Twilight 2000 Notes: Centurion BARVs already taken out of service were refurbished, and those not taken out of service were retained. Most found themselves being used as regular AEVs as well as *ad hoc* bridging vehicles using trackways and fascines, though most of them were present at the odd British, Danish, or Israeli amphibious landing.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-4018		D, A	3 tons	50 tons	4	36	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV-4018	114/80	32/22	386	353	Stnd	T6	HF22 HS10 HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV-4018	None	None	L-7A2 (C) or Bren	1600x7.62mm (belted) or 1500x7.62mm (in 50x30-round Bren magazines)

Alvis/BAE FV-434

Notes: The ARV part of the FV-432 family, the FV-434 comes in three variants, most of which differ from each other only in the way they are equipped; others include the Fitter's Vehicle and the Maintenance Carrier. It is designed primarily to repair damaged and disabled vehicles, but because it is small, it has limited recovery ability.

The FV-434 RMV is the primary subtype of the FV-434. It has a crane with a capacity of 3 tons and a flat area at the rear of the

deck for powerpacks -- however, an FV-430 series powerpack is about the largest one it can handle. The FV-434 is equipped with a selection of tools and parts appropriate it's to its job of repair work. Parts are primarily for FV-430 vehicles, though the FV-434 can also be sent out to repair other vehicles of a similar size or smaller. Toolsets include basic, wheeled vehicle, tracked vehicles, and power tools, as well as a set of pioneer tools. A two-meter-long folding workbench can be extended out of the rear hatch, and a tent enclosure can also be extended over the work area. Another "penthouse" can be erected over the top of the of the vehicle, leaving a space for the crane.

The FV-434 is powered by a Rolls-Royce K-60 Multifuel engine, developing 240 horsepower. The transmission is semiautomatic and can be a bit balky, but once you get used to it, it is easy to manage (sort of like an M-113's). The FV-434 has an external NBC pack on the front left side, allowing the crew to plug their hoses from the vehicle to their masks. Swimming requires the erection of a flotation screen, the extension of a flotation screen, and the turning on of bilge pumps.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-434	$122,952	D, A	3 tons	17.5 tons	4	17	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
FV-434	110/77	31/21/5	454	92	Stnd	T6	HF6 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV-434	None	None	L-7A2 (C) or Bren	1600x7.62mm (belted) or 1500x7.62mm (in 50x30-round Bren magazines)

BAE Terrier Armored Digger

Notes: The Terrier was designed to replace the FV-180 CET in British service. There have as yet been no export sales, though the French are in the process of field testing Terriers for its Army. The first prototype was displayed in mid-2005, but there were considerable delays, both during the testing and manufacturing process; manufacture of the first Terrier hull did not occur until early 2010, and Army and Marine service did not begin until 2013.

The Terrier has a more powerful engine than the FV-180, as well as a drive train with exceptional torque. The engine used is a C18 Caterpillar 700 horsepower diesel, with an automatic transmission. Most of the critical systems, lines, oil reservoirs, and power pack areas are under the Terrier's belly armor. Armor is all-welded steel; appliqué is bolted on, except for the belly armor, which is a new installation. The fuel tank is made from synthetic material stronger than steel, and is self-sealing. Terrier borrows a feature from the FV-180: it's double-walled construction, which also insulates from the noise of the tools and bucket and from mines.

The most prominent feature of the Terrier is its front clamshell bucket; this bucket has AV6 on the sides, AV4 on the top, and AV12 on the bottom and back, and allows the Terrier to be used as an *ad hoc* demining vehicle. The bucket can be quick-detached and dropped, in the event of the bucket getting stuck or if it inadvertently picks up dangerous material that must be abandoned. It can lift 400 cubic meters of soil or 8 tons. Another prominent feature is the right-side-mounted digger/tool arm, which can operate with a bucket, claw-hook, drill, or pneumatic hammer. It is able to reach out 20 meters and lift 3 tons. If the bucket is not in use, a roll of fascine or trackway can be put between the partially-raised bucket and the vehicle, allowing the Terrier to carry and deploy a section. However, the Terrier is more likely to use a GKN HMT, carrying a roll of fascine, trackway, or concertina wire. It can also tow a trailer with the Minotaur, Barmine, or Volcano minelaying systems. A rocket anchor may be deployed to help anchor the vehicle when using the tools or bucket, in any direction from the Terrier.

An unusual feature of the Terrier is that it can be teleoperated, using a radio-connected remote control similar to a video game control, at a range of up 1000 meters. This mode is used when clearing dangerous areas. The cameras that the Terrier uses for teleoperation are in front of the driver's hatch, above the bucket, and next to the side excavator. They are designed primarily for the control of the apparatuses, but the driver's camera can also look up to 300 meters in the distance. The cameras are day/night.

The crew of two has air conditioning, heating, and NBC Overpressure protection. Both crewmembers have all-around vision blocks, with the front having a day/night channel. The commander has a manually-rotating cupola with a weapon mounted so that it can be aimed and fired with the hatches closed; alternatively, an RWS may be mounted. A bank of four smoke grenade launchers are found on each side of the vehicle at the top of the hull side. They have five day/night cameras for their use, giving them a 360-degree view around the vehicle.

Based on experience in Iraq and Afghanistan, the design of the Terrier has been modified. Bucket AV has been increased by 1 for each face. The Terrier has been given additional underside protection as well, and has also been given blast-absorbing seats. Finally, all-around appliqué armor has been added.

While the British MoD claimed that the Terrier is air-transportable by a C-130, this has not proven to be the case. They are now backing off that claim.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Terrier	$1,424,741	D, A	800 kg	30 tons	2	23	Thermal Imaging (D, G), WL/IR Spotlight	Shielded
Terrier (Modified)	$1,529,983	D, A	613 kg	33 tons	2	23	Thermal Imaging (D, G), WL/IR	Shielded

							Spotlight

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Terrier	171/119	43/30	521	254	Trtd	T6	HF12Sp HS8Sp HR7*
Terrier (Modified)	156/108	39/27	521	279	Trtd	T6	HF15Sp HS11Sp HR9**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Terrier	+1	Basic	L-7A2 (C)	3000x7.62mm

*Floor armor is AV 4Sp.
**Roof Armor is 6. Belly Armor is 8Sp.

BAE Titan AVLB

Notes: This AVLB is a new AVLB system, able to use several types of bridges. The Titan was designed to replace the Chieftain AVLB; the Chieftain AVLB was proving deficient at the lengths of possible span, loads of possible spans, and survivability in general. It is one of a planned family of vehicles based on the Challenger 2 chassis. The Titan has been service since 2006, and the final 33rd was delivered in 2008. The Titan has seen combat use in Afghanistan.

Depending upon bridges used and the bank conditions, the Titan can bridge a span of up to 60 meters. Three possible bridges can be carried: the No 10 Bridge can span 26 meters and weighs 13.88 tons, the No 11 can span 16 meters and weighs 8.54 tons, and the No 12 Bridge can span 13 meters and weighs 6.94 tons. The Titan also carries a number of trestles and wedges to allow the Titans' crews to overlay up to three of these bridges. The Titan can also carry and lay two No 12 Bridges. Each of these bridges is capable of supporting 70 tons. The No 10 and 11 are not scissor bridges (the No 12 is a single span), the top slides out and locks onto the front of the bottom bridge. (Unfolding a scissors bridge is like waving a big flag…)

The Titan has a number of wide-angle vision blocks and CCD cameras to increase the visibility of the crew while they work, especially if it works under fire. These cameras are day/night, with most of the night vision being by thermal imaging. The crew has an air conditioner, heater, and NBC Overpressure. The driver is in the front right while the other two crewmembers are in the center. Both are ringed by wide-angle vision blocks, and all three have one block with a night channel; they also have several LCD screens that show them the relevant images from the CCD cameras. The commander has a low-pintle mount for a machinegun.

Power for the Titan is the same as the rest of the Challenger 2 family: a 1200-horsepower Perkins CV12 turbocharged diesel, a David Brown low-loss gearbox (sort of like power assist for the steering and gearshifting), and an automatic transmission. The Trojan also has a 10kW APU to power systems while the engine is off, thus using less fuel.

The Trojan can tow the GKN HTT, with a variety of minelaying systems, MCLICs, fascines or trackway, or simple cargo.

An optional feature is a dozer blade at the front, to make the terrain on the bank more suitable or to brace the Titan while it is working. (Theoretically, it could also mount a Pearson mine plow, though this would be an unusual circumstance.)

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Titan (No 10 Bridge)	$970,095	D, A	400 kg	62.5 tons	3	29	Thermal Imaging (D, G, RWS), Image Intensification (RWS), WL/IR Spotlight	Shielded
Titan (No 11 Bridge)	$887,211	D, A	734 kg	57.16 tons	3	29	Thermal Imaging (D, G, RWS), Image Intensification (RWS), WL/IR Spotlight	Shielded
Titan (No 12 Bridge)	$862,377	D, A	834 kg	55.56 tons	3	27	Thermal Imaging (D, G, RWS), Image Intensification (RWS), WL/IR Spotlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Titan (No 10 Bridge)	127/89	29/21	1592+600	616	CiH	T6	TF10 TS10 TR10 HF140Cp HS24Sp HR16

Titan (No 11 Bridge)	139/97	35/24	1592+600	565	CiH	T6	TF10 TS10 TR10 HF140Cp HS24Sp HR16
Titan (No 12 Bridge)	143/100	36/25	1592+600	549	CiH	T6	TF10 TS10 TR10 HF140Cp HS24Sp HR16

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Titan	None	None	L-7A2	2000x7.62mm

*The “turret” is actually the bridge; it does not actually have anyone in it.

BAE Trojan AVRE

Notes: Designed to replace or supplement several vehicles, including the Centurion AVRE, Chieftain AVRE, and to some extent, the CR ARRV, the Trojan is an AVRE that can, to a certain extent, double as an ARV. The Trojan is based on a Challenger 2 chassis, and retains the Chobham and spaced armor of that tank, though overall, the armor levels are lower to reduce weight. They have not yet been offered for export, but a small number are stationed in Canada at the British Army Training Unit Suffield. Britain has 33 Trojans in service, and expects to have 66 by 2018. They saw their first combat use in Afghanistan in 2009.

The most prominent feature of the Trojan is its huge over-width mine plow. A Pearson Full-Width Mine Plow, it is generally able to push mines out of the way, being angles to slide the mines to the side without detonating them. It can, however, take some mine explosions and has an AV of 30Sp. (It not actually *Spaced* armor; this is an illustration of the plow’s strength.) The mine plow can instead be replaced with a standard bulldozer; this has an AV of 6. Another alternate installation is the mine plow at the front and bulldozer blade at the rear, though this makes towing a trailer impossible. This configuration is chosen when the excavator arm needs extra bracing, or when large positions need to be dug. The Trojan has a huge excavator arm attached on the front left, which can dig, clear obstacles, or deposit the fascine or trackway that the Trojan can carry at its rear. This bucket has a capacity of one cubic meter.6.5 tons. Alternate attachments include a three-way claw, a drill, an auger, and a hammer/pile driver. The Trojan can automatically mark the mines or mine-free lanes it has found with small flags (the Pearson Pathfinder system).

The armor suite of the Trojan is based on the armor of the Challenger 2, but it is believed that the individual layers in the armor are not as thick. The Trojan can also take lugs for ERA on the hull front and hull sides. It should be noted that though armor levels are not as great as the Challenger 2, but the suspension is actually much better protected, even though the roadwheels are aluminum (the drive sprocket, idler, and return rollers are steel). The engine is similar to that of the Challenger 2, being a 1200-horsepower Perkins CV12 turbocharged diesel, a David Brown low-loss gearbox (sort of like power assist for the steering and gearshifting), and an automatic transmission. The Trojan also has a 10kW APU to power systems while the engine is off, thus using less fuel.

The Trojan can tow the GKN HTT, with a variety of minelaying systems, MCLICs, fascines or trackway, or simple cargo.

The crew consists of a driver on the front left, a commander’s hatch, and the raised position for the operator of the excavator arm and plow, next to the driver. The driver has one day/night wide-angle vision block to the front. The commander does not have a cupola, but his position is ringed by vision blocks. The equipment operator has an electrically-operating cupola with all around vision blocks; one is day/night. The Trojan has an L-8A2 MAG machinegun mounted on an RWS to the left of the commander; this RWS has it’s own vision devices for the commander or equipment operator to use (either may control the machinegun), Also on the roof is a spotlight, which may be controlled by the commander or the equipment operator. The crew has air conditioning, heating, and NBC Overpressure, and there is some room inside for rations, ammunition, personal weapons and ammunition, and a few assorted personal items. (The Trojan has, to an extent, been designed around the crew positions.)

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Trojan	$1,292,539	D, A	700 kg	62.5 tons	3	35	Thermal Imaging (D, G, RWS), Image Intensification (RWS), WL/IR Spotlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Trojan	127/89	29/21	1592+600	616	CiH	T6	TF8 TF8 TR8 HF140Cp HS24Sp HR16

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Trojan	+2	Fair	L-8A2 (RWS)	3000x7.62mm

*The “turret” refers to the plow and excavator arm. The Mine Plow has an AV of 30Sp, the standard dozer has an AV of 6, and the excavator arm an AV of 10. Belly AV is 9Sp.

Vickers FV-4205 Chieftain AVLB

Notes: This is an AVLB in British service, based on the chassis of the Chieftain main battle tank. I have discovered that there were some export sales, but the only customer I have been able to find is Iran (before the revolution). The design work began in 1962, but the first examples did not see service until 1974. The Chieftain AVLB is currently used by only one regiment of the British Army. Chieftain AVLBs have seen action with the British in Desert Storm and Iraqi Freedom, and by the Iranians against the Iraqis.

The Chieftain can use one of two bridges: the No 8 Scissors Bridge, or the No 9 Single-Span Bridge. The No 8 Bridge weighs 12.2 tons, takes 5 minutes to emplace, and 10 minutes to recover. It is designed for up to 70-ton loads, and is capable of bridging a 22.86-meter gap. The No 9 Bridge is lighter at only 9.14 tons, and shorter at being able to bridge a 13.4-meter gap. It is still capable of holding 70 tons. Though the No 9 Bridge is not as capable in most ways, the Chieftain AVLB is much quicker carrying the No 9 Bridge. The Chieftain AVLB can also carry the No 8 or No 9 Bridge on top, and tow a trailer with a No 9 Bridge on it. The AVLB is able to grab the bridge from the trailer and lay it as an extension or adjunct to the previous bridge. Bridges may be combined by laying one bridge on top of the other at approximately the halfway point of the first span.

The driver, bridge operator, and commander are all in tandem, each seated somewhat above each other as you go back. The commander's cupola has a light machinegun which can be fired with hatches closed, and has full rotation, with all-around vision blocks. He does not have night vision. The bridge operator has vision blocks as needed – to the front and to see the bridge atop the vehicle. He has night vision. The driver has vision blocks to the left, front, and one that allows him to see somewhat to the right side. He has night vision.. A cluster of four smoke grenade launchers are on the hull on each side just forward of the driver's position.

Power is provided by the Leyland L60 multifuel 730-hp engine, coupled to a manual transmission. The transmission has an unusual feature – it can jump from Park to 2nd gear if necessary for a quicker takeoff.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Chieftain AVLB (No 8 Bridge)	$237,738	D, G, A	400 kg	53.3 tons	3	25	Passive IR (D, BO)	Shielded
Chieftain AVLB (No 9 Bridge)	$230,844	D, G, A	450 kg	50.24 tons	3	25	Passive IR (D, BO)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor*
Chieftain AVLB (No 8 Bridge)	138/56	35/14	1037	263	CiH	T6	TF4 TS4 TR4 HF48 HS16 HR10
Chieftain AVLB (No 9 Bridge)	142/58	36/15	1037	255	CiH	T6	TF3 TS3 TR3 HF48 HS16 HR10

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Chieftain AVLB	None	None	L-7A2 (C)	4500x7.62mm

*The "turret" is actually the bridge; it does not actually have anyone in it.

Vickers CR ARRAV (Challenger Armored Repair and Recovery Vehicle) Rhino

Notes: This is an engineer vehicle based upon the Challenger chassis. The adoption of the Challenger 1 tank and it's dramatic increase in size and complexity meant that a new class of recovery and repair vehicles was needed to perform field engineer work on them. As yet, it is exported only to Oman. The vehicle is officially referred to as the CR ARRAV, but more popularly known as the Rhino.

The Rhino is capable of carrying an entire Challenger power pack as well as all necessary repair equipment. There is a winch that can pull 68 tons (104 tons with block and tackle), an auxiliary winch that can pull 20 tons, and a crane on the left hull (able to reach over the entire vehicle) with a capacity of 6.5 tons and capable of lifting an entire Challenger 1 or 2 powerpack. The Rhino also has a front-mounted dozer blade capable of excavating 229 cubic meters per hour and offers increased bracing and traction when lifting heavy loads. A special trailer (The HMT, of High-Mobility Trailer) is often towed, carrying a spare powerpack, to free up room for other spare parts. The Rhino is equipped with welding and cutting equipment, powered by the vehicle's engine. Tracked and wheeled vehicle tool sets are also carried.

The CR ARRAV generally carries a crew of three, including a specialist mechanic. An extra two seats are provided, to seat the extra two mechanics that are normally carried. There is also room for two more passengers. The Rhino is equipped with night vision devices and has an L-37A2 MG located in a remote cupola, operated by the commander or one of the mechanics; feeding is by a continuous-feed belt mechanism. At the rear of the vehicle at the corners are, on each side, a cluster of four smoke grenade launchers. Two more are found at the front of the Rhino. The Rhino has an NBC Overpressure system with a vehicular collective system backup. Omani Rhinos have in addition an air conditioner and an engine able to operate without penalty up to 50 degrees Celsius; these modifications have since been made to British Rhinos.

The CR ARRAV is powered by the same Rolls-Royce Condor CV12 TCA turbocharged diesel engine as on the Challenger 1, developing 1200 horsepower. The transmission is automatic, and the engine and transmission can be set to bypass the drive train to bring full power to the devices (winches, cranes, power tools, etc. Towing capacity is 68 tons, with a solid tow bar or by wire rope. (If the latter option is chosen, someone must be in the disabled vehicle to actuate the brakes on it.) While towing 68 tons, the Rhino can maintain a speed of 30 kilometers per hour.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological

$751,951	D, A	5.8 tons	62 tons	3+4	37	Thermal Imaging (C, CO), Image Intensification (D, C, CO)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
150/105	38/26	1592	440	Stnd	T6	HF149 HS21Sp HR16

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	L-37A2	1000x7.62mm

Vickers Chieftain Engineer Vehicles

Notes: These vehicles are grouped mainly because they use the same chassis, powerpack, running gear, roadwheels, and tracks. Equipment varies, however.

FV-4002 Chieftain AVRE

There was to be a standardized Chieftain AVRE, with the designation of FV-4203, but that vehicle was never produced. Meanwhile, the need for AVREs did not dissipate, in Willich, Germany, the BAOR came up with their own Chieftain-based AVRE. This vehicle, at first being considered an interim design. was later put into production.

The primary role of the Chieftain AVRE is to enhance the mobility of combat forces. To this end, it has a large rack above the vehicle able to carry three sections of 60-meter, steel pipe type, 14.5-ton MLC-70 fascine trackways. The Chieftain AVREs winch can pull 57 tons, the auxiliary winch can pull 17 tons, and the crane can lift 36 tons. The dozer blade can excavate 192 cubic meters per hour. It thus has racks for explosives and connections to pull multiple trailers that are usually carrying more fascines or the Giant Viper or Python mine-clearing systems.

The hull of the Chieftain has had its turret removed; the positions for the crew are equipped with several wide-angle vision blocks, and the commander's position has a weapon on a pintle. Observation is also available to the rack operator through a wide angle periscope mounted on the left-rear bumper. A similar periscope is found on the front-left bumper. The rear of the Chieftain AVRE normally has a "penthouse" fitted, a simple position covered with pads to even out the surface and with bows and a tarp; up to six more periscopes may be fitted around the penthouse if necessary. In the penthouse, a collective NBC pack can be fitted; the inside of the vehicle has NBC Overpressure protection. The driver is still on the left front, the commander is in the center, while the equipment operator is on the right. Behind and below them are the other two engineers. Only the driver has night vision.

Power is provided by the Leyland L60 multifuel 730-hp engine, coupled to a manual transmission. The transmission has an unusual feature – it can jump from Park to 2nd gear if necessary for a quicker takeoff. (I have not yet determined the game effect of this feature.)

The statistics below are with the Chieftain AVRE carrying two fascine rolls and with the penthouse deployed, the standard configuration.

It should be noted that Danish Chieftain AVLBs and CHAVREs used different tracks and sprockets, and they are not interchangeable with British tracks and sprockets.

FV-4006 Chieftain CHAVRE

The CHAVRE (Chieftain Assault Vehicle Royal Engineers) has been replaced, first by modified Challenger 1, then by later Challenger 2-based like the Trojan and Terrier. Unlike the AVLB, most CHAVREs are new-build vehicles. The turret is removed, replaced by a higher roof with numerous cutouts for observation when using the CHAVRE's tools. Atop this raised roof, on the right side, in front and under full armor, is a commander's position with a pintle-mounted position; this is normally an L-7A2, but M-2HBs and L-86A1s have also been seen of CHAVREs. At the front of the vehicle is a heavy dozer blade, which has an AV of 20 against mine blast and IEDs. If desired, this dozer blade can be replaced by a dedicated mine plow. The winch at the rear is capable of pulling 10 tons, and in the center is a smaller winch with a capacity of 3.5 tons. A common attachment was a Giant Viper mine clearance device, towed by the winch or the vehicle itself. Atop the vehicle, up to four bundles of fascines. The CHAVRE has a telescopic jib; this is not for heavy loads, but for general clearance work or to attack heavy tools such an auger, pile driver, or small bucket.

Along with clearing obstacles, the Chieftain CHAVRE was often tasked with digging fighting positions, using its dozer blade and bucket.

The British keep some of the AVLBs in reserve. Some are also "civilianized" and sold on the open market. Others have ended up on display, in various states of running order. Many have also ended up as range targets at training ranges in Canada. One Danish AVLB is kept in running condition in a museum, one is on display at the Danish base Skive Barracks, and yet another Danish AVRE is a range target on a Danish range. The British also keep some CHAVREs in reserve, though like many AVLBs, they've been civilianized, put on display, or used as range targets. However, unlike the AVLB, CHAVREs are still used by Australia, India, Israel, Netherlands, Sweden, and Switzerland.

Twilight 2000 Notes: Though some Challenger CRARRV made to the festivities, most of these were sent to the Middle East. The AVLB was the primary British AVLB of the European Theater, and the CHAVRE was heavily used.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Chieftain AVLB	$345,276	G, AvG, D, A	4.9 tons	52 tons	5	18	Passive IR	Shielded
Chieftain CHAVRE		G, AvG, D, A	5 tons	48.35 tons	4		Passive IR	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Chieftain AVLB	140/56	35/14	955	265	CiH*	T6	TF8 TS8 TR8 HF84 HS18 HR10
Chieftain CHAVRE			1014		CiH**	T6	TF8 TS8 TR8 HF84 HS18 HR10

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Chieftain AVLB	None	None	L-7A2 (C)	1800x7.62mm
Chieftain CHAVRE	None	None	M-2HB (C) or L-7A2 (C) or L-86A1 (C)	1100x.50 or 1800x7.62 or 2460x5.56mm

*The “turret” is actually the fascine rolls. If they have already been deployed, the configuration of the Chieftain AVRE changes to “Stnd.”

Alvis FV-106 Samson ARV

Notes: The Samson is an armored recovery vehicle built on the Scorpion chassis. It is designed primarily to recover members of the CVR(T) family, but can also service the FV-430 series. Design work began in the early 1970s, with production starting in 1978. Users include Britain, Belgium, Brunei, Philippines, Oman, and Thailand.

The Samson is fitted with an internally mounted capstan 3.5-ton winch in place of the vehicle's turret and main gun. The vehicle is stabilized when working by an earth anchor that is manually deployed. Entry is by a small door in the rear of the vehicle, or by the commander's and driver's hatches on the roof. The Samson is used to repair and recover smaller armored vehicles and unarmored vehicles. Except as noted below, it is identical in characteristics to the Scorpion. The Samson has a main winch with a pull of 12 tons, a secondary winch with a pull of 3 tons, and an A-frame crane that can lift 5.5 tons.

The Samson is capable of amphibious operation by raising a flotation screen, and can be fitted with a propeller kit. Power is provided by a Jaguar J60 No 1 Mk 100B 190 horsepower gasoline engine, or a Perkins T6-3544 200-horsepower diesel engine, with a manual transmission. British Samsons, however, are powered by a Cummins 6BT diesel with 235 horsepower.

The driver is in the front left; behind him and in the center of the deck is a gunner manning a No 27 cupola with a pintle-mounted L-7A2. The commander and the other engineer are seated in the hull. The crew is protected by a collective NBC system.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Samson (Gas Engine)	$99,216	G, A	1 ton	8.74 tons	4	9	Passive IR (D)	Shielded
Samson (Diesel Engine)	$99,861	D, A	1 ton	8.76 tons	4	9	Passive IR (D)	Shielded
Samson (Perkins Engine)	$99,911	D, A	1 ton	8.77 tons	4	9	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Samson (Gas Engine)	174/70	44/18	405	97	Stnd	T3	HF6 HS3 HR3
Samson (Diesel Engine)	168/66	42/17	405	68	Stnd	T3	HF6 HS3 HR3
Samson (Perkins Engine)	188/76	47/19	405	81	Stnd	T3	HF6 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Samson	None	None	L-7A2 (C)	900x7.62mm

BAE FV-180 RO Defence Combat Engineer Vehicle (CET)

Notes: Three British companies originally participated in the competition for the CET; later, France and Germany also became interested in the eventual vehicle which would become the CET. In fact, tests were carried for the British in the UK and for Germany and France in Germany. Royal Ordnance Facility Leeds originally received the contract, but they were eventually bought by Vickers; the project was later bought by BAE. They incorporated some of the features of the US CET. The Germans withdrew from the project

in 1968, after they expressed a need for a heavier vehicle. British service began in 1975, after two major redesigns were carried out; full production began in 1978. The system, however, was discontinued in the 1990s, though it was deployed to Iraq as part of Operation Granby, and the type did not begin to leave service until 2001, when replacement started at a slow rate with the Trojan.

Though the design looks like it is based on a tank chassis, it is in fact a new design. It is unusual in that it has two casemates, one lower than the other. The dozer blade is a modification of that of the US CET; a different mine plowing blade may be installed instead. In either case, the driver controls the blade, as the blade is connected to the vehicle's final drives. The hull is all aluminum; in fact, only crucial parts which require high strength are made of steel, and some parts are of plastic. Most surfaces of the FV-180 are double walled; this not only has the effect of spaced armor. It's primary function, however, to decrease the amount of vibrations and noise inside the cabin (with mixed results).

The driver normally operates the winch. Behind him, on the upper casemate, is the dedicated crane operator; he can also operate the winch, or the jib crane. The commander's cupola is behind the engine on the lower casemate; it is armed with a heavy machinegun or grenade launcher. Note that it cannot be fired in the direction of the upper casemate. The crane operator's position can also be equipped with a medium or light machinegun, though it is on a normal pintle mount. (Many crewmen of the FV-180 prefer a grenade launcher. The FV-180 may skid steer to position itself more precisely, or to make sharp turns (though, as is usual for tracked vehicles, a thrown track is a possibility). The bucket/dozer is of light alloy, while the teeth at front are of steel. It has a maximum capacity of 1.72m^3, and the maximum lift height is 1.829 meters. (The FV-180 also travels with the bucket up when carrying fascines.) The bucket can dig 10.2 centimeters below ground height for digging or scarifying roads and runways. The bucket can also be used to steady the vehicle when using the winch on heavy loads. An earth anchor may also be employed, with a maximum reach of 91.4 meters; 10 charges are available for the rocket anchor, and the anchor may be repeatedly shot and reeled in. This may be employed for self recovery or normal recovery of vehicle, or to help increase pulling and digging power; however, the FV-180 is not primarily a recovery vehicle. The anchor can also be attached to the winch for an even longer shot. The dozer blade has an attachment that smoothes and hides the earth excavated, if possible.

The driver is seated in the front left, with a hatchway that opens left and right. The driver has a vision block to the front which may be removed and replaced with an IR block. (The vehicle also has a WL/IR spotlight at the top of the lower casemate; the upper casemate has a WL spotlight.) Behind him on the upper casemate is the winch operator, who also operates the WL spotlight. The other crewmen normally face to the front when they are at their stations; however, any one these may reverse his seat and consult an LCD panel, allowing them to take over the driver's duties using a set of duplicate controls. The other two may operate the bucket, winches, of any of the rest of the vehicle's mounted tools. The crew does not have NBC Overpressure protection, but does have an NBC collective system. It is air-portable in a C-130 Hercules aircraft. A normal crew for the FV-180 is only two, though up to two more engineers may be housed and accommodated within the vehicle. They enter and leave through a door on the rear.

The engine is to the right of the driver and the transmission is underneath it; they form an integrated power pack. The engine is a 320-horsepower Perkins E320TX diesel with a manual transmission that has four speeds forward and in reverse. The two together not only have power, but possess considerable torc. Without preparation, the FV-180 can ford 1.83 meters; it is amphibious with (considerable, 15 minutes) preparation. A trim vane must be lowered at the front of the vehicle, the bucket must be raised to its maximum elevation, and Hydrafloat blocks, made of plastic-cased foam, are attached behind the open trim vane, to the sides of the vehicle, and to the rear of the vehicle. It is propelled in water by waterjets; when they are turned on, the driver's controls are used to change the angle and deflection of the waterjets.

The main winch has a maximum pulling strength of 8 tons; it has 113 meters of wire rope and other lengths of rope may be attached at the end. The rope can be led to the front or back by changing the direction of the winch drum's rotation. The movable bucket can be rotated up to 270 degrees and may move 4 tons/1.72 cubic meters at one go. It may lift this crane, regardless of angle, to 1.829 meters at a maximum and a minimum height of 102 millimeters. It may travel safely with that load in either the front bucket of the crane for 50 meters at maximum load. An auxiliary lifiting device, a davit with a lifting winch, can be fitted to the inside of the earthmoving bucket. (It cannot, however, skid-steer while under load in the jib bucket of the main bucket.)

Other roles for the FV-180 include towing the Giant Viper and Python MCLICs. It can carry and deploy up to two fascine rolls, a class 30 or 60 trackway, or a pusher bar to aid an AVLB in deploying a bridge or to deploy a non-vehicle-launched bridge. A jib crane with a capacity of 4 tons can be installed in the bucket and hooked up to the crane bucket.

The FV-180 carries two sets of basic tools and two sets of power tools. It also has two air compressors to power the external tool sets. 20 kilograms of C4 are carried for exceptionally tough obstacles. Two sets of pioneer tools are also carried for when hands-on excavation is required. Heavy manual tools, like wire rope or normal rope cutters, are also carried. A full set of manuals (the actual printed manuals) are carried as part of the vehicle's basic equipment.

Indian and Singapore vehicles are equipped with air conditioners, but these were not retrofitted until the FV-180s were deployed to Iraq. (They were not so equipped for Desert Storm.) The weapon mounts are optional; British and Indian FV-180s have them, but most of Singapore's FV-180s do not. On the front of each bumper is a cluster of three smoke grenade launchers, for a total of six; these all face to the outside of the FV-180.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$752,844	D, A	800 kg	18.35 tons	2+2	30	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
123/86	34/24/7	418	113	Stnd	T4	HF6Sp HS4Sp HR4Sp

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB or Mk 19 AGL (C), L-7A2	1000x.50 or 320x40mm; 1000x7.62mm

*The front bucket is 50% likely to be hit by frontal shots. This bucket adds 6Sp to the FV-180's front armor, essentially doubling the effect of spaced armor if the bucket is hit. Belly and roof armor are 4Sp and 4, respectively.

GKN FV-434 Fitters Vehicle

Notes: Also known as the REME Fitters' Vehicle, this is an older repair vehicle used by England; design work began in the early 1960s and introduction was made in the mid-1960s. As yet, no export sales have been made or attempted. These vehicles have been partially replaced by the Challenger Repair and Recovery Vehicle, especially in tank units, and the FV-512/13 in armored units.

The FV-434 is based on the FV-432 APC, and cannot service vehicles larger than the Chieftain main battle tank (it is not powerful enough to carry the Challenger-series' engine or transmission), and even taking care of Chieftains is a stretch. It is basically similar to the FV-432, but has a load area at the rear of the hull roof for carrying large items. This load area is covered with a canvas tarpaulin supported by bows. On the right side of the hull is a crane with a capacity of 1.25 tons and a reach of 3.96 meters, or 3.05 tons at a 2.26-meter reach. A full range of tools is carried, along with workbench, vise, tow bars, and tow cables. The FV-434 does not have a winch, and it not means to recover vehicles (even itself). Light armored and unarmored vehicle repair is its purview.

On the right side of the hull is a crane with a capacity of 1.25 tons and a reach of 3.96 meters, or 3.05 tons at a 2.26-meter reach. A full range of tools is carried, along with workbench, vise, tow bars, and tow cables. The FV-434 does not have a winch. Though there are no blades or anchoring devices, the suspension can be locked when equipment such as the crane are used. These vehicles have been partially replaced by the Challenger Repair and Recovery Vehicle, especially in tank units.

The FV-434 is equipped with a fold-away work bench that opens to the rear of the vehicle, along with an attached, folding tent that extends the work area by one meter. There is also an interior folding work bench inside the rear of the vehicle. Power is provided by a K60 Multifuel engine with 240 horsepower, and a manual transmission. The engine does not only have high horsepower, but also a lot of torque. Toolsets include tracked and wheeled vehicle tools, pneumatic tools, and welding and cutting tools. (Once everything is loaded, along with a part of the crews' personal gear and ammo storage, not much room is left for any potential passengers.) Limited recovery can be done by towing or by the crane.

The FV-434 has a crew of driver, commander, and two mechanics, though the driver and commander are also qualified mechanics. The commander has a cupola with manual rotation and a pintle mount for a light machinegun. The driver is in the front left; the commander is directly behind and above the driver. The two other mechanics are seated inside the vehicle. The FV-434 has a small computer that primarily provides access to the many British Army vehicles' specifications. On the glacis is a cluster of four smoke grenade launchers on each side of the vehicle. A small "penthouse" can be erected over part of the rear deck of the vehicle, but this is limited in space by the installation of the crane.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$102,433	D, G, A	2.71 tons	17.75 tons	4	17	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
134/54	34/14	454	83	Stnd	T2	HF6 HS4 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	L-7A2 (C) or Bren L-2A4 (C)	1600x7.62mm

Alvis FV-512 MCRV/FV-513 MRV(R)

Notes: These related vehicles are also known as the Warrior Recovery and Repair Vehicles, or WRRV or the MCRV (Mechanized Combat Repair Vehicles). As the name suggests, they are recovery vehicle versions of the FV-510 Warrior IFV, and are used by Great Britain and Kuwait to support those vehicles and sometimes tanks. The primary difference between these vehicles is that the FV-512 does not have a winch, while the FV-513 does. The FV-512 may not have a winch, but it has a much greater stowage of repair parts.

Both vehicles have a crane with a 6.5-ton capacity in place of the turret of the FV-510, with a maximum reach of 4.52 meters. The FV-513 has a winch internally at the rear with a capacity of 20 tons (38 tons with pulleys installed), and has 100 meters of cable. The FV-513 also has a pilot winch on this vehicle that has 200 meters of cable and a capacity of 1.25 tons. On the front of the superstructure of both vehicles, there is a small one-man turret mounting a 7.62mm EX-34 ChainGun. The vehicles are air-conditioned, and have a small spade at the rear that is lowered to provide stability for the crane. NBC Overpressure with a collective backup is provided. These vehicles typically carry a wide variety of tools appropriate for their task of repairing tracked fighting vehicles.

Power for the vehicle and its components is provided by Perkins CV8 TCA 550-horsepower diesel, coupled to an automatic transmission. On either side of the forward superstructure are banks of four smoke grenade launchers.

In preparation for Operation Granby (the operational name for Britain's part in OIF), a decent layer of appliqué armor was added to British MRV(R)s. MCRVs were not sent to Iraq.

Both of these vehicles can tow the GKN High Mobility Trailer. This four-wheeled trailer was purpose-designed for these vehicles, but may be towed by other vehicles capable of handling the weight. It weighs 5.5 tons, can carry 6.5 tons (approximately the weight of

a Challenger power pack or two Warrior power packs), and is designed to provide a stable platform regardless of terrain conditions. The trailer's platform can be raised and lowered and provides a safe level platform for work when not connected for towing.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-512	$216,956	D, A	1.2 tons	30 tons	5	23	Passive IR (D)	Shielded
FV-513	$197,232	D, A	1.2 tons	30.2 tons	5	23	Passive IR (D)	Shielded
FV-513 (w/Side Applique)	$218,746	D, A	900 kg	32.63 tons	5		Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV-512/513	150/60	38/25	770	197	CiH	T4	TF4 TS4 TR4 HF20 HS6 HR6
FV-513 (w/Side Applique)	118/83	33/23	770	205	CiH	T4	TF4 TS4 TR4 HF20 HS12Sp HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(Both)	None	None	EX-34 ChainGun	1500x7.62mm

Vickers ARRV

Notes: These are Armored Repair and Recovery Vehicles based on the Vickers Mk 3 main battle tank. The users of the Vickers ARRV are the same as those who use the Vickers series of tanks, including Kenya, Kuwait, Nigeria, and Tanzania.

The Vickers ARRV lacks the heavy and composite armor of the Vickers Mk 3 (though it's protection is still substantial), and instead of a turret has a raised superstructure mounting a crane with a capacity of 4 tons (just enough to lift a tank power pack). Mounted to the left of the driver in the front of the vehicle is the main winch. It has 122 meters of cable and has a capacity of 25 tons, or 65 tons with block and tackle. When using the winch, an earth anchor is normally employed to brace the vehicle. There is also an auxiliary winch at the rear with a capacity of 4.06 tons and 250 meters of cable. The Vickers ARRV normally carries a full range of recovery and repair equipment, including welding and cutting gear, an air compressor, a fuel pump, a large set of tools (basic, wheeled vehicle, tracked vehicle, small arms, heavy ordinance), a tow bar, block and tackle, and various ropes, cables, and chains. The Vickers has a hatch on the front right deck for the driver, a commander's cupola on the left superstructure deck with an externally mounted machinegun that can be aimed and fired from within the vehicle, and a large hatch for the crew to work with the crane. A flat area on the rear deck can carry a complete MBT power pack.

Power is provided by a Detroit Diesel 12V-712T 720-horsepower turbocharged diesel. Vickers will instead equip the Vickers ARRV with a Perkins CV12 800E turbocharged diesel developing 800 horsepower. (No actual orders for a Vickers ARRV with this engine have been made, but the stats have been worked out anyway.) The Vickers ARRV is known for its exceptional suspension. Three of Kenya's Vickers ARRVs are unusual – they are not equipped with cranes, and are meant to be primarily recovery vehicles instead of repair and recovery vehicles, and the main winch can pull 75 tons with block and tackle. On each bumper, aimed slightly outward, is a cluster of six smoke grenade launchers. The driver is on the front left, and the commander behind and opposite of him, with a manually-operated cupola with a weapon mount.

The driver is on the front right, with the commander opposite him on the front left. As noted above, there is a large hatch on the left rear, running to the center; this is normally meant to facilitate working with the crane. (Supposedly, Kenyan ARRVs that do not have a crane use the extra space, modified into a rack for water and food and various oddments of personal items.)

Twilight 2000 Notes: Prewar sales went only to Kenya, Nigeria, and Tanzania, and even then only in small numbers, but some of these vehicles were produced during the Twilight War, and a few of these went to British forces in Europe.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Vickers ARRV	$875,340	D, A	3 tons	36.8 tons	4	23	Passive IR (D, C), WL Spotlight (C)	Shielded
Vickers ARRV w/800hp	$876,240	D, A	3 tons	36.8 tons	4	23	Passive IR (D, C), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Vickers ARRV	168/68	42/17	1000	262	Stnd	T6	HF76 HS10 HR8
Vickers ARRV w/800hp	177/72	44/18	1000	277	Stnd	T6	HF76 HS10 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Vickers ARRV	None	None	L-7A2 (C)	2600x7.62mm

BETA PLC MTP-1 ARV

Notes: This armored recovery vehicle is a variant of the MTLBu used by Bulgaria. It is used to recover and repair vehicles of a similar size and weight. Though based on an unmanufactured East German design, the MTP-1 is for the most part of Bulgarian design. Currently, except for spare parts, production is done when needed. It appears that the MTP-1 has not been built since the early 1990s The MTP-1 was designed to recover and repair light vehicles, with a secondary role in building large fighting positions.

MTLBu chassis is expanded both to the rear and to the sides; it is not only longer and has an additional roadwheel, the sides are for the most part sloped. The roof has a telescopic crane that can lift 3 tons, and can be extended over the entire vehicle to a maximum of 3.4 meters. (The operators can also restrict weight lifted to 2 tons, in which case the crane may be extended to 5 meters.) The crane is designed to reach over the front of the vehicle and can rotate 280 degrees, but does not have enough reach to reach over the rear of the vehicle or towards the rear corners.

The rear of the vehicle has a large blade similar to that on the engineering variant of the MT-LB that is used to brace the vehicle when using the crane. It can also be used to prepare vehicle entrenchments, and the MTP-1 can prepare a hull-down position for a main battle tank in 110 minutes. The MTP-1 also has a winch that can pull 30 tons, or 10 tons when not braced by the dozer blade. The dozer blade can also scrape and dig, digging, for example, to dig a complete Vasilek firing position in 110 minutes, The MTP-1 is fully amphibious with preparation. On the center deck is a flat area with tie-down rings for the carrying of a powerpack or large cargoes.

The cupola of the MT-LBu is retained. Most MTP-1 are armed with a PK or similar machinegun for local defense; however, some 25% of them are equipped with a DShK or NSVT. Power for the MTB-1 is a 300-horsepower turbocharged diesel; this no coincidence, as the MTP-1 is based on the MT-LBu. Along each side, there is a set of three stowage lockers; these not only store tools and spare parts, but also change the side armor from “no slope” to moderate slope. The MTP-1 is topped on the front left by the same turret as an MT-LBu; this is normally armed with a PKT, some 10% have seen with a DShK, or NSVT. On each side of the vehicle are three firing ports; in front and the rear door are each another firing port. These are inherited from the MTLBu. In the deck roof are a pair of hatches, plus a hatch for the driver on the front left side. On each glacis plate, on each side, are a cluster of three smoke grenade launchers; the crane operator has a WL spotlight.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$300,414	D, A	2.5 tons	15 tons	2+3	10	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
135/107	34/27/3	450	106	Stnd	T3	HF4 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT or DShK (C)	2500x7.62mm or 1200x12.7mm

M-113 Engineering Specially Equipped Vehicle (ESEV)

Notes: The ESEV is an M-113 APC modified with the use of a kit for combat engineers. The ESEV features an improved layout for 8 combat engineers plus their equipment; a hydraulic auger that may dig in earth, asphalt, and frozen ground to a depth of 3.048 meters and 203mm wide; hydraulic power tools (a chain saw, jack hammer, and an impact wrench that can also be used for wood boring); and a modified ramp that can be used as a working platform (and may hold up 500kg). Only the Canadian Army uses the M-113 ESEV. The ESEV may use the same add-on armor as the standard M-113.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$104,969	D, A	2 tons	11.65 tons	2+6	7	Passive IR	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
120/84	25/20	360	117	Stnd	T2	HF6 HS4 HR4

Fire Control	Armament	Ammunition
None	M-2HB (C)	2000x.50, Engineer Demo Chest

617 Factory Type 73 ARV

Notes: The Chinese lacked indigenous tank production facilities until 1956, when the Russians helped the Chinese construct 617 Factory, which at first manufactured a copy of the T-54A, which they designated the Type 59. However, they lacked adequate recovery and repair vehicles for their new tank until the early 1970s, when they started manufacturing the Type 73 ARV. This ARV was, like the Type 59, later exported to several countries, including Vietnam, Laos, Cambodia, and several African nations. The Type 73 was, as will be seen, only *adequate* for the PLA's needs.

The Type 73 is, as stated, based on a Type 59 chassis, without the turret, which is replaced by box-like stand from about one-third back to the rear of the vehicle. This has a flat area atop it for the transport of a Type 59's engine or transmission – it cannot transport both at the same time, as it does not have enough carrying capacity, nor does the crane have enough strength to lift both at once. (And anyway, the Type 59 does not have an integrated powerpack.) The crane is on the right side and is a simple boom-type crane with a capacity of 1 ton. The boom is manually operated from a hatch on the on the right deck just behind the commander's hatch; it does not have power operation The boom operator has a WL spotlight for use in night repair and recovery operations. The boom can rotate 140 degrees, mostly on the right side. The recovery winch can pull 25 tons, or 50 tons with two sets of block and tackle. At the rear is a dozer blade with teeth on the underside; it can brace a maximum of 54 tons, and is used to brace the vehicle when using the crane or winch. It has a secondary role in digging major fighting positions, moving rocks, and ripping up roads. Tools include basic, tracked vehicle, wheeled vehicle, power, small arms repair, and heavy gun repair tools (except the bore swabbing brush). It has an air compressor, a chainsaw, and a power-operated jack.

The driver is on the front left and has vision blocks around him except to the rear. The center vision block is a wide-angle block. To his right is the commander, who has a manually-operated cupola with all-around vision blocks and a mount for a heavy weapon. Most of the crew is armed with pistols, but one has a Type 56 assault rifle with 300 rounds, and the Type 73 carries 20 fragmentation grenades. Another crewmember sits inside the vehicle just behind the boom operator; he has no windows or firing ports. On each bumper is a cluster of four smoke grenade launchers.

The engine is the same M-12150L liquid-cooled diesel developing 520 horsepower. It has a manual transmission. The engine and transmission are modified to produce high torque when necessary. It has a Christie-type suspension, with reportedly a rough ride. Unlike the Type 59, the Type 73 cannot carry rear-mounted auxiliary fuel tanks – the rear-mounted dozer blade is in the way.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$208,562	D, A	1.1 tons	31 tons	4	17	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
122/85	34/24	790	150	CiH	T6	TF3 TS3 TR3 HF60 HS10 HR8

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

*The "Turret" is the boom crane; it is not a "Turret" as such. Personnel hits are considered misses.

**The dozer blade can be hit by rear incoming hits, where it can take the hits depends on the attitude of the dozer blade of the time. If such a hit is ruled, the rear get the additional benefit of 5Sp.

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NORINCO Type 84

Notes: This is a Chinese AVLB based on the Type 69 main battle tank chassis. The bridge is derived from that of the German Biber AVLB (see *NATO Combat Vehicle Handbook*), with alterations to mate it to Chinese-made bridge laying system. The total length of the bridge is 18 meters (16 meters usable), with a load limit of 40 tons. There is also a narrow inner track to the bridge, with a load limit of 8 tons. 3-4 minutes are required to lay the bridge, and 3-4 minutes are required to recover it. The bridge itself weighs 8.5 tons, and is based on the German Biber's bridge. It is constructed of light steel. Deployment is from the rear of the vehicle, with both halves being moved to the rear of the Type 84 along with the carrier frame. This frame lays the bridge.

The Type 84 has a crew of three; one of which is the driver in the front left side behind the glacis plate. The other two are the commander, who is in the right of the hull with all-around vision blocks and a raisable pivoting day/night periscope. When the bridge is deployed, the commander may mount a machinegun on the provided external mount. The bridge operator is in the center of the vehicle, again with all-around vision blocks and a day/night periscope. The chassis is basically a modified Type 69 MBT chassis. Power is provided by a Type 12150L-7BW diesel developing 580 horsepower, with a manual transmission.

If necessary, the Type 84 AVLB can operate without a commander, the position being left empty. However, the bridge operator cannot use the machinegun from his position, nor can he use the bridge controls from the commander's position.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$430,158	D, A	315 kg	38.5 tons	3	19	Passive IR (C, BO)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
124/87	25/20	935+380	167	CiH	T6	TF4 TS4 TR4 HF40 HS10 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	PK (C)	1500x7.62mm

NORINCO Type 85 Armored Repair Vehicle & Recovery Vehicle

Notes: The Type 85 Armored Repair Vehicle is a vehicle based on the chassis of the Type 85 armored personnel carrier, designed for vehicle repair teams. This vehicle has a raised superstructure topped with a cupola-mounted machinegun. The vehicle has a 5 kW generator, basic, wheeled vehicle, tracked vehicle, small arms, and heavy ordinance tools, a welding set, air and oil filter cleaners, and an inertia dynomometer. It normally carries a wide selection of spare parts.

The Type 85 Recovery Vehicle is a Type 85 armored personnel carrier with a hydraulic crane that has a capacity of 1 ton. Also included are basic, wheeled vehicle, and tracked vehicle tools, a welding set, a 5kW generator, excavating tools, an air compressor, a tow bar, ropes, and cables. They tend to be found in conjunction with Type 85 ARV noted above.

As a variant of the Type 85 APC, the two engineer variants have a Deutz BF8L 413F turbocharged diesel developing 320 horsepower; their suspension is by torsion bars and the transmission is manual. The crew enter and exit through a large door in the rear face; a table can also be folded down outside the vehicle to create more work space. The gunner (who is also a mechanic, like the rest of the crew) is on the center roof, manning a machinegun. The gun has full armored gun shields, with AV2. The driver is on the front left; he has three vision blocks to the front, and the center front can be replaced with a night vision block. A third hatch, behind the driver's hatch, is normally manned by the chief mechanic and has all-around vision blocks. The two oblong hatches are deleted, though there is a smaller hatch on the left side to the rear of center.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ARV	$89,500	D, A	1.5 tons	15 tons	5	14	Active/Passive IR	Enclosed
RV	$269,100	D, A	1.5 tons	15 tons	5	16	Active/Passive IR	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
(Both)	157/110	44/30/4	450	114	CiH	T4	TF2 TS2 TR2 HF6 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(Both)	None	None	DShK (G)	1120x12.7mm

NORINCO Type 90-II ARV

Notes: China's latest ARV design is meant to recover the Type 96 and 99 tanks, amongst other vehicles. As yet the Type 90-II ARV has not been exported; I have not been able to find reliably whether it is even on the export market. It is used by the PLA and will eventually replace all other ARVs in the tank recovery role.

As the name would indicate, the Type 90-II ARV is based on the Type 90-II tank. As such, it has the same basic chassis, leading to a heavily-armored ARV (though it does not have the Type 90-II tank's composite armor glacis), which is fast and able to operate with other newer vehicle formations. It has a French-designed 1200-horsepower engine, with an automatic transmission that is able to switch to manual mode to take advantage of the engine's enormous torque. The Type 90-II ARV has a MIL-STD-1553-A data bus to allow it to operate with Western BMSs (a version of which the PLA has standardized). The Type 90-II ARV has the same suspension improvements as the Type 90-II tank, giving it a smooth ride.

The driver is on the front left and sees through a large armored window to his front. He also has a pull-down image intensifier stowed to the front and above his head. The window has an armored shutter with a vision slit to close over the window in high incoming fire situations. The commander is on the front center on a power-traversed cupola. To the left of the commander's cupola is a manually-operated cupola with a heavy weapon mount. He can aim and fire the weapon when buttoned up. Both cupolas have all-around vision blocks and the both cupolas' frontal vision blocks have an image intensifier. Both cupolas have a WL spotlight for use when working at night. Other crewmembers sit in the hull when travelling. They have an NBC overpressure system with a vehicular NBC backup. They have a heater and AC. On the top front right side is a cluster of eight smoke grenade launchers.

The Type 90-II ARV has on the right side of the hull a 25-ton-capacity winch, able to traverse 290 degrees. The winch uses a 30mm wire rope and can pull 41 tons, or 82 tons with block and tackle. It can tow 50 tons as full speed, or 65 tons at half speed. In front is a dozer blade 400mm in height and as wide as the front of the vehicle, which can brace the vehicle during crane of winching operations, recover vehicles, or excavate 120 cubic meters per hour. Tools include deluxe versions of basic tools, wheeled vehicle tools, tracked vehicle tools, and power tools. It has an arc welder, a power jaw ("jaws of life") and a circular cutter. It has a chainsaw. It has two sets of pioneer tools, a 40-ton capacity hydraulic jack, and a selection of spare parts. It is able to carry a complete powerpack for a Type 90-II tank, Type 98, or Type 99. Tools, vehicle equipment, and the crane can be powered by a 118kW APU, to allow operation with the engine off. (The winch requires the use of engine power.)

The crew has a computer with a complete set of tech manuals for most of the PLA's vehicles and mechanical equipment to refer to when they have any questions.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,090,405	D, A	7.5 tons	48 tons	5	37	Image Intensification (D, C, G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**					
169/118	47/33	1000+400	440	CiH	T6	TF8	TS8	TR8	HF181Sp	HS30Sp	HR19

Fire Control	Stabilization	Armament	Ammunition
None	None	W-85 (C)	3450x12.7mm

*The “turret” is actually the crane, and a “turret” hit means that the crane has been hit. Personnel hits are regarded as a miss.
**The frontally-mounted dozer blade can sometimes take a hit; this blade adds 6Sp to the frontal armor. Whether it has been hit depends upon how high the blade is raised.

NORINCO Type 653/653A

Notes: The Type 653 (also known as the Type 84 or WZ-653A) series is an armored recovery vehicle based on the chassis of the Type 69 tank. The Type 653A is basically a Type 653 with a heavier, more powerful crane. The turret of the Type 69 is replaced with a raised superstructure, offset to the left of the vehicle. To the right of the vehicle is a crane; on the Type 653, this has a capacity of 10 tons, while on the Type 653A, the capacity is 20 tons. Both cranes have a reach of 6 meters and can rotate 360 degrees; the base is on the front right side. To the front of the vehicle is a large dozer blade used for bracing and for earthmoving (it may excavate 100 cubic meters per hour on dry soil, or use the blade as a brace if lifting heavy items). The Type 653 series also has a hydraulic winch with a capacity of 70 tons with 130 meters of cable (160 meters on the Type 653A). The Type 653 also has an auxiliary winch with a capacity of 10 tons. The Type 653 is equipped with a variety of tools for work on tracked and wheeled vehicles, and also carries excavating tools, as well as a large number of stowage boxes where other tools may be kept (other tools must be bought separately). A tow bar is carried on the roof. The Type 653 series is in use by China, Bangladesh, Iraq, Pakistan, and Thailand. The vehicle carries 100 kg of random vehicle parts, with the accent on tracked vehicle parts. A small amount have also been supplied to Kuwait along with their new PLZ-45 SP howitzers.

The commander is at the right of the superstructure; he has a modified position for his gun which may be aimed and fired from within the vehicle, with it buttoned up. The commander has all-around vision blocks and one with a day/night channel, and has a manually- operated cupola with a pintle for a heavy weapon. The driver is on the front left of the front, raised somewhat above the equivalent position on the Type 69 tank. At the rear of the superstructure is a large hatchway, one meter long and two meters wide, which has the control positions for the winch and crane. The two seats in this position may be swiveled 360 degrees, and may also move up and down. The operators have vision blocks to the rear and to each side of the compartment. One more crewmember is inside the hull, under the superstructure. As with the Type 69, the vehicle is powered by a Type 12150L-7BW diesel developing 580 horsepower, with a manual transmission.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 653	$929,762	D, A	3 tons	38 tons	5	17	Passive IR (D, C)	Enclosed
Type 653A	$978,351	D, A	3 tons	42 tons	5	17	Passive IR (D, C)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 653	124/87	25/20	935+380	167	Stnd	T6	HF40 HS10 HR8
Type 653A	118/83	24/20	935+380	176	Stnd	T6	HF40 HS10 HR8

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

ZTS MTU-34

In the post-World War 2 world, the Soviets were slow on the uptake on new AVLBs and the Czechs has a tradition of adopting their own designs or modifying Soviet designs. The MTU-34 is based on the T-34 tank, with the turret removed and replaced by a fold-out two-section bridge, able to span 20 meters and weighting 8 tons, and it can handle 40 tons. The crew is only two, a driver and a commander/bridge operator. The driver has a position in the glacis plate, with a large raiseable hatch with a vision block in it, that can be propped open to a straight-out position or closed. The hatch, when open, exposes the entire upper body. The commander/bridge operator is in a manually-operated cupola, with all-around vision blocks. There is no weapon mount or weapon carried. The top is largely taken up with the bridge and its erection system. Engine is the V-2-34 38 8 L 500 horsepower engine, with a manual transmission.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$894,870	D, A	400 kg	30.5 tons	2	11	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
131/92	36/25	480+360	143	CiH	T4	TF4 TS4 TR4 HF37 HS13 HR7

Fire Control	Stabilization	Armament	Ammunition
None	None	None	None

*The "turret" is the bridge; no crew casualties are possible, and such results should be treated as misses. If the bridge is deployed, Config is Stnd.

Nowy Jicin MTU-55 AVLB

Notes: The MTU-55A is a Czech AVLB is based on the T-55A chassis. It is used in place of the MTU-20 in Czech service and alongside the MTU-20 in Russia, India, Iraq, Yugoslavia, and in some Middle Eastern countries. It uses a stronger bridge that can support 50 tons. If necessary, a bridge from an MT-72 or MTU-72 can be substituted for the normal bridge carried by the MTU-55A. The normal bridge can span a gap of 18 meters, weighs 6.5 tons, takes 3 minutes to lay, and 3-8 minutes to recover. The bridge can support a vehicle weighing 50 tons.

A pre-production version, the MTU-55, is still in use by some third-world countries. It is often (erroneously) referred to as the MT-55L. It uses the bridge of the MT-34 on the T-55A chassis; This bridge is actually longer and heavier than the standard bridge, able to span 20 meters and weighting 8 tons, though it can handle only 40 tons.

As with the T-55A, the MTU-55 series has a V-55 38.88-I 581 horsepower diesel engine with a manual transmission and suspension by torsion bars. The two-man crew consists of a driver, on the front left, and a commander/bridge operator. The driver has three vision blocks to the front and slightly to the sides, and the commander has a manually-rotating cupola with all-around vision blocks. No weapon mount is provided.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-55	$1,015,332	D, A	500 kg	36 tons	2	19	Headlights	Shielded
MTU-55A	$1,142,249	D, A	500 kg	34.5 tons	2	19	Headlights	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-55	124/87	31/22	580+400	167	CiH	T6	TF4 TS4 TR4 HF63 HS12 HR8
MTU-55A	124/87	31/22	580+400	167	CiH	T6	TF4 TS4 TR4 HF63 HS12 HR8

*The "turret" is the bridge; no crew casualties are possible, and such results should be treated as misses. If the bridge is deployed, Config is Stnd.

Nowy Jicin VOP-025 Cancer 55 CEV

Notes: In this case, “Cancer” is not a disease; instead, it refers to the crab-like planform it has due to its many tools which stick out like a crab when deployed. It is based on a heavily-modified version of the T-55 and is, as I said, heavily-modified to fulfill its CEV role. The Czechs also sell the Cancer 55 as a kit, and this is especially applicable to T-55-based ARVs and RRVs.

The conversion removes the 100mm gun from the turret; the turret is retained and the main gun slot plated over. The turret now serves to rotate the main jib, which is on the right side of the turret roof. The jib can reach out 7.5 meters and has an elevation of +7 meters to
-4.5 meters. The jib can be tipped with a shovel able to raise 0.6 cubic meters per bucketful, a crane head with a capacity with a capacity of 30 tons, an auger able to drill half-meter holes 10 meters in 30 seconds, a large claw able to lift 1 ton, including the ability to place demo charges; and anti-bomb enclosure 2x2 meters in size. The Cancer 55 has a capstan-operated crane with a capacity of 45 tons, or 90 tons with block and tackle; it has 200 meters of 30mm steel cable. The front has a half-height dozer blade for bracing the winch or crane or to dig large fighting positions. The blade also has teeth to dig up road surfaces and concrete. For further stabilization, stabilizer legs may be lowered between the first and second roadwheels on each side.

The tool set includes an air compressor, power tools, excavation tools, tracked vehicle and basic tools, A large power hand-held circular saw is carried, as are power jaws ("jaws of life"). Large boxes on both sides of the rear carry these pieces of equipment. A large flat area on the rear of the hull normally carries at least 20 kg of plastic explosives and an engineer's demo chest, along with some personal gear as fits and other items that CEV crews have found necessary in the past.

Being a T-55 variant, it has the same V-12 water-cooled diesel developing 580 horsepower. The normal, travelling transmission is automatic; however, manual transmission may be switched to apply more torque when using the winch.

The crew normally consists of a driver and a commander/crane operator, though seats for two more crewmembers are provided in the hull. The driver is in the front left while the TC is in the right side of the turret. He has a cupola with night vision and a pintle for a heavy machinegun and a manually-operated cupola. The driver also has night vision as well as a backup camera. A small computer provides most relevant manuals and tech papers, and the vehicle has GPS that is tied into a battle and vehicle management system. On the left side of the turret is a cluster of eight smoke grenade launchers. The vehicle has NBC Overpressure capability.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$3,728,025	D, A	800 kg	43 tons	2+2	25	Passive IR (C), Image Intensification (Dx2, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
104/73	29/20	812+380	209	Trtd	T6	TF43Sp TS14Sp TR11 HF54Sp HS12Sp HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	NSVT (C)	3000x12.7mm

*The armored dozer blade has an AV of 12Sp. Whether it gets hit depends on how high the driver has the blade raised.

Nowy Jicin VT-55A

Notes: This vehicle was type standard in the Czech Army until the advent of the VT-72B; it is still used to recover lighter tanks and other armored vehicles. It is based on the chassis of the T-55 tank, and is similar to the Russian BTS-T-55-T recovery vehicle, and even more so, to the MTU-55A.

The turret of the T-55 is removed, and the opening replaced with steel plate and a cupola for the commander. The cupola has manual traverse, but the machinegun cannot be mounted unless the bridge is already deployed. On the right side of the hull roof is a crane that can lift 1.5 tons. On the rear of the hull deck is a platform that can carry a load of 3 tons. There are two winches; the main winch is driven by the engine, and can pull 25 tons with 200 meters of cable. The auxiliary winch has its own motor, can pull 800 kg, and has 400 meters of cable. The front of the vehicle mounts a full-width dozer blade that can excavate 150 cubic meters per hour. The VT-55A can normally ford water of 1.4 meters depth, but can be equipped with a snorkel allowing the vehicle to ford 5 meters for 1000 meters. These vehicles typically carry several tow bars and a 4.2 meter tow cable, as well as welding equipment and toolkits appropriate to its purpose of recovering and repairing smaller tanks and armored vehicles. The crew compartment has a heater.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,546,923	D, A	500 kg	36.45 tons	3	20	Active/Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
124/87	31/22	812	167	Stand	T6	HF67 HS16 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT (C)	3000x7.62mm

Leopard 1 ARV

Notes: These are descendants of the German BPz-2 Bergepanzer, and are generally improvements of modifications of that design. They were designed specifically for Denmark's needs, though some other countries use them as well.

Leopard 1 QRF

Developed by the Danes in Afghanistan, the QRF model (Quick Reaction Force) has upgraded armor, including dramatically increased belly armor and slat armor on the sides and front, as well as full track skirts on the sides. Its heavy machinegun has AV3 gunshields around it, and the commander is on an elevated rotating cupola and can aim and fire the gun while under armor with the hatch closed. He has all-around vision blocks. The QRF has the database of recovery and repair solutions. It may be regarded as a stopgap between the BPz-2 and the Wisent.

Leopard 1 Wisent

The Wisent is a Danish attempt to continue to make their Leopard 1 ARVs relevant by allowing them a shot at being able to recover Leopard 2 tanks. Chief among these improvements is the replacement of the 830-horsepower multifuel engine with a 1000-horsepower MTU MB 838 Ca M500 turbocharged diesel with a tropical kit. The crane is able to lift 30 tons, about the weight of a Leopard 2 turret (but not a 2A5 or 2A6 turret). Armor has been added, including MEXAS Applique passive composite appliqué armor and slat armor for the front and sides; the suite is equivalent is equivalent to the Canadian C2. The commander is surrounded by AV3 gunshields and can aim and fire his machinegun from under armor with the hatch closed. The crew has an air conditioner and heater and NBC overpressure protection. The secondary winch has been modified into a "Combat Recovery System", which makes recovering and use of the winches and crane possible without leaving the vehicle, using day/night CCTV cameras. Though a reasonably successful vehicle, particularly in recovering Leopard 1s and similarly-sized vehicles and smaller, it was not considered adequate at recovering the Leopard 2. The Wisent has a number of new components replacing the older components, including the powerpack, crane, winches, and hydraulic components. At first, the Danish government opted for the BPz-3 Buffel, but costs led them to continue with the Leopard 1 Wisent, which has become the prime vehicle for recovering Leopard 2s. The Wisent is also used by Belgium and Chile. It carries much more spare parts and tools, including those above and a chainsaw, power saw, "jaws of life," a pair of 30-ton hydraulic jacks, tracked vehicle tools, basic tools, wheeled vehicle tools, pioneer tools, an air compressor, and a 20kW APU. The Danish and Belgian Wisents have a GPS and a BMS system, compliant with NATO standards.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Leopard 1 QRF	$858,892	D, G, AvG, A	4 tons	45.53 tons	4+4	25	Passive IR (D, C)	Shielded
Leopard 1 Wisent	$1,866,390	D, A	4 tons	47 tons	3	26	Image Intensification (D, C), WL Spotlight, CCTV (Corners)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
Leopard 1 QRF	143/100	36/25	1410	333	Stnd	T6	HF46Sp HS15Sp HR8***
Leopard 1 Wisent	162/113	45/31	1410	371	Stnd	T6	HF76Cp HS22Sp HR8***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Leopard 1 QRF/Wisent	None	None	M-2HB (C)	2600x.50

*Gun hits are hits on the various cranes, winches, and tools on the vehicle. The GM will choose what it hit in such a case.
**The dozer AV is 6Sp. What will be protected on the front depends on how high the dozer is raised.
***The QRF and Wisent have a floor AV of 12Sp and a roof AV of 4Sp.

FFG Leopard 2 Wisent 2

Based on Afghanistan experience, the Danes have developed the Wisent 2. The Wisent 2 can double as an AEV through the use of modular components. Such a change in role takes 5 hours to accomplish. The dozer blade can be replaced with a mine plow regardless of role. Also regardless of role, the Wisent 2 can be equipped with a mine lane marking system. As an AEV, the crane is replaced with a modular crane that can mount a bucket with a 1.3 cubic meter capacity and can lift 4 tons. The crane can also mount an auger, scraper, or rocket anchor (for digging also; the crane has a capacity for only 30 tons). A high-performance dozer blade can be mounted, and extensions may be mounted, that allow an earthmoving capacity of 400 cubic meters per hour.

As an ARV, the Wisent 2 can lift 32 tons with its crane, able to lift even a Leopard 2A5 or 2A6 turret, or the powerpack of a Leopard 2 as well as smaller vehicles. The main winch's capacity has been increased to 40 tons, or double that with block and tackle, or 120 tons with a 3-1 mechanical advantage. It has 160 meters of cable. The auxiliary winch has a capacity of 3 tons and has 280 meters of cable. Armor has been dramatically increases, so that it is on par with the Leopard 2 MBT. It also can take slat armor, and has lugs for era on the sides and front. The Wisent 2 has a fire suppressions and detection system, and puts out only the affected module. The

engine has been replaced by an MTU MB 873 Ka 501 turbocharged diesel engine with a capacity of 1500 horsepower. It has an automatic transmission that can be switched to a manual transmission for more efficient pulling and winching operations. The Wisent can ford up to 2 meters, or 4 meters with a deep wading kit. It should be noted that the Wisent 2 is based on the Leopard 2 tank. It has the same tools as on the Wisent 1 and the same APU. The Wisent 2 is equipped with a CIWS that allows the commander to aim, fire, and reload the machinegun or grenade launcher from inside the vehicle, though his position is still on a raised cupola. This CIWS has night vision and a ballistic computer, and the cupola has all-around wide-angled vision blocks.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$3,060,924	D, A	6 tons	60 tons	3	10	Image Intensification (D, E, C), Thermal Imaging (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
169/119	47/33	1450	552	CiH	T6	TF 20Sp HS15 HR10 HF200Cp HS28Cp HR16***

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	M-2HB (C)	2600x.50, Engineer Demo Chest, 20 kg C4 (for AEV)

*Some turret hits are hits on the various cranes, winches, and tools on the vehicle. The GM will choose what it hit in such a case.
**The dozer AV is 6Sp. What will be protected on the front depends on how high the dozer is raised.
***The Wisent 2 has a floor AV of 12Sp and a roof AV of 6Sp.

KAM-1

Notes: This Finnish recovery vehicle is a conversion from the T-55 chassis. The turret of the T-55 is removed and replaced with a large turntable mounting a heavy-duty crane. The crane has a capacity of 22 tons with a reach of 6.7 meters. The winch has a capacity of 36 tons in a straight pull, or 72 tons with block and tackle, and has 140 meters of cable. The vehicle is equipped with a dozer blade, a towing jib and tow bar, ropes, and a wide variety of tools, including wheeled vehicle, tracked vehicle, excavating, small arms, heavy ordinance, basic, and welding. The vehicle has the ability to generate smoke by injecting diesel into its exhaust.

Twilight 2000 Story: This vehicle was just beginning to be produced before the Twilight War, and there are perhaps 20 of them in all Finland.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$112,371	D, A	2 tons	44 tons	2	14	Active/Passive IR, WL Spotlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
92/64	20/15	812	215	Stnd	T6	HF67 HS16 HR8

GIAT AMX-10 ECH

Notes: The AMX-10 ECH is the repair vehicle version of the AMX-10P APC. It retains the full armament of the standard AMX-10P, but instead of an infantry squad carries a reduced crew of mechanics. The driver is seated at the front left of the hull, and there is a large drop ramp in the rear of the vehicle with a door in it. On the right side of the rear deck is a crane with a capacity of 6 tons. The commander/operator has a small roof hatch that he uses when working with this crane. When the crane is used, jacks are lowered under the rear of the hull to brace the vehicle. The vehicle has a dedicated gunner, who is also a mechanic. Other equipment carried includes a full range of tools and a pair of jacks each with the ability to jack up one side of a 15-ton vehicle, allowing torsion bars to be repaired or replaced. Other tools include an air compressor, and tool sets for most wheeled and tracked vehicle needs. Note that the AMX-10 ECH does not have a winch, does not normally carry tow bars or tow cables, and in general does not have the muscle for recovery operations. Power is provided by a Hispano-Suiza HS-115 280 horsepower diesel. with a manual transmission and a torsion bar suspension. Though the AMX-10 ECH is primarily meant to repair the AMX-10 family of vehicles, it does have a secondary role of servicing the AMX-30 series.

The AMX-10 ECH is powered by a Hispano-Suiza HS-115 supercharged diesel developing 276 horsepower. It does not have automatic transmission.

France, Saudi Arabia, Greece, Mexico, Qatar, and the United Arab Emirates use the AMX-10 ECH, though the AMX-10 ECH has largely been replaced in the French Army by the Leclerc ARRV.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$629,120	D, A	2.5 tons	13.8 tons	5	13	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
154/108	43/30/5	528	82	CiH	T2	TF3 TS2 TR2 HF4 HS3 HR2

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	20mm M-693 autocannon, AAT-F1	576x20mm, 2000x7.62mm

*The dozer blade has an AV of 4Sp, and what it protects in the front depends on how high the dozer is lifted.

GIAT AMX-13 PDP

Notes: This is an AVLB based on the AMX-13 chassis. The scissors-type bridge can span a gap of 14.01 meters and is suitable only for light vehicles, able to support 25 tons. The bridge weighs 4.7 tons and takes 3 minutes to emplace or recover. It is deployed and recovered over the rear of the vehicle. Two stabilizers are lowered at the rear before the bridge is emplaced or recovered. The crew consists of a commander on the right side, the bridge operator in the center, and the driver in the front left. The commander is able to employ his machinegun when the bridge is loaded onto the AMX-13 PDP, though fields of fire are very limited when the bridge is loaded (practical fields are about 80 degrees to the front). The power is provided by a SOFAM gasoline engine developing 250 horsepower, with a manual transmission.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$382,949	G, A	400 kg	19.2 tons	3	11	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
109/76	30/21	480	104	CiH	T3	TF4 TS4 TR4 HF6 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	AAT-F1 (C)	2000x7.62mm

*The "turret" is actually the bridge when carried by the vehicle. “Turret” personnel hits are not possible, and treated as misses. The Config is Stnd when the bridge is deployed.

GIAT AMX-13 VCG

Notes: This is a Combat Engineer Vehicle version of the AMX-13. The VCG has a 2.85x0.7m dozer blade capable of excavating 45 cubic meters per hour, An A-frame crane with a 4.5-ton capacity, a winch with 40m cable able to pull 20 tons, 2 smoke projectors, 1 smoke discharger, 2 mine detectors, an electric drill, a hammer drill, a power saw, and an integral 4.5Kw generator are all included. The turret has been replaced with a raised superstructure with an M2HB aimed and fired from inside or outside the vehicle. There are two hatches on the roof and hatches on the sides, and a driver’s hatch on the front left deck. The passenger seats are little more than seats squeezed in to the interior where they fit, and are more often than not filled with extra equipment. The engine may be a SOFAM gasoline engine developing 250 horsepower, or a Detroit Diesel 6V-53T turbocharged diesel (a variant of that found in the M-113) developing 280 horsepower. The AMX-13 VCG often tows a trailer with anything from more fuel to a Minotaur or MICLIC.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Gas Engine	$1,798,770	G, A	2 tons	17.6 tons	3+6	17	Passive IR (D)	Shielded
Diesel Engine	$1,799,001	D, A	2 tons	17.8 tons	3+6	15	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Gas Engine	122/86	34/24	410	112	Stnd	T3	HF6 HS4 HR4
Diesel Engine	131/91	36/25	410	83	Stnd	T3	HF6 HS4 HR4

Vehicle	Fire Control	Armament	Ammunition
(Both)	None	M-2HB (C)	1000x.50, Engineer Demo Chest, 30 kg C4

*The dozer blade has an AV of 6Sp, and what it protects in the front depends on how high the dozer is lifted.

GIAT AMX-30D ARV

Notes: This is an armored recovery vehicle version of the AMX-30 tank. Known users include France (being replaced by the Leclerc DNG), Cyprus, Greece, Qatar, Saudi Arabia, Spain, UAE, and Venezuela. The AMX-30D is built by France and used by that country, as well as most countries that use the AMX-30 tank, though in France it is being replaced by Leclerc-based ARVs, since the AMX-30D cannot consistently recover the larger and heavier Leclerc. It is still available on the international market, either as a new-built vehicle or as a kit for existing AMX-30 tanks. It's primary role is recovery and repair of MBTs and their family of vehicles; engineering work is a secondary role.

The turret is removed and replaced with a raised superstructure. The driver sits at the front and slightly to the left side of the vehicle, with the commander to his rear with a raised TOP-7 cupola mounting a machinegun. This cupola is similar to that of the AMX-30 series of tanks but does not have the IR searchlight and is manually-rotated. The machinegun may be aimed and fired when the vehicle is buttoned down via a 10x periscope. To the rear of the commander's cupola is a hatch for the two mechanics; to the front and rear of their hatch is a single wide-angle vision block. At the front of the hull is a dozer blade used for earthmoving and to brace the vehicle during crane and winching operations.

The crane, known as a Griffet-type crane, is on the front left side and can lift 12 tons through 240 degrees, or 15 tons when lifting while the crane is positioned straight forward and the dozer blade is lowered. (There is a version used only by France, called the AMX-30DI, which can lift 15 tons through the entire 240 degrees.) There is a platform on the rear of the superstructure to carry engines and other large assemblies. The main winch is located in the center of the hull, with the cable leading out of the front of the hull. This winch has a 35-ton pull with 100 meters of 34-millimeter cable. It cannot be overstressed, as it stops automatically when this 35-ton limit is reached, but block and tackle can increase the amount pulled to double the normal 35 tons. The auxiliary winch has 120 meters of 11.2-millimeter cable and has a 3.5-ton pull. The crew compartment has a heater, and a snorkel can be installed that allows fording of up to 4 meters depth. It has a selection of tools, including basic tools, tracked vehicle tools, wheeled vehicle tools, and standard power tools, as well as an air compressor, 30-ton hydraulic jack, and a welding set. It carries 5 tons of spare parts, as well as sometimes a power pack on its rear deck (not included in the price).

The engine is a simpler and more reliable version of the HS-110 engine of the AMX-30 (called the HS-110-2), it develops 700 horsepower at 2600 rpm, instead of the 720 horsepower at 2000 rpm of the HS-110, so it has more torque and less raw power. A small computer database aids with repairs of most French-built vehicles. Most countries have installed GPS and a BMS system. Versions sold to the Middle East are designated AMX-30D(S) and have more robust sand and oil filters, better-sealed components, and sand shields along the tracks and front and rear of the vehicle.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,125,394	D, G, A	3 tons	36 tons	4	21	Passive IR (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
139/98	39/27	1100	208	Stnd	T6	HF58Sp HS14Sp HR8

Fire Control	Stabilization	Armament	Ammunition
None	+1	AAT-F1 (C)	4000x7.62mm

*The dozer blade has an AV of 10Sp, and what it protects in the front depends on how high the dozer is lifted.

GIAT AMX-30 AVLB

Notes: This is an AVLB version of the AMX-30 main battle tank. The AMX-30 AVLB is not used by France, but is used by Saudi Arabia, and it remains on the international market, either as new-build vehicles or a kit to convert from an AMX-30 tank. Though proposed in the 1960s, production did not begin until the mid-1970s.

The hull is virtually unchanged from the base vehicle, but the turret is removed and replaced with a bridge that can span a gap of 20 meters with a total span of 22 meters. The bridge is a scissors-type bridge, can support 50 tons and takes 5 minutes to lay or recover. The bridge itself weighs 8.5 tons; it is 3.1 meters wide, but may be widened with thick panels to 3.92 meters. The vehicle has a commander, driver, and bridge operator, but the vehicle is unarmed except for crew small arms. The driver is in the front left behind the glacis plate, and has three forward vision blocks, with the center one replaceable by a night vision block, either Passive IR or Image Intensification. The commander and bridge operator are to the rear of the driver; the commander has a manually-operated

cupola, but is unarmed. The bridge operator has no cupola, but has all-around vision blocks. The bridge can be deployed and recovered without the crew leaving the vehicle. The crew has air conditioning, heating, and NBC Overpressure. The EBG has a small computer with engineer solutions and ideas in it. The driver's compartment and power pack are separated from other parts of the vehicle by a fireproof bulkhead. The engine is a HS-110 turbocharged diesel developing 700-horsepower at 2400 rpm with torsion bar suspension and an automatic transmission. Saudi AVLBs have GPS and a BMS.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,099,755	D, G, A	315 kg	42.5 tons	3	27	Image Intensification (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
134/94	37/26	1100	258	CiH	T6	TF4 TS4 TR4 HF58Sp HS14Sp HR8

*The "turret" is actually the bridge when carried by the vehicle. Turret personnel hits are not possible, and treated as misses. The Config is Stnd when the bridge is deployed.

GIAT AMX-30 EBG

Notes: This is a CEV version of the AMX-30, similar in concept to the US M-728. It was not built for export and used only by France. They retired shortly after Desert Storm.

The EBG has a dozer blade capable of excavating 120 cubic meters per hour and also acts as a mine plow, a winch capable of pulling 20 tons with 40m of cable, and a hydraulic arm with pincers capable of lifting 15 tons.

The EBG has a two-tier turret with a MAG MG and 4 reloadable smoke projectors on the top tier, and a 142mm demolitions gun and 4 separate mine throwers on the bottom tier. The two tiers are able to rotate independently; they are for all intents and purposes independent turrets. Note that the sights are designed only for the firing of HESH rounds, and the Fire Control and Stabilization below apply only to that gun. The EBG has an integral 50Kw generator. Tools carried includes a chainsaw, electric saw, “jaws of life,” basic & tracked vehicle tools, and pioneer tools. The driver’s hatch is located on the left front deck, and the commander’s and loader’s hatches are located on the turret deck. The gunner uses the loader’s hatch. Note that the EBG often carries lugs for ERA on the turret sides and front.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
700 hp Engine	$2,224,942	D, G, A	500 kg	38 tons	3	19	Passive IR (D, G)	Shielded
800 hp Engine	$2,226,078	D, G, A	500 kg	38.4 tons	3	23	Passive IR (D, G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
700 hp Engine	146/102	40/28	1100	260	Trtd	T6	TF23Sp TS8 TR6 HF58Sp HS14Sp HR8
800 hp Engine	147/103	41/29	1100	297	Trtd	T6	TF23Sp TS8 TR6 HF58Sp HS14Sp HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(Both)	+2	Fair	142mm Demolitions Gun, AAT-F1 (C), 4xMine Throwers	15x142mm, 4000x7.62mm, 40xMines, Engineer Demo Chest, 20 kg C4

*The dozer blade has an AV of 10Sp, and what it protects in the front depends on how high the dozer is lifted.

AMX-D Recovery Vehicle

Notes: Also known as the AMX-13-AD, this is a recovery vehicle meant to recover and repair AMX VCI and AMX-13 vehicles and similar-sized vehicles. The basic chassis is fitted with a raised superstructure in the center of the hull; it is large and looks like a turret, but it is not. To the left of this superstructure is a crane with a capacity of 6 tons and the ability to swivel through 240 degrees. The main winch leads out through the front of the hull and has a capacity of 18 tons with 100 meters of cable; this can be raised to 36 tons by use of block and tackle. Atop is a large roller to help support the crane, allowing it to be a lighter structure than would be normal for such a crane on a small vehicle. What looks like a radar dish on the front left on the superstructure is actually a spare roadwheel; another is carried on the glacis plate. The auxiliary winch is in the rear of the hull and has a capacity of 3.5 tons with 120 meters of cable. The AMX-D is equipped with basic, tracked vehicle, wheeled vehicle, small arms, and heavy ordinance tools, an air compressor, a welding set, and excavating tools. The front has a dozer blade to stabilize the vehicle when using the crane of winches. The driver remains in his front right position, and the gunner and in front of him, with a manually-operated cupola with all-around vision blocks; the front vision block has a night vision channel. The commander is opposite and behind the gunner near the back of the superstructure, with a manually-operated cupola with all-around vision blocks. The vehicle is generally festooned with boxes containing spare parts and tools. At the rear of the superstructure is a WL spotlight, which can be turned from within the superstructure.

The engine used is a SOFAM 8Gxb gasoline engine developing 250 horsepower.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AMX-D (M-2HB)	$356,427	D, G, A	500 kg	38 tons	3	33	Passive IR (D, G)	Shielded
AMX-D (20mm)	$534,870	D, G, A	500 kg	38.4 tons	3	33	Passive IR (D, G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
AMX-D (M-2HB)	77/53	22/16	410	139	Stnd	T3	HF8 HS4 HR4
AMX-D (20mm)	76/53	21/15	410	139	Stnd	T3	HF8 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AMX-D (M-2HB)	None	None	M-2HB (C)	2000x.50
AMX-D (20mm)	None	Basic	M-693 20mm Autocannon (C)	576x20mm

*The dozer blade has an AV of 4Sp, and what it protects in the front depends on how high the dozer is lifted.

GIAT Leclerc EPG AEV

Notes: Based on the Leclerc MBT, the EPG (Engin Principal du Genie, or Armored Engineer Vehicle) was originally conceived as a private venture by GIAT/Nextor. It is also referred to as the Modular Armored Engineer Vehicle. It is offered on the international market, but it's only customers so far are the UAE (who bought 46) and the French Army (who bought 15). The chassis is based on a turretless Leclerc, and uses most of that chassis in a modified form.

The EPG is based more properly on the Leclerc DNG Armored Recovery Vehicle, and uses the same planform of a Leclerc chassis with a raised superstructure. The modular nature of the EPG means that the EPG may have a front-mounted dozer/mine blade or a rocket anchor. The rocket anchor is attached to a winch with a capacity of 36 tons and 180 meters of cable. The two cannot be mounted at the same time. A lead winch has a capacity of 1.5 tons, with 200 meters of cable. The EPG is equipped with a large arm, which is normally faced to the front and is capable of traversing through 230 degrees. It has a maximum range of 9 meters. It can be equipped with a bucket capable of digging to a depth of 3.7 meters and has a capacity of 1000 kilograms. An optional larger bucket can dig to the same depth, but has a capacity of 1200 kilograms. The arm may also be fitted with an auger, grappling hook, or standard hook (turning the arm into a hoist). The EPG can be configured by the attachment of a trailer for minelaying or mine removal.

On the rear deck is a platform to carry specialized equipment or extra tools or attachments. It can also carry a MICLIC, minefield markers, demolition equipment, or the Minotaur minelaying system. In the lower front of the vehicle is the Demeter magnetic signature duplicator, which prevents the detonation of magnetic mines the EPG is moving over 90% of the time.

Behind and to the left of the arm is the commander's hatch; he has AV3 gun shields surrounding him and is armed with a heavy weapon. He has an electrically-rotating cupola (with a manual backup) which is raised somewhat and has all-around vision blocks. The front three blocks have night vision channels and a gunsight reticle; he may aim and fire his weapon when buttoned up. The driver has his station on the front left; he has vision blocks on the front and left, including one in the front with a day/night channel. A third combat engineer has a seat in the hull. Smoke screens are provided by four (two on each side of the glacis) Galix wide-band smoke/IR smoke grenade dischargers. A further four dischargers on each side of the glacis can fire smoke grenades or antipersonnel grenades. The EPG uses the Leclerc armor suite and is further protected by ERA lugs on the front and sides, and appliqué on the floor. The crew is protected by an NBC overpressure system with a vehicular NBC backup. An automatic fire detection and suppression system is standard. The EPG is equipped with the standard French Army GPS and BMS systems, as well as a small computer with a database of combat engineer operations. The crew compartment has air conditioning and heating and a rarity in combat vehicles, a chemical toilet.

Tools include a chainsaw, air compressor, two sets of pioneer tools, a power rotary saw (used by hand), a welding and cutting set, and a "jaws of life." These, the arm, the rocket anchor, the dozer blade, and the winches can be powered by a 10 kW diesel APU carried internally.

If necessary, the EPG can be operated unmanned and remotely, through a control box with 50 meters of cable that has controls for the winches, rocket anchor, and arm, and a video link with a day/night channel. This is often useful for breaching minefields.

The armor of the EPG is modular; as better or new types of armor are developed, the faces of the turret, glacis, and hull sides can be easily removed and replaced with new developments in armor. The engine is a 1500-horsepower SACM V8X-1500 Hyperbar supercharged diesel with an automatic transmission. It can spray diesel fuel into the exhaust to produce a smoke screen. The driver can adjust track tension from his station, allowing him to increase tension for road use or loosen it for more challenging terrain. UAE EPGs start out as Block I chassis, but the engine and transmission replaced with the EuroPowerPack consisting of an MTU 883 1500-horsepower supercharged diesel along with an automatic transmission that are both more reliable in desert conditions. The UAE EPG is a bit longer in the rear sections to allow it to carry larger internal fuel tanks. UAE EPGs have improved cooling systems for the

engine, and improved air filters.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
EPG	$4,472,993	D, A	2 tons	60 tons	3	29	Image Intensification (D, C)	Shielded
UAE EPG	$4,480,448	D, A	2 tons	60.1 tons	3	17	Image Intensification (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
EPG	171/120	47/33	1300	279	Stnd	T6	HF170Cp HS28Sp HR19
UAE EPG	171/119	47/33	1600	279	Stnd	T6	HF170Cp HS28Sp HR19

Vehicle	Fire Control	Stabilization	Armament	Ammunition
EPG	+1	Basic	M-2HB (C)	2000x.50, Engineer Demo Chest, 30 kg C4

*Floor armor is 12Sp. The dozer blade has an AV of 6Sp and what it protects in the front depends on how high the dozer is lifted.

Nextor Leclerc DNG

Notes: This armored recovery vehicle was originally produced for Abu Dhabi, but France later decided to buy some for its own army when the AMX-30D proved its shortcomings when recovering the Leclerc series. (The French designation is the Leclerc DCL.) Though the primary job is the recovery and repair of the Leclerc series, it has a secondary role of general dozing and obstacle removal.

The Leclerc DNG is a conversion of the EPC Leclerc main battle tank. The turret has been removed and replaced with a raised superstructure, and the vehicle has been lengthened so it has seven roadwheels on each side instead of six. The right side of the vehicle carries a long crane with a reach of 7.9 meters over 260 degrees that can lift 30 tons. This is enough to lift a Leclerc turret and swing it out of the way. The vehicle has a main winch with a capacity of 34 tons and 160 meters of cable, and an auxiliary winch with a capacity of 15 tons and 160 meters of cable. The main winch has a capacity of 70 tons when improved with block and tackle. To the rear of the superstructure is a platform that may carry a complete Leclerc power pack (approximately 4 tons; this is not included in the cost of the vehicle below). On the hull front is a dozer blade for bracing the vehicle or obstacle removing. This may be replaced with a mine plow. The crane, dozer, and winches are the same as the ones on the German Buffel ARV. A 10kW diesel generator is provided to power tools, the winches, and crane when the engine is turned off. The Leclerc ARV carries a welder, air compressor, electric and electronic repair tools, and a complete set of tools to service main battle tanks and other armored vehicles. The crew compartment is air-conditioned and heated and includes a chemical toilet. The Leclerc DNG has an NBC overpressure system. The vehicle mounts the Galix close-defense system, which automatically lays a smoke screen and infrared countermeasures if the vehicle is threatened by enemy missiles or targeted by lasers. For this reason, there are 20 smoke dischargers.

Armor is similar in protection to the EPC Leclerc, though it typically lacks the composite armor. There are lugs on the glacis, vehicle front, and vehicle sides for ERA. The commander's gun position is ringed by AV2 gun shields. His manually-operated cupola is also ringed by vision blocks. The chief mechanic/crane operator also has a cupola with all-around vision blocks, to the left of the commander. The passenger, if any, has no outside vision and simply has a seat; this is simply a passenger seat and is primarily for specialist mechanics or engineers that may be needed at the job site. The driver is in the front center near the top of the glacis and the commander is on the front left on the roof. He has no gun shields or other such protection, but has a heavy machinegun for local defense, and an electrically-rotating cupola. The crane operator has a hatch near the rear stand, and has a WL spotlight. The DNG has automatic fire detection and suppression. Main power is by an MTU 883 turbocharged 1500-horsepower engine, with hydropneumatic suspension and automatic transmission. Abu Dhabi DNGs have an MTU 883 1500-horsepower supercharged diesel along with an automatic transmission that are both more reliable in desert conditions. The UAE DNG is a bit longer in the rear sections to allow it to carry larger internal fuel tanks. UAE Leclercs have improved cooling systems for the engine, and improved air filters.

The DNG carries a small computer with a repair and recovery database. GPS and a BMS are standard on French DCLs.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
DNG	$1,675,399	D, A	4 tons	59 tons	3+1	33	Image Intensification (D, C), WL Spotlight	Shielded
UAE DNG	$1,692,153	D, A	4 tons	59.1 tons	3+1	33	Image Intensification (D, C), WL Spotlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
DNG	172/120	48/33	1300	553	Stnd	T6	HF170Sp HS28Sp HR19
UAE DNG	172/120	48/33	1600	554	Stnd	T6	HF170Sp HS28Sp HR19

Vehicle	Fire Control	Stabilization	Armament	Ammunition
DNG	+1	Basic	M-2HB (C)	2000x.50, Engineer Demo Chest, 30 kg C4

*The standard dozer has an AV of 6Sp and what it protects in the front depends on how high the dozer is lifted. The mine plow has an AV of 12Sp and is subject to the same protective capabilities.

Nextor Leclerc PTG AVLB

Designed at first primarily for use by the UAE, the PTG was subsequently taken up by France to handle their heavier Leclerc tanks. They are also still being actively marketed, both by Nextor and Vickers Defence.

The PTG is an AVLB designed for up 70-ton vehicles. Two bridges are possible: a 26-meter trifold bridge, or a pair of 13.5-meter bridges. The 26-meter bridge weighs 13 tons and has pipeway down the center in addition to vehicular loads. It is the same as the British No 10 bridge. The short 13.5-meter bridges weigh 17.5 tons each; they are the same as the British No 12 bridge and require trestles to lay them end to end. (The same bridges were evaluated for use on a Chieftain tank chassis.) The PTG uses the newly-developed UBLE (Universal Bridge Laying Equipment). Laying each bridge takes 5 minutes; picking them up again takes only 90 seconds. They are MLC 70 bridges, able to handle virtually any vehicle in the world at present. Armor is almost identical to a standard Leclerc. The commander/bridge operator is in the center of the vehicle, and he is able to keep his weapon mounted whether a bridge is present or not. He does not have to exit the vehicle to lay the bridge; he has all-around wide-angle image intensifiers and CCTV, and controls allowing him to take full control of bridgelaying. The driver is on the front left. The crew does not need to unbutton to lay the bridges. The commander/bridge operator also has a cupola (manually-operated) with all-around vision blocks; when the bridge is mounted, his machinegun is limited to an arc of fire 80 degrees in front of him. Both members have night vision. The vehicle has an automatic fire detection and suppression system, an NBC Overpressure system. The PTG has GPS and a BMS (the Franch version, which is called FINDERS). Engine is an MTU-883 turbocharged diesel developing 1500 horsepower, with an automatic transmission and hydropneumatic suspension. The PTG has BMS and GPS, and has the extended fuel tanks (since it was originally designed for UAE service).

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,519,357	D, A	4 tons	59 tons	3+1	21	Image Intensification (D, C), 8xCCTV	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
171/120	48/33	1600	551	CiH	T6	TF4 TS4 TR4 HF140Cp HS28Sp HR19

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

*The Crew-in-Hull “turret is actually the mounted bridge. No personnel hits are possible on this bridge; treat such hits as misses. If the bridge is deployed, treat the PTG’s configuration as “Stnd.”

Rheinmetall BRP-1 Biber

Notes: This German AVLB is based on the hull of a Leopard 1 tank, topped with a bridge and the equipment to deploy it. The RFD was issued in 1965, and first issue was 1968. 105 were built, but it is getting long in the tooth, and may be replaced in the near future by the PBS-2. Most of these vehicles are used by Germany, but small numbers are used by Australia, Canada, Denmark, and the Netherlands. Some 64 were also were also built by Italy, where they were license-produced. Unusually, in NATO operations, spare bridges for Danish Bibers are to be carried and delivered by German Army personnel on IVECO Magirus MP-260E37W heavy trucks.

The driver is in the normal Leopard position at front right of the hull and the commander/bridge operator in the center of the hull. The bridge can span a gap of 20 meters and has a capacity of 50 tons or 60 tons if the vehicles move across the bridge with care; it is made of aluminum. It may be deployed or recovered from either end, requiring 3 minutes to deploy and 7 minutes to recover. It deploys cantilever (slide-out) style instead of the scissors fashion of most AVLBs; the bridge is stacked in two sections, and two sections slide out from each other. The crew can lay the bridge with the crew under armor with hatches closed. The advantage of the cantilever design is that its deployment cannot be seen over a long distance; the disadvantage is that it is mechanically more complex and takes longer to recover. By itself, the bridge weighs 9.94 tons. The dozer blade on the front of the Biber is deployed before emplacing or recovering the bridge; this can also be used to prepare the bridging site, though this is normally done by other vehicles. The Biber is not issued with a weapon mount, but many crews have retrofitted their vehicles; in most such cases, the weapon cannot be mounted unless the bridge has been deployed. The crew has an NBC Overpressure system with a vehicular NBC system backup.

The hull is almost identical to that of a Leopard 1, other than the closing off of the turret mount and lack of the associated hardware, though the commander/bridgelayer does have a manually-operating cupola with all-around vision. Power is provided by an MTU MB-873 Ca-501 multifuel engine developing 830 horsepower, with an automatic transmission. Suspension is by torsion bar and two sets of hydraulic shocks.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$595,831	D, A	400 kg	45.3 tons	2	31	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
145/101	40/28	995	304	CiH	T6	TF4 TS4 TR4 HF38 HS10 HR6

*The "turret" is not a turret as such; it is the carried bridge. If the bridge is deployed, the Config is Stnd. No crew casualties are possible on a "turret" hit; treat such results as misses.

**The front dozer blade has an AV of 4Sp. What in the front it protects depends on how high it is raised.

Rheinmetall BPz-3 Büffel

Notes: This is a newer armored recovery vehicle based on the Leopard 2 chassis. The Buffel was designed when the previous recovery vehicle, the BPz-2A2, proved unable to consistently recover the new generation of Leopard 2 tanks. Prototypes appeared in 1988; deliveries began in the early 1990s. The Büffel is used by Germany and the Netherlands; Sweden also had some delivered to them in late 2003. Greece, Canada, Singapore, and Switzerland also use the Buffel. Deliveries to the German Army began in 1988. Components are the same as on some other countries' vehicles, like the winches, cranes, and dozer blade, which are also used by France on the Leclerc DNG and South Korea on their new K-1-based recovery vehicle.

The turret is removed, and from the front to the center of the vehicle is a raised superstructure. The Büffel has a crane on the right side of the superstructure that can traverse through 270 degrees and can lift 30 tons or pull 70 tons. This crane cannot be overloaded, as it will refuse to function at a higher load. The crane is powerful enough to lift the turret or powerpack of virtually all current main battle tanks. The vehicle has a main winch with 180 meters of cable and a pulling force of 35 tons, or 70 tons with block and tackle. This winch is mounted on the front hull and does not require the use of the dozer blade, since it is designed to distribute forces over the entire vehicle. It too cannot be overloaded. The Büffel also has an auxiliary winch with 280 meters of cable and a 650kg capacity. The Büffel has two tow bars, including one for quick recoveries that is attached to the dozer blade. The front-mounted dozer blade is primarily for the bracing of the vehicle, but can be used to dig large fighting positions. Towing capacity is 62 tons at full speed; greater loads may be towed, but at a reduced speed. Cutting and welding gear is carried along with a full set of tool and a power saw. There is a cradle over the engine compartment to carry large assemblies such as engines. The Büffel has a crew heater and a bilge pump for deep fording operations (though it is not amphibious). It can ford up to 4 meter, though all hatches must be closed. The hull mounts 16 smoke grenade launchers on the front fenders and glacis.

It is often found towing a trailer specially designed for it, carrying spare parts and more tools. This trailer is four-wheeled, partially powered, weighs 3 tons, can carry 7.5 tons, and does not affect the Büffel's mobility.

Power is provided by an MTU MB-837 Ka-501 developing 1500 horsepower, along with an automatic transmission. The commander has a manually-operated cupola with all-around vision in the center top behind the driver's position; slightly to the rear and the right is the crane operator has a hatch on the left rear deck in front of the engine. The crew has an NBC Overpressure System and has a vehicular NBC backup. Primary access to the vehicle is by three large doors on the hull roof. The BPz-3 has a small computer with recovery and repair solutions.

In 2011, four German BPz-3A1s were modified to the BRP-3A1 for operations in Afghanistan. They were designed to operate alongside the new Leopard 2A6M tanks. Canadian BRP-3A1 were actually deployed first, in 2007, in Afghanistan; later, German BRp-3A1s were deployed. Modifications included an increase in armor through MEXAS appliqué, a titanium plate of spaced armor on the floor, sides with armored skirts, The BPz-3A1 has a radio jammer, which prevents phone, opposition radios, and items like walkie-

talkies and electrical detonation systems from detonating (two levels more difficult). These jammers are optimized for civilian frequencies, including TV signals, though some intervehicular radios are also affected at higher frequencies. Available machinegun ammunition was increased dramatically. The commander's position was ringed with AV2 gun shields. The BPz-3A1 is usually supplemented with cage armor which covers the glacis, sides, and rear, this is covered on the sides with armor plate.

The BPz-3A1 uses the same engine and transmission, as well as power train, and suspension, as the BPz-3. The crew has the same amenities as the BPz-3, with the addition of a 50-liter drinking water tank and an air conditioner. The BPz-3 has GPS and a BMS. Like the BZp-3, the Buffel can ford a body of water 4 meter deep.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BPz-3	$1,431,432	D, G, A	4.1 tons	54.3 tons	3	46	Active/Passive IR (D, C)	Shielded
BPz-3A1	$1,859,566	D, G, A	4.1 tons	59 tons	3	51	Active/Passive IR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BPz-3	185/129	51/36	1620	454	Stnd	T6	HF193 HS25 HR15
BPz-3A1	172/121	48/34	1620	554	Stnd	T6	HF203Cp HS35Cp HR25Sp**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BPz-3	None	None	MG-3 (C)	2375x7.62mm
BPz-3A1	None	None	MG-3 (C)	4750x7.62mm

*The addition of bar/slat armor means that 5 of the AV is the cage. The cage is not like normal spaced armor; it stops only 1d6 armor instead of 2d6. For the front and sides, the GM should assess the damage reduction from the cage, then the composite armor. Before that, on the vehicle sides, the GM should assess the armor plate over the cage armor.
**Floor Armor is 14Sp.

Krauss-Maffei Pionierpanzer PiPz

PIPz-1 Pionierpanzer

Notes: This is an armored engineer vehicle developed from the Bergepanzer. The crane is retained but has special attachments to allow work with mines, demolition charges, and special tools to build and destroy fortifications. The Pionierpanzer has no generator or fuel pump, but has a 700mm auger able to dig to 3.75 meters, a dozer blade, a 70-ton winch, and a digging bucket that can lift 2 tons. On the right side of the upper hull is a hoisting winch that has 100 meters of cable and a capacity of 20 tons. The Pionierpanzer typically carries a wide variety of excavation tools and attachments for its crane, as well as a welding set, a 5-meter ladder, 117kg of plastic explosives, 10 engineer demolitions sets, and a variety of mines (up to 50). The plow can have a set of ripping teeth attached to it.

The vehicle has no turret but has a raised superstructure, topped with a commander/crane operator's manually-rotating turret with all-around vision blocks. Power is provided by an MTU MB-873 Ca-501 multifuel engine developing 830 horsepower, with an automatic transmission. Suspension is by torsion bar and two sets of hydraulic shocks. The Pionierpanzer has a secondary role as an ARV, primarily vehicle recovery. The dozer blade can excavate 200 cubic meters per hour, with a maximum width of 3.75 meters. The ripping teeth can rip up roads or pull up train tracks, of pull down electrical of communications poles; four such attachments may rip to 50mm, eight may rip to 400mm. The crane has a ladder on it to assist in attaching tools. The crew is protected by an NBC Overpressure system and personal gas masks.

PIPz-2 Dachs

The PiPz 2 Dachs (Badger) is an upgrade of the PiPz-1, with conversions being done by MaK in the 1990s, and continuing production done by Rheinmetall. In addition to vehicles being sold, a kit was sold for upgrade purposes to countries wishing to do their own upgrades or do them on retiring Leopard 1s. Most conversions, however, were done by MaK, or MaK teams sent to the receiving countries. They were first brought up to like-new status. A new dozer blade (similar to the old one in concept, but stronger and more effective) and a new hydraulic system was fitted. The excavator/tool arm is able to rotate 360 degrees, but for practical purposes, is limited to 270 degrees. The driver has upgraded night vision; the commander/arm operator also have night vision. The commander is shifted to behind the driver, and has a manually-operated cupola with all-around vision blocks and a front block with a night channel. Six grenade launchers, three on each side, equip the vehicle. So does an automatic fire detection and suppression system, and an NBC Overpressure system. The arm can extend 8 meters and the bucket can lift 5 tons. The vehicle is otherwise similar to the PiPz-1, though updated in form and working methods, can lift 20 tons and has 100m of cable. The crane can be equipped is equipped with a ½-meter-wide auger, a tow bar, internal welding tools; tools and the crane and dozer blade can be operated by a 10Kw generator. The driver's hatch is on the front left deck. The turret is replaced by a raised superstructure upon which are two hatches. An MG3 is located on a weapons mount next to the commander's hatch; another is next to the driver. A small laptop computer contains the tech manuals for the Dachs and for its equipment, as well as some engineering solutions. The PiPz-2 is used by Germany, Canada, and Chile.

PIPz-2A2 Dachs

Canadian Dachs' have MEXAS composite appliqué armor applied for use in Afghanistan and Kosovo, as well as a floor plate. It has GPS and a BMS. The commander may aim and fire his weapon from inside the vehicle. This is the PiPz-2A2.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PiPz-1	$1,441,713	D, G, AvG, A	3 tons	40.8 tons	4	21	Passive IR (D)	Shielded
PiPz-2 Dachs	$1,454,913	D, G, AvG, A	3 tons	43 tons	3	22	Passive IR (D), Image Intensification (C)	Shielded
PiPz-2A2 Dachs	$2,459,547	D, G, AvG, A	3 tons	47 tons	3	37	Passive IR (D), Image Intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
PiPz-1	157/110	43/30	1410	308	Stnd	T6	HF38 HS10 HR6
PiPz-2 Dachs	139/97	39/27	1410	325	Stnd	T6	HF38 HS10 HR6
PiPz-2A2 Dachs	129/91	36/25	1410	340	Stnd	T6	HF46Cp HS12Cp HR6**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
PiPz-1/2	None	None	MG-3 (Bow), MG-3 (C)	4250x7.62mm, Engineer Demo Chest, 20 kg C4
PiPz-2A2 Dachs	+1	Basic	MG-3 (C)	4250x7.62mm, Engineer Demo Chest, 20 kg C4

*Gun hits are hits on the various cranes, winches, and tools on the vehicle. Ammunition hits are on the machinegun ammunition, the plastic explosive or engineer demo chests, or the mines. The GM will choose what it hit in such a case.
**Floor AV is 5Sp.

MaK BPz-2 Bergepanzer

Notes: This is an armored recovery vehicle based on the Leopard 1 chassis. About 700 BPz-2s have been built or modified from Leopard 1 tanks, and are or were used by Germany, Australia, Belgium, Canada, Netherlands, Italy (built under license by OTO Melera) Norway, Turkey, Turkey, and Greece. The BPz-2 replaced the M-48-based ARVs. The RFD was issued in 1961, and first deliveries took place in 1966. The BPz-2 is known as the Taurus in Canadian service.

The turret of the Leopard 1 is removed and replaced with a raised superstructure. The Bergepanzer is equipped with a crane on the front right side that can traverse 270º and lift 20 tons. The winch can pull a 35-ton vehicle with 90m of cable, or double that with block and tackle, or 100 tons with a 3-1 mechanical advantage. The forward winch can pull 2.5 tons. The Bergepanzer is usually equipped with a wide variety of tools, spare parts, and has an integral fuel pump, 10Kw generator, and a dozer blade. The dozer blade is primarily for bracing during winching or crane operation, but can also be used for obstacle clearance and digging major fighting positions. The Bergepanzer has a driver's hatch on the front center deck, a commander's hatch on the front left deck, and two hatches on the left hull side. Passenger spaces are provided for an entire tank crew or additional repair personnel. The BPz-2 can carry an entire Leopard power pack on it's rear deck. The BPz-2 also has a fuel pump, so it can refuel vehicles from a containerized source fuel, a trailer, or a truck.

BPz-2A2

The BPz-2A2 is an upgraded form of the BPz-2. It has a jack carried on the rear face, a small hatch in the rear, a crane boom able to reach 7.68 meters, and can lift 32 tons, and it is strengthened. The jack is used to reduce the pressure on the dozer blade when working with the crane. The winch can pay out cable at 74 meters per second (as opposed to 22 meters per second). The BPz-2A2 has double-vane pumps for the hydraulic system. It has mechanical dozer blade locking. The BPz-2A2 has a small computer with a database of recovery and repair solutions. The armor suite is slightly upgraded with passive and spaced armor. The BPz-2A2 is sometimes called the Buffel, though it is not to be confused with the BPz-3.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BPz-2	$343,920	D, G, AvG, A	4 tons	39.8 tons	4+4	21	Passive IR (D)	Shielded
BPz-2A2	$840,773	D, G, AvG, A	4 tons	40.6 tons	4+4	22	Passive IR (D)	Shielded
Leopard 1 QRF	$858,892	D, G, AvG, A	4 tons	45.53 tons	4+4	25	Passive IR (D, C)	Shielded
Leopard 1 Wisent	$1,866,390	D, A	4 tons	47 tons	3	26	Image Intensification (D, C), WL Spotlight, CCTV (Corners)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
BPz-2	159/112	40/31	1410	308	Stnd	T6	HF38 HS10 HR6
BPz-2A2	155/109	37/26	1410	314	Stnd	T6	HF40Sp HS12Sp HR6
Leopard 1 QRF	143/100	36/25	1410	333	Stnd	T6	HF46Sp HS15Sp HR8***
Leopard 1 Wisent	162/113	45/31	1410	371	Stnd	T6	HF76Cp HS22Sp HR8***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BPz-2/2A2	None	None	MG-3 (Bow), MG-3 (C)	4250x7.62mm
Leopard 1 QRF/Wisent	None	None	M-2HB (C)	2600x.50

*Gun hits are hits on the various cranes, winches, and tools on the vehicle. The GM will choose what it hit in such a case.
**The dozer AV is 6Sp. What will be protected on the front depends on how high the dozer is raised.
***The QRF and Wisent have a floor AV of 12Sp and a roof AV of 4Sp.

MaK M-47 BGs

Notes: As with the M-48 ARV (see below), this vehicle was originally produced by Germany for export and as kits for those retiring their M-47 main battle tanks. Another major seller of this vehicle was Spain, and the designs of the two countries are similar. The basic design is similar to the M-48 ARV, with the turret being replaced with a raised superstructure, crane, winch, fuel pump, and dozer blade. The M-47 ARV was used to recover both lighter tanks and armored vehicles and armored personnel carriers and infantry fighting vehicles. Slightly smaller than the M-48 ARV, it also is somewhat less capable than that vehicle in towing capacity. The crane is capable of lifting 18.7 tons at a reach of 5.3 meters, and unlike the M-48 ARV, can turn a full 360 degrees. The main winch of the M-47 ARV can pull 35 tons, or 70 tons with block and tackle. A secondary winch can pull 6.5 tons, or 13 tons with block and tackle. The dozer blade can excavate 190 cubic meters per hour, but is mainly used to brace the vehicle during heavy lifting or winching operations. The M-47 carries basic tools, wheeled vehicle tools, tracked vehicle tools, a welding and cutting set, an air compressor, small arms and heavy ordinance tools, a tow bar, several coils or rope and cable, and pulleys and snatch blocks for heavy winching operations. The engine remains a Continental AV-1790-5B gasoline engine developing 810 horsepower. The M-47 ARV was developed for the Turkish, but has also been trialed in Pakistan.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$868,724	D, A	1.4 tons	44.9 tons	4	24	WL Spotlight (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
144/101	40/28	875	361	Stnd	T5	HF50 HS14 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	MG-3 (C) or MAG (C) or M-2HB (C)	2000x7.62mm or 1200x.50

MaK M-48 BGs

Notes: This is a recovery vehicle based on the chassis of the M-48A3 or A5 main battle tank. These vehicles were first produced by Germany for export and as kits to be sold to countries retiring their M-48 tanks; however, M-48 ARV began to be used in front-line service by many countries as damaged vehicles became more common. As such, they can be found in many of the countries that once used the M-48A3 or A5. In this role, the M-48 chassis has its turret removed, and a raised superstructure, along with a crane, winch, fuel pump, and dozer blade are added. The crane is mounted on the front right side and can lift 20 tons (enough for most tank turrets) at a reach of 6 meters. The winch has a pulling strength of 35 tons without bracing and 70 tons with bracing, and has 90 meters of cable. There is a secondary winch with a capacity of 6.5 tons, or 13 tons with bracing, and 100 meters of cable. The dozer blade can excavate 200 cubic meters per hour and is also used to brace the vehicle during heavy lifting or winching operations. The M-48 ARV is equipped with a welding and cutting set, an air compressor, tracked and wheeled vehicle tools, basic tools, small arms tools, heavy ordinance tools, a tow bar, several coils of rope and cable, and items such as pulleys and snatch blocks.

Many other improvements of the M-48 over the years, including a wider driver's hatch, the commander's machinegun is on a pintle mount rather than an enclosed cupola, larger dust shields, side shirts, larger fuel tanks, better sand filters, and numerous automotive, hydraulic and electrical improvements.

These vehicles were built primarily for use by Germany herself, but The Turks have 4 and the Greeks have 3. The vehicles have been upgraded with a Continental AVDS-1790-21 turbocharged diesel engine developing 908 horsepower with an automatic transmission.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$437,517	D, A	1 ton	50.1 tons	4	24	Passive IR (D), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
130/91	26/25	1420	265	Stnd	T6	HF51 HS16 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	MG-3 (C) or MAG (C) or M-2HB (C)	5000x7.62mm or 3000x.50

Wiesel 2 Engineer Reconnaissance Vehicle

Notes: This is a Wiesel 2 APC fitted out for the engineer reconnaissance role. It is designed for use by German Airborne use and so far is not used by any other country; I have not been able to determine if any other countries use it, though the US Army's Ranger Battalions have been testing it along with other variants of the Wiesel 2. So far, four have been ordered by the Germans.

In this role, the Wiesel 2 carries a remote mine detector, an engineer demolitions chest, several kilograms of plastic explosive, mines, an optical chemical sniffer, a Geiger counter, and radiation shielding. Other equipment carried includes an inertial navigation set, GPS, a BMS system, a rubber raft for water inspections of bridges and suchlike, a computer to compile the results of their investigations with a wireless modem to upload it to higher headquarters, and at least two long-range. Several different modular kits have been developed for the ERV, including a blockade kit, basically by blowing down trees with C4), demolition of bridges and strongpoints. The vehicle is fully digitized, and has a BMS and GPS. The ERV can be operated by a remove cable and interface up to 60 meters away.

The engine is a turbocharged diesel which develops 110 horsepower and has an automatic transmission.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$3,540,615	D, A	300 kg	7.25 tons	3	10	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
104/73	26/18	450	41	Stnd	T3	HF4 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	MG-3 (C)	750x7.62mm, Engineer Demo Chest, 20 kg C4

Krauss-Maffei PSB-2

Notes: The PSB-2 (Panzerschenellbrucke 2) is based on the Leopard 2 chassis (new build versions of it). Currently, Germany and Netherlands will be its customers.

The hull is essentially unchanged from the Leopard 2 hull, with it's strong armor, automotive, and powerpack abilities, but the vehicle is greatly otherwise modified to serve the role of an AVLB. The bridge has center, front, and back sections, and can be laid and recovered from either direction. The bridge is deployed and recovered cantilever style, which cannot be seen from as great a distance as AVLB which employ V-employment. The vehicle can take a load of 70 tons has a matter of course; with care, vehicles of up to 100 tons can be accommodated. The bridge consists of aluminum modules, strengthened in strategic placed with steel. Two stabilizers must be lowered to the ground before deployment or recovery; in addition, there are stabilizers on both the front and rear of the center section. The bridge weighs 9.7 tons, takes 3 minutes to deploy, and five to recover.

Power is by an MTU MB-837 Ka-501 turbocharged diesel engine with an automatic transmission. The powerpack, automotive trains, and electrical and fuel systems are identical to the Leopard 2. The crew is protected by an NBC Overpressure system, an air conditioner and heater, and a small drinking water tank of 20 liters. Normal crew is two; however, the PSB-2 can carry an additional crewmember as a bridge deployment specialist. The driver is on the front left, the commander in the center, and the additional crewmember further back in the fuselage; he has vision blocks and a periscope, but no hatch, and has four-way rotatable day/night CCTVs (these can alkso be controlled from the commander's position. Ancillary equipment includes a number of cables, supports, blocks and tackles, ropes, etc. The PSB-2 has a GPS and BMS system.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,359,899	D, A	400 kg	55 tons	2+1	31	Passive IR (D, C, BO)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
194/136	54/38	1200	552	CiH	T6	TF6 TS6 TR6 HF200Cp HS28Cp HR16

DRDO Armored Amphibious Dozer

Notes: This is the primary engineer vehicle of India. It is based on the BMP-2 chassis (which India calls the Sareth), and has its turret removed for this role. So far, this vehicle has not been exported or offered on the international market. India makes the BMP-2 and its subtypes under license from Russia.

The vehicle has a large digging bucket with a capacity of 1.5 cubic meters, and a track-width dozer with a mine plow blade at the bottom, located at the front of the vehicle. The digging bucket may replaced by an auger, larger digging bucket, or pincer claws. The 8-ton capacity winch can be combined with a rocket anchor to throw a 100-meter cable to clear obstacles and for self-recovery; like most such setups, the rocket anchor may be winched back in, but the rocket module must be reloaded by hand, necessitating leaving the vehicle. The AAD carries six such rocket modules. The AAD also has a crane with a capacity of 3 tons. The AAD normally carries construction tools, excavating tools, a welding set, and an air compressor, as well as an engineer demo chest and 40 kilograms of plastic explosive. Most equipment, including crew equipment, is carried in the large amount of armored lockers and boxes on the sides of the AAD.

Power is provided by an Indian-built version of the Russian UTD-20/3 multifuel engine. It has a manual transmission. The driver is on the front left, while the commander is in the center of the vehicle in a manually-operated cupola with all-around vision and a night channel for his front vision block. The two doors on the rear face (and their fuel tanks) are retained, but the firing ports are deleted. Controls for the vehicle's winches, cranes, earth anchor, etc, are duplicated in the driver's compartment and the AAD can be operated by only the driver, if necessary. The AAD has an NBC Overpressure system, air conditioning, a heater, and GPs and a BMS. Future projected improvements include remote control with a controller and 60 meters of cable for use in hazardous areas. A pair of MICLICs can be added to the rear deck. The AAD has a GPS and BMS.

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

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,113,010	D, G, AvG, A	1 ton	17.2 tons	2	16	Passive IR (D), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
140/98	39/27/5	460	111	Stnd	T2	HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT (C)	2000x7.62mm

Avadi Vijayanta ARV

Notes: This is one of the standard armored recovery vehicles of India, made from retiring Vijayanta main battle tanks. In this role, the turret is replaced by a raised superstructure running along almost half of the vehicle's hull. At the front of this superstructure is an A-frame crane with a capacity of 10 tons, and the rear of the hull has a winch mounted with a capacity of 23 tons, or 70 tons with block and tackle. There is an auxiliary winch with a capacity of 3.75 tons. Both winches have 100 meters of cable. The usual assortment of tools for an ARV are issued with the vehicle, including welding and cutting gear, an air compressor, a fuel pump, a large set of tools (basic, wheeled vehicle, tracked vehicle, small arms, heavy ordinance), a tow bar, block and tackle, and various ropes, cables, and chains. The driver's position has been moved to the center of the front hull, the superstructure has two hatches for crew, and there is a flat area on the rear deck for a spare power pack.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$748,727	D, G, AvG, A	3 tons	34.2 tons	4	14	Passive IR, WL Spotlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
128/89	32/22	1000	193	Stnd	T6	HF123 HS18 HR11

Fire Control	Stabilization	Armament	Ammunition
None	None	MAG (C)	2600x7.62mm

CVRDE Kartik BLT

The Kartik BLT (Bridge-Launching Tank) is an AVLB based on the same lengthened Vijayanta chassis as the Catapult SPA. It uses a scissors-style of bridge based on that of the Polish/East German BLG-60's bridge. The bridge is deployed and recovered from the front of the vehicle. Deployed, the bridge is 20 meters long and is MLC-60 -- able to handle loads of about 60 tons. It is also one of the widest vehicular bridges, at 4 meters wide. It can therefore take two lanes of jeep-sized vehicles at once, or one tank-width vehicle and a lane of foot traffic, or a lane of vehicles up to 3 tons and a lane of vehicles that are BMP-sized, or 5-man front formations. The bridge, however, is only 8 tons in weight and is made primarily of aluminum alloy, with steel bracing. The vehicle is powered by the same Leyland L-60 Diesel developing 535 horsepower, with a semiautomatic gearbox. Side armored boxes hold ammunition for the commander's gun and good-to-have equipment such as block and tackle, cable lengths, and rope, as well as basic tools and the crew's personal gear. The crew consists of a driver and a commander/bridge operator, and his machinegun is set on a

low pintle mount which can remain mounted when the bridge is loaded, though it has a limited traverse of 60 degrees to the front. The crew have air conditioning, heating, and NBC overpressure.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$845,703	D, G, AvG, A	300 kg	42.2 tons	2	39	Passive IR (D), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
113/79	31/22	1000	198	Stnd	T6	HF123 HS18 HR11

Fire Control	Stabilization	Armament	Ammunition
None	None	MAG (C)	3000x7.62mm

Medak Armored Engineer Reconnaissance Vehicle

Notes: The AERV is designed to allow combat engineers to conduct route reconnaissance, mine reconnaissance, contamination, and taking a look at road conditions, river crossings, river and streambank softness, and to measure water depth and current. It also carries some limited equipment to clear some obstacles. It is well equipped to conduct such recon, but it is by no means a heavy combat vehicle. First delivery of these vehicles began in 2008.

The AERV is based on the well-proven Sareth (BMP-2) chassis, though it is heavily shielded and completely NBC sealed. The front has a large till vane to use during amphibious operations; it also has a rocket anchor with 150 meters of cable. The cable can be withdrawn from under armor, but a new rocket would have to be loaded, something that can also be done from under armor. The AERV has the Sareth's turret, but this is unarmed other than the coaxial machinegun and is primarily used for observation and to train instruments on targets. The laser rangefinder is retained, and can be used with the machinegun or to find ranges as necessary. Side boxes contain flags that can be launched froim inside the vehicle, or automatically launched at a given interval. Each of the four boxes on each side contain twelve flags, and another is by the left rear door. The AERV carries a GPS and BMS, as well as data-capable radios that keep it in radio and video contact with higher HQ. In addition, the AERV has an inertial navigation backup. Digital recorders automatically record all relevant data, up to 40 GB. Hand-held sensors are provided for closer inspection of soil or other possibly contaminated terrain.

The vehicle is equipped with NBC overpressure and recirculating air conditioning and heating to allow it to operate in a contaminated environment. The AERV appears to be festooned with boxes and antennae, including one large one on its turret; these are the outlets for the various sensors. Two vision blocks are retained on the sides, and one is retained in the right rear door. The AERV normally runs its equipment off of vehicle power, but has a bank of Ni/Cd batteries which provide the equivalent of a 2kW APU for up to two hours and are charged again by the engine. The turret has three smoke grenade launchers on each side of the turret. Atop the turret is a rotatable image intensifier.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,376,273	D, G, AvG, A	400 kg	15 tons	4	30	Passive IR (D), Image Intensification (C, Roof), Thermal Imaging (G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
154/108	43/30/5	460	111	Trtd	T2	TF6 TS3 TR3 HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	PK	3000x7.62mm

BAE YPR-765GN AESV

Notes: Also known as the Genie, this vehicle is designed to carry a combat engineer squad and their equipment into battle and to do their tasks. For the most part, the AIFV in this role looks like a given AIFV, but in this role, the AIFV has its turret removed. On the roof of the vehicle is a crane with a capacity of 3.09 tons, and the vehicle also has a winch with a capacity of 9.07 tons and 100 meters of cable. The AIFV AEV generally carries a case of plastic explosive, an engineer's demo chest, power tools, basic tools, excavating tools, an air compressor, a jackhammer, and welding and cutting tools. A 5 kW generator is provided on the rear deck to power these tools when the engine is off. A dozer blade is in front to clear obstacles and dig fighting positions, and positions for explosives planting. On the right side is a boom with a large auger on the end. A hydraulic reservoir supplies energy to hydraulic tools. The crew has a vehicular NBC system and a heater. This vehicle is used by Belgium and the Netherlands.

The driver is on the front left. The commander has a hatch on the center of the hull top with all-around vision blocks and a manual cupola with a weapon mount. The rest of the combat engineers sit in the same type of seats as on a standard AIFV, and the firing ports and rear door and ramp are retained. Power is a 267-horsepower turbocharged diesel engine, with a manual transmission. At the top of the glacis on either side of the vehicle are a cluster of four smoke grenade launcher. The Genie is amphibious only with preparation; the trim vane must be extended, a bilge pump turned on, and buoyancy pods attached to the hull sides.

In the early 2000s, Genies were fitted with GPS and a BMS. These are the YPR-2000 modifications, and also include two storage boxes on the rear sides and AV3 gun shields around the commander's position. Air conditioning was added along with an NBC Overpressure system. The commander can aim and fire his machinegun from under armor with the hatch closed. The commander is equipped with night vision.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
YPR-765GN	$386,036	D, A	1 ton	13.69 tons	2+5	11	Active/Passive IR (D), WL/IR Spotlight (C)	Shielded
YPR-2000GN	$1,194,136	D, A	1 ton	13.93 tons	2+5	13	Passive IR (D), Image Intensification (C), WL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
YPR-765GN	139/98	39/27/4	416	99	Stnd	T2	HF6Sp** HS4Sp HR4
YPR-2000GN	137/96	38/27/4	416	98	Stnd	T2	HF6Sp** HS4Sp HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
YPR-765GN	None	None	M-2HB (C)	2000x.50, 30 kg C4, Engineer Demo Chest
YPR-2000GN	+1	Basic	M-2HB (C)	2000x.50, 30 kg C4, Engineer Demo Chest

*The floor armor of the YPR-765GN and YPR-2000GN is 4.

**The dozer blade can provide some protection to the front of the vehicle. How much depends on how high the blade is raised. The blade has an AV of 10Sp.

BAE YPR-806PRBRG Recovery Vehicle

Notes: This recovery vehicle is based on the AIFV chassis (see *Twilight: 2000 Version 2.2* rules). The turret has been removed to make room for the crane. This crane has a lifting capacity of 1.36 tons, and is mounted on the rear left side. A winch is mounted in the rear of the vehicle that has 91.4 meters of cable and a capacity of 9.07 tons. The winch's mechanism makes sure the cable is always wound tightly and evenly around its drum. A spade is lowered on each side of the vehicle during heavy winching and crane operations. The AIFV RV has extra flotation devices in certain spots to make sure it floats evenly during amphibious operations. A large selection of spare parts are carried (mostly for light vehicles and smaller APCs), primarily for the vehicles of the country's that use it. A large selection of tools for vehicle repair are available, including basic, tracked vehicle, wheeled vehicle, power tools, and excavating tools, a hydraulic jack, and an air compressor. These are normally powered by a small 5 kW generator mounted on the rear right deck. The engine, transmission, and drive train, along with most of the automotive layout, are the same as the AIFV AEV. The driver and commander are in the same place, with the third mechanic inside the vehicle near the commander. The rear door and ramp remains, but the firing ports have been deleted.

The YPR-2000PRBRG is an upgrade to the YPR-806PRBRG carried out in the early 2000s. This includes two storage boxes on the rear sides and AV3 gun shields around the commander's position. Air conditioning was added along with an NBC Overpressure system. The commander can aim and fire his machinegun from under armor with the hatch closed. The commander is equipped with night vision. The crane is upgraded to allow it to lift 2 tons, and the winch has been upgraded to be able to pull 12 tons. The vehicle has been fitted with a GPS and NATO-compatible BMS. A small computer was added that has a database of recovery and repair solutions.

Vehicles	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological

YPR-806PRBRG	$163,034	D, A	1 ton	13.75 tons	3	13	Active/Passive IR (D), WL/IR Spotlight (C)	Shielded
YPR-2000PRBRG	$893,765	D, A	1 ton	13.99 tons	3	15	Passive IR (D), Image Intensification (C), WL/IR Spotlight	Shielded

Vehicles	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
YPR-806PRBRG	139/97	39/27/4	416	99	Stnd	T2	HF6Sp HS4Sp HR4
YPR-2000PRBRG	137/96	38/27/4	416	99	Stnd	T2	HF6Sp HS4Sp HR4

Vehicles	Fire Control	Stabilization	Armament	Ammunition
YPR-806PRBRG	None	None	M-2HB (C)	2000x.50
YPR-2000PRBRG	+1	Basic	M-2HB (C)	2000x.50

Bumar Labedy BLG-67

Notes: This joint venture between the former East Germany and Poland is their version of the Russian MTU-2. The Bulgarians also use this vehicle, as well as India and Iraq. The Germans no longer use it; they sold theirs off after the reunification. The Swedish bought 32 from Germany in 2010, but as of 2012 only 12 remained in service, as they used some vehicles to fix and upgrade the others, essentially returning them to a zero-miles condition. (With the replacement of their Brobv 941s by the "new" Brobv 971s, these 12 AVLBs are now the only AVLBs in the Swedish military.) The Brobv 971s have been modernized, especially in the area of the bridge, which makes the MLC-60 class bridge into an MLC-70 class. They use only the two-span bridge.

The vehicle is based on the T-55 chassis, and on the whole looks very similar to the Czech MT-55A. The main differences are the plastic-covered bridging surface, the 20-meter maximum span of the bridge, its 50-ton capacity, and the two anti-current anchors carried by the vehicle. Each anchor is connected to the vehicle with 40 meters of cable, and they allow the BLG-67 to be used in a current of up to 0.5 meters per second. The bridges can be laid in series of up to 3 spans. The bridge takes 3 minutes to lay and 3-8 minutes to recover. It weighs 6 tons. The bridge is aluminum with a trackway covered with a tough plastic, ribbed trackway that protects it against the elements and wear from vehicles, as it is easily replaced. (This surface is good for vehicles, but tends to make troops crossing it stumble.) For the crew, they are protected by an NBC Overpressure system and have a heater.

The M2 version is designed to carry the standard bridge or a three-span bridge 30 meters long and 3.47 meters wide (wider than your average AVLB). The bridge is 8 tons. The bridge-laying mechanism is very different from those of the standard BLG-67, so the parts are not interchangeable. The stats for the M2 version below is with the longer bridge.

The driver is on the front left, while the commander/bridge operator is opposite the driver, sitting about a foot higher; the BLG-67 may also carry a dedicated bridge operator/spotter, but this is not required. The situation of the commander's cupola does not allow for the mounting of a weapon or a pintle mount on the BLG-67 or BLG-67 M2, but the Brobv 971 has a commander's position equipped with a pintle-mounted machinegun. Most of this series has standard radios and suchlike, but the Brobv 971 has GPS and a NATO-compatible BMS. The Brobv 971 does not have a position for a dedicated bridge operator, and the commander fills this function.

Power is provided by a 581-horsepower V-55 diesel engine with a manual transmission. The BLG-67 series cannot use auxiliary fuel tanks, as the bridge operation prevents this.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BLG-67	$770,085	D, A	500 kg	37 tons	2+1	31	Headlights	Shielded
BLG-67 M2	$850,976	D, A	500 kg	39 tons	2+1	31	Headlights	Shielded
Brobv 971	$1,615,722	D, A	500 kg	38 tons	2	37	Image Intensification (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
BLG-67	116/81	32/22	680	209	CiH	T6	TF4 TS4 TR4 HF60 HS12 HR6
BLG-67 M2	111/78	31/22	680	209	CiH	T6	TF4 TS4 TR4 HF60 HS12 HR6
Brobv 971	128/89	35/25	680	214	CiH	T6	TF4 TS4 TR4 HF60 HS12 HR6

Vehicles	Fire Control	Stabilization	Armament	Ammunition
Brobv 971	Nil	None	Ksp m/58	1000x7.62mm

Rheimetall/RUAG Pionierpanzer 3 Kodiak

Notes: Also known as the AEV-3 and Geniepanzer, the Kodiak is a joint venture with Rheinmetall of Germany and RUAG of Switzerland, along with several subcontractors, some in other countries. (Switzerland calls it the Geniepanzer, the Dutch call it the AEV-3 Kodiak, and the Swedish call is the AEV-3S Kodiak.) Development of the Kodiak began in 2002 to replace existing older combat engineer vehicles. Fist issue was in Switzerland in 2009; the German Army first fielded them a year later. Other users, from 2012, include Netherlands, and Sweden. The Kodiak is based on older Leopard 2 chassis that have been replaced by later versions of the Leopard 2, coming mostly from stocks kept by the German Army. (The hulls are actually stripped and refurbished first in Sweden.) The main tasks of the Kodiak include building and removing obstacles, clearing pathways though minefields, and digging major fighting positions. It has a tertiary mission of aiding in relief missions in disaster areas.

The Kodiak is based on the Leopard 2 chassis, but is heavily-modified, including a large superstructure on the front end of the vehicle. It is equipped with a large arm, hinged at the middle, and mounted on the center front; this arm has a reach of 9 meters, and may pivot through 250 degrees. The arm may lift to a height of 2.2 meters. This arm can mount an excavation bucket, claw-type grippers, a concrete cutter, and an auger. The bucket can be used to dig 1 cubic meter/5 tons per swipe. The claw can lift 2 tons or pull (such as on a tree) with a force of 4 tons. The concrete cutter is sort of a large circular saw and cut through 500 centimeters of concrete per minute. The auger can dig through earth to create a hole 1.5 meters wide and 2 meters deep per minute. These are carried on a flat space on the rear deck and snap into or off of the arm without the need for crew intervention, and can be done without the crew leaving armor protection, observing through a day/night CCTV. The Kodiak has a large Pearson Engineer Mine Plow at the front of the vehicle, which can also be reconfigured into a concrete/asphalt ripper to ruin road surfaces. This use does require the crew to leave the vehicle and attach ripper teeth. It's primary use is for creating safe lanes through minefields, but it can also be used to dig major fighting positions, as those for vehicles, for example. Though normally angled in the center, it can be reconfigured by the driver from within the vehicle to create a full-width blade for the digging of fighting positions and removing obstacles. When reconfigured, the plow has a width of 3.42 meters, or 4.02 meters with removable side extensions; when configured as a mine plow, the width is 4.2 meters. The plow can also be used to brace the vehicle during excavation operations. The blade can excavate down to 30 centimeters at a pass, and 350 cubic meters per hour; when excavating, it may be varied from an angle from 24 degrees and 79 degrees, or brought to the vertical with a front or rear slope of 5 degrees. The Kodiak is equipped with two Rotzler capstan winches, each with a capacity of 9 tons, though with successive use of block and pulley, this may be increased by them working together to 62 tons, or a single winch 30 tons. The winches each have 200 meters of cable, and the winch cable may be lead out to the front, rear, or sides. These are primarily used for obstacle removal/creation, but have a secondary use for vehicle recovery. The Kodiak carries 50 flags on each side of the rear to mark safe lanes for the vehicles and troops behind it, and these can be set to deploy at a given interval as it moves. For further mine defense, the Kodiak has a French Demeter electromagnetic mine fuze jammer that requires a roll against an ELC skill of 15 (the vehicle's skill). Success means that the mine does not operate for five minutes. Outstanding Success means that the mine is permanently disabled. Catastrophic Failure means that the mine detonates under the Kodiak. This jammer operates along the front end of the vehicle.

The Kodiak is equipped with an NBC overpressure system, an air conditioner, and a heater, along with an automatic fire detection and suppression system. The Kodiak is protected by an OWS (the RCWS Protector or Qimek) at the commander's position; this may be armed with a 40mm Mk 19 or HK GMG, an M-2HB heavy machinegun, or an MG-3 or Ksp m/58 light machinegun. The RWS has a full night vision suite as well as computer-assisted and laser aiming and stabilization, and can be aimed, fired, and reloaded from under armor. The commander's position is in the center of the superstructure, the driver is to the front and right of him at the top edge of the glacis, and the equipment operator is opposite him, with a rotating cupola, all-around vision, and input from six day/night CCTV cameras around the vehicle. The driver has a night vision channel on his forward vision block, and a backup camera. The Kodiak has a small computer with engineer solutions, along with GPS and a NATO-compatible BMS.

The Kodiak is powered by an MTU MB-837 Ka501 turbocharged diesel, the same engine as on the Leopard 2.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,916,524	D, A	2 tons	55 tons	3	29	Image Intensification (D, C), Thermal Imaging (C), 7xDay/Night CCTV Cameras (C, 6xEO)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
184/129	51/36	1600	558	Stnd	T6	HF160Cp HS25Sp HR15**

Fire Control	Stabilization	Armament	Ammunition
+3	Fair	Mk 19 or HK GMG or M-2HB or MG-3 or Ksp m/58	650x40mm or 2000x.50 or 3400x7.62mm, Engineer Demo Chest, 30 kg C4

*The plow of the Kodiak can help protect the vehicle from frontal hits; how and where on the front depends on where the shot hits and how high the plow is raised. The plow has an AV of 18Sp.

**Roof armor for the Kodiak is AV 11. Floor AV for the Kodiak is 12Sp. The Dutch version has additional roof protection against antiarmor bomblets and has a Roof AV of 13Sp.

Ramta IDF Caterpillar D-9R

Notes: The D-9 was first acquired by the IDF in the 1950s; the IDF began modifying them almost immediately, primarily increasing their survivability, until we reached the present standard, the D-9R. It has not been exported, though the US has expressed an interest in applying similar modifications to the M-9 ACE or acquiring the D-9R. The D-9R has been given the strange nickname of Doobi (Teddy Bear). The D-9R version brings to the D-9 the ability to be used in a military combat engineering role. (It is said that the two vehicles that Hamas is most afraid of are the AH-64 Apache and the D-9R Doobi.) Most D-9Rs are not new-build vehicles; they are modified versions of earlier D-9s.

The base of the D-9R is recognizably the D-9's chassis; however, the rest of the vehicle, including the plow, has been heavily armored to make viable in combat and in destroying fortifications and digging up mines and IEDs. The upper part of the D-9R is dominated by a superstructure that is armored, has large armored windows, and is further protected by slat armor. The working parts in front of the superstructure, as well as the plow attachments, are armored. At the rear is another blade, used to brace the D-9R when pushing against constructions with the front blade. The front dozer plow is larger and heavier than the standard D-9 blade It has an AV of 25Sp against mines, explosives, gunfire, and antiarmor weapons. At the top of the blade is a hedge of slat armor. In addition to removing obstacles, the D-9R can also build fighting positions, both with the front blade and with a rear deep ripper. A tertiary role for the D-9R is vehicle recovery; though it has no cables, it can, by means of a tow bar, tow up 35 tons (though slowly). It can also push up to 71.6 tons (again, slowly).

The D-9R can have a light, medium, or heavy machinegun on its roof on a pintle by the commander's position. Studies have been undertaken to mount a OWS-type installation, but none have been operationally mounted as of yet. There are also four firing ports for small arms in the superstructure. Atop each main dozer arm is a double set of high-intensity spotlights, each facing slightly away (and in opposition) to the center of the housing. The large, armored dozer blade can be detached and replaced with a dedicated mine plow which also has some utility at destroying fortifications and has ripper extensions along the bottom of the blade. The armor is greatly strengthened and the entire vehicle much more protected than a stock D-9. The floor is especially strengthened; one D-9R ran over an IED with 500 kilograms of explosives, losing only the suspension. Even the tracks have armored shoes.

The D-9L is still in service with the IDF; it is essentially the D-9 with an armored superstructure of thin steel (though the armor was equal to any small arms or rocks that the Palestinians has at the time) and a high-powered (some say overpowered) engine, but with less torque. This engine is also fuel-hungry and much larger than later engines. Revealed weaknesses to the RPG and some grenades and IEDs led to the D-9N, similar to the D-9R except for less armor protection and a lighter plow, and stronger engine. The D-9T is a version of the D-9R which can be remote-operated, used in high-hazard areas; any D-9R can be configured to the D-9T specifications by means of a kit and an engine change. Engines are variants of the 3408 HEUI, except for the D-9T, which uses a CAT C18 ACERT engine. The D-9L also uses a different engine, more akin to a civilian bulldozer.

Due to their low combat speed, high-torque engines and high weight and fuel consumption, D-9s are usually carried to and from the battle area on tank transporters.

Armored D-9s have also proved exceptional at fighting forest and brush fires, most notably the 2010 Mount Carmel Forest Fire. One controversial use of the D-9 series is to topple buildings or walls on top of suspected terrorists' heads; this can also topple them onto civilians' heads as well.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Shielded
D-9L	$473,954	D, A	600 kg	56 tons	2	27	WL Spotlights (4)	Enclosed
D-9N	$399,550	D, A	600 kg	59 tons	2	34	WL Spotlights (4)	Enclosed
D-9R	$385,508	D, A	600 kg	61 tons	2	32	WL Spotlights (4)	Enclosed
D-9T	$456,110	D, A	600 kg	62 tons	2	35	WL Spotlights (4)	Enclosed
D-9T (Tier 4)	$456,304	D, A	600 kg	63 tons	2	35	WL Spotlights (4)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
D-9L	74/52	21/14	821	158	Trtd	T4	TF14 TS10 TR6 HF12 HS12 HR8**
D-9N	64/45	18/12	821	131	Trtd	T4	TF15Sp TS11Sp TR9Sp HF13 HS13 HR8***
D-9R	66/46	18/13	821	143	Trtd	T5	TF18Sp TS12Sp TR10Sp HF15 HS15 HR9****
D-9T	64/45	18/12	821	140	Trtd	T5	TF20Sp TS14Sp TR8Sp HF17 HS17 HF10****
D-9T (Tier 4)	66/46	18/13	821	147	Trtd	T5	TF20Sp TS14Sp TR8Sp HF17 HS17 HF10****

Vehicle	Fire Control	Stabilization	Armament	Ammunition
D-9	None	None	Negev or MAG or M-2HB	7000x5.56mm or 5000x7.62mm or 3000x.50

*The "Turret" is actually the tall superstructure on top of the rear of the vehicle.

**TD and Belly armor are AV 6.
***TD armor is 6; Belly armor is 8.
****TD armor is 7Sp; Belly armor is 8Sp.

Puma Armored Engineer Carrier

Notes: This is an armored personnel carrier based on the Sho't (a version of the Centurion) chassis. It is used by Israel, and is designed to operate with Merkava tanks. The Puma saw early controversy when it was used against Palestinian fighters; the British government at first objected because the Puma has a high degree of Centurion (and therefore British-made) components; citing a breach of agreement. They have since dropped their official objections.

The turret has been removed and replaced with hatches, a commander's position with machinegun, and three other machineguns, one to each side of the crew compartment and one forward of the crew compartment. A new power pack, with an AVDS-1790-6A engine developing 900 horsepower has been added. The suspension is a Modified Horstman suspension, and the transmission is automatic. The Puma also carries a winch with a capacity of 25 tons (50 tons with block and tackle) and 100 meters of cable. The Puma carries excavating and pioneer tools.

The gunner's armament is a MAG machinegun in a Rafael OWS; the gunner can aim, fire, and reload the gun while under armor. The other three machineguns are on simple pintle mounts. In addition, the Puma is armed with a Soltam C-08 60mm mortar firing over the rear; this is meant primarily for firing covering smoke or HE rounds into minefields, but can be used offensively as well. The Puma also is armed with two obliquely forward-firing TAAS 80mm IS-6 Smoke Grenade Launchers. There 10 rockets for these dischargers. The crew are also armed with standard small arms, and all but the driver can deploy if necessary. Additional mine/IED protection comes in the form of an electromagnetic mine/IED neutralization system that jams radio frequency detonators, cell phones, and wired devices. The Puma should roll a d20 when encountering a mine or IED within 10 meters; a roll of 12 or greater jams the mine or IED permanently. An engineer demolitions chest and 40 kilograms of C4 are also carried, as well as 10 thermite grenades. It is equipped with an Israeli BMS.

The Puma can be equipped with the Carpet MICLIC system. This consists of 20 FAE rockets mounted on the rear deck of the Puma, firing forward (it may also be on a trailer towed by the Puma or other vehicle). When the fuel-air explosive bursts, it creates overpressure that destroys most mines under it. Between one and the full complement of 20 rockets may be fired at once.

The Puma has air conditioning, and a vehicular NBC pack. Appliqué armor has been added, and ERA lugs are provided on the HF and HS, and the Puma has essentially a new armor suite. The armor is modular and damaged armor can be easily replaced, or even replaced with more advanced armor if it comes available. The normal crew consists of a driver, gunner, and commander, and a 5-man sapper team. The commander has a manually-rotating cupola with all-around vision blocks; one has a night vision channel, and cameras on the RWS allow the commander to monitor the exterior situation using an LCD screen. There is a 90-liter drinking water tank inside the Puma.

The Puma often uses mine plows or rollers or tows mine-planting equipment, and has a winch. A mine plow is in fact ubiquitous, equipping nearly all Pumas. Mine rollers, rakes, or flails can be mounted instead of the plow.

An urban warfare variant of the Puma has a large superstructure ringed with firing ports for small arms and machineguns, and hatches atop the superstructure. The gunner's position remains, with its MAG-armed OWS. as on the standard Puma. The three other machineguns are removed from the sides and rear, as the hatchway is no longer there, replaced by nine firing ports with large windows of bullet-resistant glass/vinyl/Plexiglas mix, which is as strong as the rest of the superstructure's armor. Nine troops can be jammed in there, though six is a more common complement. The roof cupolas may be armed with pintle-mounted machineguns; this is reflected in the stats below. This version has a beefed-up suspension to drive over rubble.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Shielded
Puma AEC	$2,115,140	D, A	2 tons	51 tons	3+5	25	Passive IR (D), Image Intensification (C. G), Thermal Imaging (G)	Shielded
Puma w/Superstructure	$2,791,985	D, A	1.5 tons	53 tons	3+9	25	Passive IR (D), Image Intensification (C. G), Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Puma AEC	125/88	35/24	1037	321	Stnd	T6	HF100Cp HS24Sp HR20
Puma w/Superstructure	120/84	35/24	1037	334	Trtd	T6	TF40 TS40 TR40 HF100Cp HS24Sp HR20

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Puma AEC	+2	Fair	MAG (x3), MAG (G), 60mm C-08 Mortar, 2x80mm IS-6 Smoke Grenade Launchers	6000x7.62mm, 60x60mm, 10x80mm
Puma w/Superstructure	+2	Fair	MAG (x2), MAG (G), 60mm C-08 Mortar, 2x80mm IS-6 Smoke Grenade Launchers	10000x7.62mm, 60x60mm, 10x80mm

Puma RAM

Notes: One of the few vehicles of its kind in the world, the Puma RAM is based on the Puma AEC and is a heavy armored recovery vehicle. It's primary job is to service and recover vehicles like the Puma AEC and the Nagmasho't HIFV, though it is capable of working with even Merkava tanks. The Puma RAM is a basic vehicle designed to have the protection to make it up to the front lines and rescue damaged vehicles.

The heavy crane arches over the vehicle, able to turn nearly 300 degrees and take a powerpack off of it's roof and putting it into a vehicle, or vice versa. Powerpacks are carried on the rear deck of the vehicle shaped like a huge basket. The crane can lift 25 tons, and the main winch can pull 50 tons, or 90 tons with block and tackle. An auxiliary winch, normally used as a lead winch, can pull 13 tons, or 26 tons with block and tackle. Numerous boxes and stowage bins carry basic, tracked vehicle, wheeled vehicle, power, and excavating tools, and welding and pneumatic tools. They also carry a large amount of spare parts, ropes, and cables. The RAM has one machinegun at the commander's hatch on a pintle mount, and 10 smoke grenade dischargers.

The commander is in the front right, and the driver on the front left. One other hatch is on the center left deck and is used by the crane operator, as the crane is on the left rear corner. Stabilizers in the rear corners and a dozer blade are used to brace the vehicle when using the crane. The commander has a night channel on the front vision block of his manually-rotating cupola, and the driver has a night channel on his front block. The vehicle has air conditioning, a 30-liter drinking water tank, and a laptop computer to help the crew out with technical information. Engine and suspension are the same as on the parent Puma AEC. It is equipped with a BMS.

Normally, the vehicle carries four mechanics (including the commander and driver, and has seats for the crew of a rescued tank.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Shielded
$1,616,327	D, A	5 tons	44 tons	2+6	25	Passive IR (D), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
129/91	36/25	1037	329	Stnd	T6	HF100Cp HS24Sp HR20

Fire Control	Stabilization	Armament	Ammunition
None	None	MAG (C)	2000x7.62mm

Trail Blazer ACERV

Notes: The Trail Blazer is an Israeli combat engineer vehicle that doubles as a recovery vehicle. The Trail Blazer is the English name; the Israeli name is Gordon. These vehicles are converted largely from M-4A1 Shermans, with a new engine and transmission. It is an elderly design still relevant when recovering lighter vehicles and performing some less-demanding combat engineer tasks.

In this role, the turret is replaced with a raised superstructure; to the right of this superstructure is a crane of the same type mounted on the AMX-30D ARV. This crane may swivel 240 degrees, and may lift 12 tons through 240 degrees, of 15 tons when positioned straight out to the side and if it does not have to turn. At the front of the vehicle is a winch that has a capacity of 35 tons, or 70 tons with block and tackle, with 100 meters of cable; at the rear of the vehicle is an auxiliary winch with a capacity of 3.5 tons, or 7 tons with block and tackle, and 120 meters of cable. At the front of the vehicle is a large blade used to clear obstacles, while at the rear is a smaller one normally used to brace the Trail Blazer while it uses its winches or crane. There are also stabilizers at the rear of the vehicle, and they can also be used to lift loads up to the roof. Power is provided by a diesel designed for the vehicle developing 460 horsepower, but with a manual transmission.

As a combination recovery and combat engineer vehicle, it carries a wide variety of tools depending on its role; for combat engineer mode, it normally carries basic, excavating, construction, and power tools, welding and cutting gear, an engineer demolitions chest, and an air compressor; in the recovery vehicle role, it normally carries basic, wheeled vehicle, tracked vehicle, small arms, and heavy ordinance tools, an air compressor, and excavating tools, as well as a tow bar. In both roles, the Trail Blazer normally carries several lengths of rope, cable, and chains. It also carries wire and shackle/rebar cutters of various sizes, a welding set, two mine detectors, an engineer demo chest, and 20 kilograms of C4. Other equipment includes an optical chemical sniffer and 40 flags for marking contaminated area. The vehicle is festooned with external boxes, bins, and lockers for equipment, both engineer and repair and personal gear. A small laptop contains technical information about engineer tasks as well as repair tasks.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$636,984	G, A	1 ton	33.2 tons	4	17	WL Spotlight (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
81/57	22/16	636	256	Stnd	T5	HF27 HS8 HR4

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

*The dozer blades of the Trail Blazer can help protect the front and rear of the vehicle. How much depends on where the shot hits and how high the blades are raised. The front dozer blade has an AV of 6Sp, while the rear blade has an AV or 4Sp.

TAAS Tagesh

Notes: This AVLB is based on the chassis of the M-60A1 tank. The name TAGESH is an acronym for the words in Hebrew that literally means “tank bridge.”

The Tagesh is capable of mounting two types of folding bridges. Both are made of steel-reinforced aluminum alloy. The first type weighs 14.4 tons and it's single span can span an 11-meter gap, with a total bridge length of 11.7 meters. It takes 3-4 minutes to deploy or recover. It is an MLC 60 bridge. The Tzmed bridge allows for the traversing of gaps where one side is much higher or lower than the other, and can be laid at an angle of to 40 degrees (though driving must be careful at that angle). The weight of the Tzmed bridge is 27 tons and is a double span; the length of the area spanned is 19 meters, with a total bridge length of 19.7 meters. It is also an MLC 60 bridge. The deployment mechanism and carrying equipment are identical for the two bridge types, and can also be carried and deployed from older M-60-based AVLBs. The two bridge types can also be interleaved with each other to form larger spans that go straight out, then climb of descend a hill. Both use horizontal-deployment systems, like those of the German Biber. This not only does not provide such a flag to enemy forces, but is mechanically less complex.

The commander/bridge operator is in the center of the vehicle in a manually-operated cupola; he can just barely open his hatch and stick his head and shoulders out when the bridge is mounted, so he does most of the deployment and recovering through a battery of day/night CCTV cameras. He also has a night channel for his frontal vision block. The commander has a low-mounted light machinegun, but practically, he cannot fire directly ahead of him because of the bridging mechanism. The driver is in the front left and has three vision blocks to his front and one to the right, including a wide-angle block to the front with a night channel.

Though based on an M-60A1, the chassis has been upgraded with the Merkava's suspension and tracks, as well as an AVDS-1790-2D turbocharged diesel developing 750 horsepower. This version is further modified with a power take off that allows all the hydraulic and engine power to be devoted to the deployment and recovery of its bridge. The crew has an air conditioner, heater, and an NBC Overpressure system.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Tagesh w/One-Span Bridge	$552,631	D, A	300 kg	39.4 tons	2	45	Image Intensification (D, C), 4xCCTV Cameras (C)	Shielded
Tagesh w/Tzmed Bridge	$854,359	D, A	300 kg	50 tons	2	45	Image Intensification (D, C), 4xCCTV Cameras (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor*
Tagesh w/One-Span Bridge	136/95	38/27	1457	277	CiH	T6	TF4 TS4 TR4 HF56 HS15 HR8
Tagesh w/Tzmed Bridge	111/77	31/22	1457	352	CiH	T6	TF4 TS4 TR4 HF56 HS15 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Tagesh	None	None	Negev (C)	2285x5.56mm

*The CiH rating refers to when the bridge is carried on top of the vehicle. When the bridge is deployed, Config is Stnd.

Otobreda OF-40 ARV

Notes: Like most vehicles of its type, the OF-40 ARV uses the chassis of the base OF-40 Mk 2 tank, with the turret removed and a raised superstructure, crane, winch, and tools in its place. A dozer blade is at the front. The crane has a capacity of 18 tons at a reach of 9 meters, and can be manually operated if necessary. The main winch has a pulling capacity of 36 tons, or 72 tons with block and tackle, and has 80 meters of cable. The vehicle carries all the necessary tools for repair and recovery of vehicles up to main battle tanks, including basic, tracked vehicle, wheeled vehicle, small arms, and heavy ordinance tools, a welding and cutting set, an air compressor, a tow bar, a selection of spare parts, and ropes and cables.

The engine is the same as on the OF-40 Mk 2 tank: an MTU MB 838 ca M 500 830-horsepower multifuel engine.

The OF-40 ARV was designed specifically for export. The UAE bought 18 to support their force of 40 OF-40 Mk 2 tanks; the Libyans, despite the fact they bought a good number of OF-40 tanks, decided to buy ex-Soviet ARVs instead of matching OF-40 ARVs. No other sales have been made; I have been unable to determine whether the OF-40 series are still on the market. The UAE, the only known operators of the OF-40 ARV, have equipped theirs with GPS.

Twilight 2000 Notes: As with the OF-40 main battle tank, this Italian recovery vehicle had pre-war sales only to the United Arab Emirates, even though it was specifically designed for export. As with the OF-40, the Italian government requested all some stocks on Italian soil and manufacturing capability to be directed to Italian use, and these vehicles were taken into Italian Army service to replace vehicle losses, and sales during the Twilight War were made to Thailand and Greece.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$692,961	D, G, A	6 tons	45 tons	4	33	Image Intensification (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
146/102	41/28	1000	308	Stnd	T6	HF72 HS18 HR14

Fire Control	Stabilization	Armament	Ammunition
None	None	MAG (C)	2800x7.62mm

Mitsubishi Type 67 AVLB

Notes: This is a Japanese armored vehicle-launched bridge mounted on a Type 61 main battle tank chassis. Like the rest of Japan's military designs, the Type 67 was not export and production was limited to 16 vehicles. The Type 67 has almost totally phased out of service, as the newer Japanese fighting vehicles and tanks can barely be supported by the Type 67's bridge or not at all.

The bridge is short, 12 meters long and able to span a gap of 10 meters, with a maximum load of 40 tons. The bridge may be laid in 3 minutes and recovered in 5 minutes; it may be laid over the front of the Type 67, but may be picked up and restowed from either end of the vehicle.. The driver is in the front right of the hull, with the other two crewmembers in the center. The commander is forward in the hull, while the bridgelayer crewmember is more towards the center of the vehicle. The commander's machinegun can be mounted while carrying the bridge, but with the bridge present, shots to the front of the Type 67 are all but impossible.

The hull is for the most part identical to the hull of its parent Type 61 tank, with Mitsubishi Type 12 HM 21 WT diesel engine developing 650 horsepower. The transmission is manual.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$550,338	D, A	300 kg	35 tons	3	24	Active/Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
146/102	41/28	875	241	CiH	T6	TF4 TS4 TR4 HF51 HS12 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	Type 67 (C)	2000x7.62mm

*The Crew-in-Hull designation is meant to represent the bridge and its machinery when the bridge is mounted on the Type 67. The turret AV also refers to the bridge and its machinery. If the bridge is not on the vehicle, the Config is Stnd, and the turret AV does not apply.

Mitsubishi Type 67 AEV

Notes: The accent on the Type 67's abilities is the removal and clearance of battlefield obstructions. Though Komatsu offered an AEV based on the then-retiring M-4 Sherman, the JGSDF held off until it was presented with a better vehicle based on the Type 61 tank. The Type 61 has long since been retired, but the Type 67 AEV is still in use.

The Type 67 has a front-mounted mine plow/dozer blade and is controlled by the driver. Hull layout is roughly the same as the Type 70 ARV, also like the Type 70, the Type 67 has an A-frame crane with a capacity of 18 tons. It also uses the same winches as the Type 70 below. It carries a plethora of tools for obstacle removing, including a two sets of pioneer tools, a full set of power tools and hydraulic tools, including a welding set and air compressor, along with various ropes, cable, hooks, and even a tow bar. A book locker is provided with books concerning various combat engineer tactics, tasks, and solutions.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,145,050	D, A	600 kg	35 tons	4	19	Active/Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
147/103	41/29	875	193	Stnd	T6	HF51 HS12 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	Type 67 (C)	2000x7.62mm, Engineer Demo Chest, 20 kg C4

*The front dozer blade can help protect the Type 67, depending on where the shot hits and how high the blade is raised. The blade has an AV of 8Sp.

Mitsubishi Type 70 ARV

Notes: This Japanese recovery vehicle is based on the chassis of the Type 61 main battle tank, and even more so than the Type 67 AVLB, has been phased out of Japanese service. As with other Japanese military equipment, it is prohibited by Japan's constitution to sell it abroad, and the phased-out Type 70s have been scrapped, used as range targets, or ended up in museums.

As with most such vehicles, the turret of the Type 61 has been replaced with a raised superstructure; there is also an area on the flat rear deck which may carry the powerpack of the Type 61 or smaller vehicles. Atop the superstructure is an A-frame crane with a capacity of 18 tons. The Type 70 has a main winch with a capacity 35 tons, or 70 tons with block and tackle, and with 60 meters of cable. An auxiliary winch has a capacity of 3 tons, or 6 tons with block and tackle. The tool kit on the Type 70 includes a tow bar, basic, tracked vehicle, heavy ordinance, and excavating tools, an air compressor, and an arc welder. Inside, there is storage for tech manuals of various sorts of Japanese vehicles. Generally when replacing a powerpack or lifting a large load, a dozer blade at the front is lowered to increase stability. The Type 70 is armed with an 81mm mortar (primarily used for launching ILLUM and Smoke rounds, though other rounds can certainly be fired), a commander's heavy machinegun, and a light machinegun on a pintle manned by one of the mechanics through an open hatch. It also has four clusters of five smoke grenade launchers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,279,766	D, A	4.6 tons	35 tons	4	19	Active/Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
147/103	41/29	875	192	Stnd	T6	HF51 HS12 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	81mm M-2 Mortar, M-2HB (C), Type 67 (M)	27x81mm, 600x.50, 1000x7.62mm

*The front dozer blade can help protect the Type 70, depending on where the shot hits and how high the blade is raised. The blade has an AV of 8Sp.

Komatsu Type 75 ACE

Notes: This is a Japanese Armored Combat Earthmover (ACE) that entered development in 1964 and service in 1975. It replaced the D-9 non-armored combat earthmovers that the Japanese were using until that point.

The dozer blade is to the rear, and the vehicle is driven backwards for earthmoving operations, the driver sighting through a vision block to his rear and left. He sits in a turning seat with driving and dozer controls to the front and rear of him. In the front of the driver is an armored window with an aluminum armored shutter; to the rear is another armored window with an armored shutter. The crew enters through a door on the right side of the hull or by two hatches on the roof of the crew compartment in front. The driver is on the left, and the commander on the right. The driver also has wide-angle vision blocks to the front and rear, for use when the armored shutters are closed. The commander can also step up on a platform in the cab, guiding his driver through an intercom link. The driver has the same armored windshield and shutter as the driver, but has no windshield to the rear; he has one wide-angle vision block to the front for when the armored shutter is closed. The engine and radiator are at the rear of the vehicle; they are protected by appliqué armor and the rear is better protected than most light armored vehicles. The engine is a Mitsubishi diesel developing 345 horsepower. It is capable of working at a fuel-saving 160 horsepower, high-torque mode, normally when working with the dozer blade. The suspension is by torsion bar, with shock absorbers on the front, second, and rear roadwheels. The dozer blade is full-width (3.45 meters) and is hinged in the middle so it can be used as a mine plow. When traveling it is pulled up and in against the rear end. The Type 75 also has a winch with a capacity of 35 tons, or 70 tons with block and tackle; note, however, that block and tackle equipment is not normally carried by the Type 75. However, three sets of pioneer tools are carried, as well as a power saw and chainsaw; there are numerous lockers and bins for more equipment. The Type 75 is not normally armed, and no provision for a weapon is provided.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$432,962	D, A	1.5 tons	19.2 tons	2	13	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
138/97	38/27	595	98	Stnd	T3	HF4 HS4 HR5**

Mitsubishi Type 78 ARV

Notes: This is an Armored Recovery Vehicle based on the Type 74 main battle tank chassis. It is more up-to-date than the Type 67 ARV. That said, the Type 78, has much the same equipment as the Type 67, if in an updated form. The Type 78 was designed as a recovery vehicle primarily for the Type 61 and Type 74 tanks and is being used as an interim solution for the recovery of the Type 90 and Type 10 tanks. The JGSDF had 50 Type 78s in service in 1999, but some have been retired or raided for spare parts.

In place of a turret, the Type 78 has a raised superstructure offset to the right.with a crane on the right able to lift 20 tons, easily able to lift the turret of any vehicle in Japanese service. The crane may be traversed through 270 degrees, and has a reach of five meters. The Type 78 has a winch with capacity of 38 tons (or 76 tons with block and tackle), and 60 meters of cable. The winch has high-speed (15 meters/minute) and low-speed (6 meters/minute) modes. The winches (both of them) have tension devices which make sure that the cables wind and unwind on the drum evenly. An auxiliary winch has capacity of 3.26 tons. or 6.52 tons with block and tackle; it is normally used as a lead winch for the main winch. The vehicle carries a wide variety of recovery and repair tools, including a tow bar, basic, tracked vehicle, heavy ordinance, and excavating tools, an arc welder, two 20-ton hydraulic jacks, and an air compressor; a selection of spare parts is also carried, and items such as transmission fluid and lubrication oils and grease. There is a dozer blade at the front of the vehicle for bracing and earthmoving; in addition the suspension can be locked to further brace the vehicle.

The Type 78 is powered by a Mitsubishi 10 ZF 720-horsepower turbocharged diesel, with an automatic transmission, three smoke grenade launchers can be found at the front of the superstructure on either side. The commander is armed with a heavy machinegun, though only a limited supply of ammunition is carried as basic load and the weapon; as on virtually all such vehicles, is defensive in nature. His position is on the front center of the roof. The driver is on the front right. The other crewmembers have seats in the hull. There is a third hatch on the roof with an adjustable stand to allow one of the mechanics to be an equipment operator; it has no vision blocks. On each side of the center of the glacis, there is a cluster of three smoke grenade launchers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,130,040	D, A	5 tons	38 tons	4	27	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
149/104	41/29	950	267	Stnd	T6	HF56 HS14 HR10

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	660x.50

Mitsubishi Type 90 ARV

Notes: This is a Japanese recovery vehicle based on the chassis of the Type 90 tank; and designed specifically to service the Type 90 tank and other vehicles, and replace the Type 78 ARV. By 1999, 14 Type 90 ARVs have been delivered to the JGSDF; though production rate is slow, they certainly have more by now.

Instead of a turret, the Type 90 ARV has a raised superstructure and a crane on the right side with a capacity of 25 tons. The crane can be controlled from outside the vehicle via a control box connected to the Type 90 with a cable. It pivots from the front right side and folds along the right side for travelling. It also has a winch with a capacity of 55 tons (110 tons with block and tackle), and 80 meters of cable. On the front of the vehicle is a dozer blade that is used to stabilize the vehicle during recovery operations and to clear obstacles and prepare fighting positions; The Type 90 ARV carries a wide variety of tools, including basic, tracked vehicle, heavy ordinance, and excavating tools, two 20-ton hydraulic jacks, and an arc welder and air compressor. A tow bar and a selection of spare parts for the Type 90 and a few other commonly-recovered vehicles is also carried. The driver sits on the front left with the commander and two other crewmembers behind him in the superstructure. The hull layout of hatches, bins, and lockers are much the same as the Type 67; these boxes are where most of the tools and some of the spare parts are located.

Commander's and driver's positions are in the front of the nearly-vertical front of the vehicle. At the rear if a larger hatch for the recovery specialist can use the crane and enter and exit. When traveling, the crane is folded along the right side of the superstructure; the superstructure is shifted to the left side to allow this. The commander has a cupola above his position, manually-operated and with a pintle-mounted heavy machinegun. The Type 90 has five-cell smoke grenade launchers at the top of the forward superstructure. This gun may aimed and fired from inside the vehicle with hatches closed. The interior has the ability to recover the Type 90 tank or any similar or lighter vehicle; four seats inside are for the recovered vehicle's crew. The T-90 ARV is equipped with the same engine as the Type 90 tank: Mitsubishi 10ZG turbocharged diesel developing 1500 horsepower, coupled to an automatic transmission; the Type 90 can lock it's suspension as well as pivot turn in place. The Type 90 ARV is connected to an BMS and has a small computer that carries tech manuals for all Japanese vehicles as well as the BMS software. Two LCD screens allow the crew to monitor the BMS information; the driver has an LCD screen to monitor the vehicle's health, and the commander has a duplicate of the BMS screens. Conventional maps are also carried, as well as a small computer and typed notes that summarize recovery and repair information and solutions.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,051,372	D, A	7.59 tons	49.57 tons	4+4	29	Passive IR (D), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
212/149	59/41	1100	557	Stnd	T6	HF100Cp HS24Sp HR12*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	1500x.50

KADDB AB1 Monjed P2 ARRV

Notes: Also known as the AB1, the Jordanians still have a number of M-47-based repair and recovery vehicle in service, even now in 2016. Though the pioneering work on converting M-47s to ARVs was done by the US and Germany, many countries who have obsolete M-47 tanks have converted them to ARVs or AEVs. The Jordanian's M-47 ARV was first produced as an experiment, to see if could recover newer tanks and armored vehicles. It proved quite capable of servicing those vehicles, including the more modern tanks that the Jordanians now used. It takes many components from other ARVs, including the American M-88, and the British Chieftain and Centurion ARVs. The M-47 ARRV fist entered Jordanian service in 2001. Some 20 have been modified in such manner, and used only by the Jordanian Army.

Like virtually all heavy ARVs, they are based on tank chassis, in this case the M-47. The turret is removed and replaced by low superstructure, and the turret basket is plated over, and the equipment removed, and replaced by a large open area. At the front is a large hydraulically-actuated dozer blade which is attached just outside of the final drives, and moved by the final drives when the vehicle is doing its recovery duties. It is lowered to the ground to dig fighting positions and remove obstacles, and lowered a bit more to brace the crane. The blade is 3.4 meters high and 750 centimeters high. The ATLAS crane, fitted to the Chieftain ARV, is mounted on the front right side and can be rotated 280 degrees. It has a reach of 3.3 meters and can lift 6.5 tons; maximum lift height is 4.4 meters. On the front of the vehicle, high enough to clear the dozer blade when it is in the down position, is a winch, taken from the M-88A1. It has a pulling capacity of 28 tons, or double with block and pulley; is has 157 meters of usable cable. Once the vehicle is recovered, the AB1 can tow a vehicle of up to 60 tons, if it is not mobile.

The driver is on the front right side below the roofline, with the commander behind him in a manually-operated cupola. He has a machinegun on a pintle mount. The cupola is identical to that found on the M-113 series. The basic crew is two, driver/mechanic and commander/mechanic, though a third mechanic may be carried on a seat in the hull. The crew has air conditioning, a heater, and NBC Overpressure, even though much of the crew's tasks must be carried out outside of the AB1. A GPS/GLONASS system has been added. On each side of the glacis is a

The original powerpack of the M-47 chassis has been replaced by a smaller but more powerful AVDS-1790-2DR taken from an M-88A1; this would seem to indicate that the chassis used is that of an M-47M. It has a fully-automatic transmission, and the gearing of the engine may be uncoupled from the wheels and the power applied to the crane or winch. The engine is a turbocharged diesel that provides 750 horsepower at 2400 rpm, and has a lot of torque. Track skirts taken from Centurion tanks, have been attached to the sides of the AB1. Of course, the AB1 carries a large selection of tools, including basic, tracked vehicle, wheeled vehicle, power, and pioneer tools. Also carried are an arc welder, an air compressor, two 40-ton hydraulic jacks, a hand-held circular saw (as used by firefighters), a "jaws of life," a tow bar, and a selection of spare parts. It has a small computer that has a database of repair and recovery solutions.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,532,875	D, A	6 tons	42 tons	2+1	20	Image Intensification (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
138/96	38/27	1514	298	Stnd	T5	HF50 HS14 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	660x.50

*The dozer blade may protect the AB1 from frontal hits. Whether it does so depends upon where the shot hits and how high the blade is raised. The blade has an AV of 10Sp.

M-32 Chenca

Notes: This Mexican version of the M-32B1 Sherman-based Tank Recovery Vehicle differs from chiefly in the engine used and the abilities of its recovery and engineering equipment. The final drives have brackets added to allow mounting of a dozer blade, and the engine is an earlier version of that mounted on the Stingray tank. The Chenca is designed for use by both recovery and combat engineer vehicle, with a wide variety of tools and weapons for this purpose. Primary recovery equipment is a winch in the front hull with a capacity of 27 tons, or double that if block and tackle is used; the cable is lead out of the glacis plate, and the reel is located behind the driver's seat. There is also an A-frame crane with a capacity of 9 tons, or 14 tons if the vehicle is stationary and the bogies locked. The turret is replaced with a circular superstructure. A large amount of tools are carried containing almost anything a recovery mechanic or combat engineer could need, including basic, tracked vehicle, wheeled vehicle, excavating, power, small arms, and heavy ordinance tools; a jackhammer, a chainsaw, an air compressor, up to 6 fire extinguishers, and a combat engineer's chest. The Chenca uses the Detroit Diesel 8V-82-T, a derivative of the M-113A3's engine, developing 300 horsepower. Due to budgetary considerations, the Mexican Army was not able to buy more up-to-date equipment and her plans to get a Leopard 1 ARV version was called off, leaving it with obsolete recovery vehicles and engineer vehicles. The Chenca was forced to into both the recovery and engineer roles.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,066,592	D, G, AvG, A	1.5 tons	29.2 tons	4+2	21	Active/Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
97/68	27/19	651	85	Stnd	T5	HF27 HS8 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C), MG-3 (Bow), M-29 81mm Mortar (FH)	300x.50, 2000x7.62mm, 30x81mm, 20 kg C4, Engineer Demo Chest

HIT Al-Hadeed

Notes: Basically a small workshop on wheels, the Al-Hadeed is similar to other ARRVs, being a modification of the Talha APC (itself a modification of the M-113A2). Like the Talha, the Al-Hadeed has a lengthened chassis with six roadwheels. The vehicle, if possible, looks even blockier than ARV versions of the M-113; this is a sign that extra armor has been added and the widening of the hull. Like the Talha, the Al-Hadeed has good space for its crew, despite the sheer amount of spare parts and tools it carries. (to be fair, some are carried in boxes and lockers on top and on the sides of the vehicle, or are simply strapped on the outside.) At the front of the hull, with the base opposite the commander, is a hydraulic crane with a telescoping jib and able to lift 3 tons as 2.2 meters. Leading out the rear is a winch cable with a capacity of 20 tons (40 tons with block and tackle), and 130 meters of cable. At each corner, hydraulic outriggers can be lowered for stability when the crane or winch is being used. Some Al-Hadeeds have a vehicular NBC pack, into which the crew plugs in the extended hoses of their protective mask; others have NBC Overpressure and extra roof and side viewing ports and vision blocks. On the fender on each side is a cluster of four smoke grenade launchers. The night vision fit is normally a passive viewer for the driver; some are equipped with a backup camera and an image intensifier for the commander though one of the vision blocks of his manually-rotating cupola, and one image intensifier on a wide-angle vision block for use by the crane operator. (These extra night vision devices are normally found only on Al-Hadeeds with NBC Overpressure.) Al-Hadeeds with NBC Overpressure also have the ability to aim and fire their commander's weapon while under armor with the hatches closed. While the Al-Hadeed has the standard mix of basic, wheeled vehicle, tracked vehicle, and small arms tools, it also has a folding work table, a battery charger, an air compressor, power tools, a power lathe, two welding sets (both electric and gas), a grinder, a hydraulic press, and a small computer which is loaded with tech manuals, papers on repair, hints, and suchlike. To power all this while the engine is off, the Al-Hadeed has a 5kW APU.

Being a descendant of the M-113A2, the engine used is a Detroit Diesel 6V53T variant developing 265 horsepower and high torque for towing and winching operations. The transmission is automatic, and the driver has normal pedal and wheel controls. The suspension is by torsion bar, but the front two, the second from the rear, and the return roller have hydraulic dampeners, and the ride is unusually smooth.

Stats below and in the price assume a maximum fit.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$793,935	D, A	3 tons	15 tons	5	12	Passive IR (D), CCTV (D), Image Intensifier (C, CO)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
123/86	34/24/3	480	86	Stnd	T3	HF9Sp HS5Sp HR5

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

Obrum MID Bizon CEV

Notes: The MID is a Polish combat engineer vehicle based upon the PT-91 chassis, and incorporating many features of the WZT-3 armored recovery vehicle below. Its main characteristic is the heavy jib crane on the right side of the roof; this crane arm can be equipped with a gripper claw for removal of battlefield obstacles, or a digger bucker. The crane has a capacity on 7 tons, and can extend a maximum of 7.94 meters away from the vehicle. (It may not operate closer than 5.94 meters from the vehicle, as that is the arm's minimum length.) The crane arm may rotate 240 degrees in seven seconds, covering the right side of the vehicle; it also has a depression of -55 degrees up to +60 degrees. On the front of the vehicle is a V-shaped dozer blade with a width of 4.2 meters; this is primarily a mine removal tool, moving the mine outside of the MID's track, but also can be equipped with a lower ripper claw to destroy road surfaces. When used at a mine plow, it has an AV or 8. The bucket may also be equipped with a ripper claw, and this is more likely to be mounted. The ripper claw may be extended 5.94 meters; The individual ripper teeth are 0.45 meters long and the blade can dig out a 1-meter square and digger bucket can lift 0.96 meters square if it can grab on a vehicle that is large enough can lift up to 3.3 tons and pull, for example, a vehicle from the roadway. Other attachments for the arm are a claw, a large circular saw that can cut through 500 centimeters of concrete per minute, a cable sling with a lifting capacity of 7 tons, and an auger that can dig a 1-meter-wide hole 1.5 meters deep per minute. The MID has a primary winch with a capacity of 45 tons, and a secondary winch with a capacity of 4.5 tons with 400 meters of cable. The MID also carries integral welding gear. If necessary, the MID can be equipped with a deep wading system that allows fording to a depth of 5 meters for up to 1000 meters. Normal wading depth is 1.2 meters. Finally, the M.I.D. is equipped with a smoke generation system that produces smoke that is opaque to IR detection systems (such as passive or active IR, or starlight scopes), as well as obscuring normal optical devices. Other equipment includes basic and tracked vehicle tools, 2 sets of pioneer tools, a chainsaw, and a 5kW generator with a voltage converter, and can be used to recharge the batteries or take their place if they are drained. The RPK and RPG-7 come with the vehicle, but are not actually mounted; 50 kg of plastic explosive and an engineer demo chest are carried to reduce stubborn explosive obstructions. The RPG-7 is normally armed with FAE warheads for the rocket launcher, A secondary role for the MID is for the repair of buildings and field fortifications and roads, as well as their destruction. In addition to its normal armament, the MID has an NSVT, and a RPK on the right hull and an PKT on the left side near the center in both cases, near the fender, and both have limited traverse and elevation, and may fired directly or by a remote uplink from the commander's or gunner's position. The seats are directly behind the driver, and gunner's seats. Four seats may carry up to four other engineers, It has well as four smoke grenade launchers on each fender. It normally carries two bundles of 40 meter long trackway.

PZL-Wola in Poland developed the S-12U diesel engine, a modernized version of the T-72M1's V-46-6. Though the higher 850-horsepower output cut the range of the Bizon, the increased performance was deemed a worthwhile trade-off. The Bizon has an automatic transmission. The driver is on the front center and has vision blocks to his front and both sides. The center block has a night vision channel. He has access to an RPK-74 on the right bow and an RPK on the left bow. The commander is on the front left, and has a raised cupola with all-around vision blocks and a heavy machinegun that may be aimed and fired from within the vehicle. He has a night vision channel on his center front block, and an aiming reticle with computer assistance. The Bizon may carry a dedicated equipment operator. He also has all-around day/night CCTV cameras. The vehicle may carry additional combat engineers; four seats are found in the hull for them. The Bizon has a NATO-compatible BMS. On either side of the glacis is a cluster of six smoke grenade launchers. It has air conditioning, heating, and NBC Overpressure protection, as well as an automatic fire detection and suppression system.

Aside from Poland, the MID is used by the Malaysian Army, based on its version of the PT-91, called the PT-91M. This is the MID-M.

Twilight 2000 Notes: The MID was barely into production at the outset of the Twilight War, and perhaps fewer than 30 of these vehicles were built.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,225,032	D, G, AvG, A	1 ton	46 tons	2+4	39	Active/Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
132/92	37/26	1000	272	Stnd	T6	HF149Cp HS20Sp HR10**

Fire Control	Stabilization	Armament	Ammunition
+1	Fair	NSV (C), RPK, RPK-74K, RPG-7	300x12.7mm, 1000x5.45,1000x7.62mm, 7xRPG-7 Rockets, 20 kg C4, Engineer Demo Chest

HSW MT-LB TRI Armored Engineer Reconnaissance Vehicle

Notes: This Polish adaptation of the MT-LB is intended for reconnaissance of bridges, road conditions, structures, potential demolitions and trap sites, and possible fortification sites. In this role, the MT-LB is fitted with a variety of standard and video cameras, an optical chemical sniffer, a Geiger counter, and specialized equipment for determining the state of repair and strength of roads and bridges, as well as open ground, ice, snow, river banks and bottoms, and beaches. Water depth can also be measured. A characteristic of the MT-LB Armored Engineer Reconnaissance Vehicle is the large rail type antenna centered over the right side of the vehicle, for the 5 long-range radios. The NSV machinegun is in a small cupola, and may be aimed and fired from within the vehicle. The RPG-7s come with the vehicle, but are not mounted; the vehicle normally carries FAE warheads for its RPG, in order to

reduce obstacles. 20 kilograms of plastic explosive and an engineer demolitions chest are carried for the same purpose. The crew's findings are radioed to higher headquarters via a high-gain antenna, and the radios can transmit digital, radio, and teletype information. It is not equipped for NBC purposes, and has no such detectors, though the front hull does have a mine detector in it. The crew consists of a driver and commander, as well as 1-6 additional engineers as necessary to operate the reconnaissance equipment. At the rear of the vehicle, on each side, are clusters of four smoke grenade launchers.

Power is provided by SW680/167/1 turbocharged diesel developing 245 horsepower.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,169,698	D, A	1.7 tons	13.15 tons	2+6	33	Passive/Active IR (D, C), Image Intensification (D, C, 4xDay/Night CCTV)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
146/102	41/28/4	450	90	Stnd	T3	HF5 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	NSVT (C), 6xRPG-7	240x12.7mm, 36xRPG-7 rockets, 20 kg C4, Engineer Demo Chest

Bumar Labedy WZT-1

Notes: Originally based on the hull of a T-54 in prototypes, the WZT-1 was designed after the Russians developed a similar vehicle in the early 1950s. Later, the hull of the T-55 was used, and then later the T-55A. Development was slow, with many new components added in, and finally in the late 1960s, Czechoslovakia and Poland bought the upgraded prototype version BTS-2, placed in production as the WZT-1. The WZT-1 hull was later used in the upgrade of the Newa SAM system to the Newa-SC standard.

The WZT-1

The WZT-1 is out of service in both Poland and Czechoslovakia, as it is inadequate for recovering more than 40-ton vehicles (though it can repair them. To the opposite side of the commander and behind the driver is the crane; this can lift 3 tons at 4.5 meters. The main winch leads out the front and has a capacity of 49 tons, or 64 tons with block and tackle; it has 200 meters of cable. The lead winch has a capacity 1.5 tons with 200 meters of cable. To assist with everyday tasks, the WZT-1 has a 2kW APU; this also assists with powering the power tools, arc welder, and air compressor. Also available are basic tools, tracked vehicle tools, wheeled vehicle tools, pioneer tools, and a selection of spare parts. The dozer blade is full-width and has teeth to aid in obstacle-clearing and digging. Improved versions have IFF, data-capable radios, and printout capability, and analog components have been replaced with digital ones. They also have automatic transmissions. They retain the V-55A 580-horsepower engine. Some of the older vehicles have had their wheels and undercarriage replaced with those allowing them to operate on railroad tracks, to service trains. By 1978, the WZT-1 was replaced by the WZT-2. Towards the rear of the vehicle on each side is a cluster of four smoke grenade launchers.

The WZT-2

The WZT-2 is also another ARV that is incapable of recovering most of the tank fleets used by the owners' countries. It is based on the WZT-1, using a T-55A hull with a more powerful engine that also has a little more torque. Towing capacity is about 42 tons. The WZT-2 is still the base RRV for Poland, Czech Republic, Slovakia, India, Serbia, and Croatia; it can carry out most repair duties on almost all of the vehicles in those fleets, but cannot tow the heavier ones -- in particular, tanks and the heavy ARVs cannot be recovered by the WZT-2. It can, however repair most of these vehicles and recover some of them. Iraq also used the WZT-2, but most of those were scrapped or used as range targets after the Third Persian Gulf War, replaced by newer vehicles. Several WZT-2s have also been bought from Poland by museums or private owners.

The WZT-2 carries a crew of 4; it can also carry the crew of the disabled vehicle, up to 3 persons; alternately, three extra mechanics or technicians may be carried. Layout is similar to that of the WZT-1, though the interior is different due to the space for three members of the recovered vehicles' crew; in addition, the WZT-2 has an NBC Overpressure system. Remote controls allow the use of the crane from inside the WZT-2. A rearranged interior, however, allows carriage without much loss of space for spare parts, and external stowage also allows for more carriage of spare parts and tools. The crane, winches, and tools sets are the same as the WZT-1, and the WZT-2 also carries a 2kW APU. Early versions of the WZT-2 had the same cupola as on the T-55; later, this was replaced with a square hatch that opened to right and had the weapon on a pintle.

The engine for the WZT-2 is a V-55W 591-horsepower turbocharged diesel. Most have been converted to automatic transmission; newer versions also have IFF, data and print-capable radios, and digital components. A number of these vehicles have been modified as railroad RRVs.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
WZT-1	$653,852	D, A	3 tons	31.5 tons	3	18	Active/Passive IR (D)	Shielded
WZT-1M	$380,837	D, A	3 tons	32 tons	3	19	Active IR (D), WL Spotlight (C)	Shielded
WZT-2	$189,130	D, A	3 tons	34 tons	4+3	16	Active IR (D), WL Spotlight (C)	Shielded

WZT-2M	$230,121	D, A	3 tons	34.5 tons	4+3	17	Passive IR (D), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
WZT-1	143/100	40/28	530+380	209	Stnd	T6	HF63 HS12 HR8
WZT-1M	141/99	39/27	680+380	212	Stnd	T6	HF66 HS13 HR6
WZT-2	128/90	36/25	680+380	219	Stnd	T6	HF66 HS13 HR6
WZT-2M	126/89	35/25	680+380	222	Stnd	T6	HF66 HS13 HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
WZT-1/2	None	None	DShK (C)	200x12.7mm

Bumar WZT-3 ARV

Notes: This Polish armored engineer vehicle is based on the T-72M MBT chassis, and is similar in appearance to the Russian BREM-1 ARV. It was designed in the late 1980s, and is the last (so far) in a long line of Polish ARVs that started after World War 2. It has several differences from the BREM-1, however, to suit Polish needs. It was designed to support the T-72 and smaller vehicles, as well as some vehicles still on the drawing board or experimental phase at the time. In addition to Poland, Bulgaria uses the WZT-3, as does Malaysia. The WZT-3 was built only from 1988 to 1989, and only 20 were built.

The WZT-3

As with the BREM-1, the turret of the T-72 is replaced with a raised superstructure. The driver sits in the front left of the superstructure, with the commander in a cupola to the driver's right. Two mechanics sit in the hull, behind the driver and commander's positions, and facing to the rear. There is a hatch on the front of the roof for them to enter and exit, but it has no vision blocks. Behind the superstructure on the deck is a platform for power packs and other major components. Just behind the driver is the crane, which has a reach of 5.8 meters and can lift 15 tons at that reach; if extended 5.8 meters or less, it can lift 15 tons. At the front of the vehicle is a large dozer blade for excavating or bracing purposes, and has a width of 3.3 meters. The main winch is driven by the engine and has a capacity of 65.3 tons, or 83.5 tons when block and tackle is used; this winch has 200 meters of cable. The auxiliary winch has its own motor, has 400 meters of cable, and a capacity of 2.04 tons, but is not designed to be used with block and tackle. The WZT-3 has specialized equipment carried include two tow bars, tow cables, electrical and gas welding gear, impact wrenches, basic and vehicle tools, electrical and electronic tools, and a chain saw. A 6kW APU is provided to power the tools and the winches. The WZT-3 also has a fuel pump to provide fuel from another source to itself or other vehicles. The WZT-3 has smoke grenade launchers on either side of the superstructure, but in clusters of five. The WZT-3 has NBC Overpressure air conditioner, and heating.

The engine of the WZT-3 is the V-46-6 turbocharged diesel, with an output of 780 horsepower. This and the high torque allows the WZT-3 able to tow 50 tons at half speed, or 75 tons at one-quarter speed.

The WZT-3M

When the Polish brought the PT-91 Twardy into service, it was felt that the combination of the heavier Twardy and the advent of new technologies meant that the WZT-3 would have to be upgraded. The primary differences were the basing of the armor suite on the Twardy (the WZT-3M is based on the PT-91, instead of the stock T-72); and the use of the Twardy's S-12U turbocharged diesel, developing 850 horsepower, though it also has a gun at the commander's position that may be aimed and fired from within the vehicle. 9 new WZT-3Ms were built for Poland and Bulgaria, and all other WZT-3s were upgraded to the WZT-3M standard. India went all out and bought 352 WZT-3Ms; they have another 204 on order. These 204 will be supplied in kits, to be assembled in India. Indian Army WZT-3Ms have the designation ARV-3. They are built in India by BEML.

The Malaysians call their version of the WZT-3M the WZT-4.

Kuwait operates 15 ARVs which are functionally equivalent to the WZT-3, but is based on the Serbian M-84AB tank. Their stats are somewhat different, but the results are similar. These are designated by the Kuwaiti military the M-84ABI. They continue to be powered by the V-46TK engine, developing 780 horsepower. These have inertial navigation and GPS, as well as the standard NBC overpressure, air conditioner, and heater, along with the other features of the WZT-3 and 3M. The vehicles also have a small computer with a database of repair and recovery solutions.

Polish WZT-3Ms are equipped with a BMS, allowing them to interact with higher headquarters and receive orders; Polish BMSs are NATO-compatible. It also carries computers dedicated to the BMS and interfacing with maps and the GPS, as well as one to provide technical information on virtually any Polish vehicle. Indian models also have a BMS and GPS, as well as inertial navigation backup. Indian BMSs are proprietary, but based on Russian models.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
WZT-3	$1,306,786	D, A	6 tons	42 tons	4	33	Active/Passive IR (D)	Shielded
WZT-3M	$836,101	D, A	6 tons	42 tons	4	32	Passive IR (D), Image Intensification (C)	Shielded
WZT-3M	$1,676,521	D, A	6 tons	43 tons	4	34	Passive IR (D),	Shielded

(Polish/Indian)							Image Intensification (C)	
M-84ABI	$1,522,827	D, A	6 tons	43 tons	4	32	Passive IR (D), Image Intensification (C), WL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
WZT-3	145/101	40/28	1126+400	285	Stnd	T6	HF140Cp HS22Sp HR12
WZT-3M	156/109	43/30	1126+400	316	Stnd	T6	HF149Cp HS20Sp HR10
M-84ABI	132/93	37/26	1050+400	290	Stnd	T6	HF158Cp HS15Sp HR12

Vehicle	Fire Control	Stabilization	Armament	Ammunition
WZT-3/3M/M-84ABI	None	None	NSV (C)	500x12.7mm

Morozov BAT-2

Notes: The BAT-2 is a combat engineer vehicle used by Russian and Pact forces. The vehicle is based on a T-64 chassis, and has a large V-shaped dozer blade mounted at the front, used primarily as a mine plow. It is a little wider than the width of the vehicle, and has a variable bow to the "V" shape; the plow can actually be pulled into a dozer shape. In mine plow shape, the blade is 4.2 meters wide, while in dozer configuration, it is 4.5 meters wide. The mine plow may be lifted to 90 degrees, entirely clear of the front. At the rear is a soil ripping blade, which may be lowered or raised, and is the width of the vehicle. The BAT-2 has a crane with a capacity of 2 tons that may reach out 7.3 meters from the vehicle, and may be fitted with pincer-type tools, an auger, and a bucket. Mounted on the same platform as the crane is a 25-ton capacity winch with 100 meters of cable. The BAT-2 has a cab up front with large bullet-resistant windows on the front and sides, and it contains the driver on the left and commander on the right. In the rear section is an entire combat engineer squad; they have bullet-resistant windows on either side of the front of their compartment. The vehicle is protected by an NBC Overpressure system.

The BAT-2 is equipped with a V-64-5 710 horsepower turbocharged diesel. This engine is derived from the one on the T-72.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$698,604	D, G, AvG, A	6 tons	39.7 tons	2+8	27	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
130/91	38/27	1000	262	Stnd	T6	HF8 HS3 HR3

Uralvagonzavod BREM-1 ARRV

Notes: This is an ARRV (Armored Repair and Recovery Vehicle) based on the T-72A. The basic BREM-1 is designed to support the T-72, T-64, and T-80. Though the Soviets reported it as entering service in 1975, other official sources state that is did not enter full production until 1984. In either case, 342 were built by 1990 when production stopped. Besides Russia, the BREM-1 is used by various African nations, India, Venezuela, and several former Soviet Republics. Most these are the improved BREM-1M, designed to support the T-90S tanks that many of these countries also field. It's main role is to recover damaged or stuck or overturned tanks and IFVs from the battlefield, and its armor suite helps in this regard, as it is meant to work on the front lines.

BREM-1

The turret of the T-72A has been removed and replaced with a raised superstructure. The main vehicular repair tool is a 4.4-meter crane, able to lift 19 tons at 2.2 meters and 3 tons at its maximum reach of 4.4 meters. It can be used to help recover stuck or overturned vehicles, but it's main role is to lift turrets clear of a tank for repair and to acts as a jack to facilitate roadwheel, suspension, and track repairs (though the BREM-1 also carries two hydraulic jacks). The BREM-1 may move if the crane is lifting no more than 3 tons, but the suspension locks if the BREM-1 tries to move with more than 3 tons on the crane. The main winch has a base pull of 25 tons, but this may be doubled with block and tackle, or quadruple that with double blocks and tackle. The cable is 200 meters. An auxiliary winch can pull 530 kg, with 425 meters of cable. The BREM-1 can tow vehicles of up to 50 tons, at a Tr Mov of 48/33. The dozer blade is primarily used to brace the BREM-1 when using the crane or winches, but can also be used to clear obstacles and dig fighting positions. It is 3.1 meters wide.

The BREM-1 has a full complement of tools, including all basic types of tools, an arc welder, and an air compressor. On the roof is a flat area large enough for a full tank powerplant or 1.5 tons. A selection of spare parts, including several roadwheels and track sections, are carried. A 5kW APU is carried to power the equipment without turning on the engine.

The driver is on the front left, with the commander on the front right. The crane operator is on the top of the superstructure in a cupola with all-around vision blocks. A fourth mechanic can be carried inside the vehicle as necessary.

The engine is a V-46 780-horsepower turbocharged diesel engine developing 780 horsepower, with an automatic transmission.

BREM-1M

The BREM-1M is the same base vehicle, but is more powerful to support the T-90S tank. The main improvement is the use of a V-92S2 engine, developing 1000 horsepower. The crane is improved to be able to lift a base weight of 28 tons at 2.2 meters or 4.4 tons at 4.4 meters. The BREM-1M is BMS-compatible, as well as having a GPS and a small computer with repair solutions. Other details are as per the BREM-1.

Vehicles	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BREM-1	$1,317,201	D, A	2 tons	41 tons	3+1	27	Active/Passive IR (D)	Shielded
BREM-1M	$2,174,544	D, A	1.6 tons	41.8 tons	3+1	29	Passive IR (D)	Shielded

Vehicles	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor**
BREM-1	137/96	38/27	1000+400	289	Stnd	T6	HF140Cp* HS22Sp HR12**
BREM-1M	165/115	46/32	1000+400	371	Stnd	T6	HF140Cp* HS22Sp HR12**

Vehicles	Fire Control	Stabilization	Armament	Ammunition

BREM-1/1M	None	None	NSVT (C)	840x12.7mm

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

Kurganmashzavod BREM-2

Notes: This is a recovery vehicle based on the BMP-1, in the same way that the BREM-1 is based on the T-72. It is intended for recovery and repair of the BMP-series of infantry fighting vehicles. It saw first service in 1982. Some BMP-1s were also converted to BREM-2s, starting in 1986.

The turret of the BMP-1 is replaced with an armored plate, and the rear of the vehicle is fitted with a load-carrying platform able to carry a BMP powerpack or something of equivalent weight (1.5 tons). The upper hull mounts a crane with a capacity of 1.5 tons. An auxiliary crane may be mounted to increase this weight to 7 tons, though this crane may not work on its own. The interior of the vehicle houses a 6.5-ton capacity winch, which may be lead out the sides or front or rear. It's pulling capacity may be raised to 19.5 tons with two sets of snatch blocks. Various recovery tools are placed in stowage positions at various locations on the hull roof and sides, including a tow bar, 200 meters of rope, basic, tracked vehicle, small arms, and heavy ordinance tools, and excavating tools. In addition, a hydraulic jack, arc welder, and air compressor is carried, along with a selection of spare parts. The front of the vehicle has a large dozer blade which is used to brace the BREM-2 in recovery operations and when using the crane. Russia and other Pact forces use the BREM-2.

There are 12 smoke grenade launchers on the BREM-2, in two clusters. One of these clusters is a standard 902V Tuchna smoke grenade cluster, while the second cluster is a TDA thermal grenade launcher. The layout leaves the driver in his standard position on the front left. The commander is in the front, slightly offset to the right; he has a pintle-mounted machinegun. The other crewmembers are in seats in the hull; the firing ports of the BMP-1 have been deleted, but the vision blocks are retained. The rear doors, with their fuel tanks, were also retained, and like the BMP-1, their crews often fill them with water or sand to stop rear hits from setting them on fire. The BREM-2 carries a lightweight folding table and a tent to extend the work area at the rear of it. Later, the sideskirts/mudflaps of the BMP-2 were added, making it more stable when swimming. The crew is protected by an NBC Overpressure system.

The engine is inherited from the BMP-1, and is a UTD-20 multifuel developing 300 horsepower. The BREM-2 also inherits the BMP-1's manual transmission, and its torsion-bar suspension with shocks on the first and last roadwheels.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$488,738	D, G, AvG, A	2 tons	13.6 tons	4	8	Active/Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
154/108	43/30/5	460	89	Stnd	T3	HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT (C)	2000x7.62mm

Omsk BREM-80U

Notes: The intent of the BREM-80U is to replace the BREM-1 with a much improved recovery vehicle based on the T-80U tank chassis. It's specific design role was to provide a recovery vehicle for the T-80 series, though it has a secondary role of recovering other tanks and some smaller vehicles. It was designed in the late 1980s, but did not enter service until 1998. The advent of the T-80, with its gas turbine engine, introduced complexities in recovery and repair efforts that it was felt only a new ARV could address. The BREM-80U has its own deficiencies (including its faulty gas turbine engine) and many feel that the need would be better met by a set of improvements to the BREM-1. The need for the BREM-80 was made more acute by the introduction of the T-80 series onto the international market. Many say that while the BREM-80U is an important step, and will do as a stopgap, it cannot meet the needs for which it was designed and may soon have to be upgraded or replaced. The only export customer so far is Cyprus, who also run a number of T-80Us. It should be noted that the BREM-80U received only low-rate production orders, and never entered full production.

The BREM-80U is generally similar in layout to the BREM-1, but is greatly improved. The turret of the T-80U is removed and replaced by a raised superstructure. There are several external stowage boxes on the sides, and roof of the vehicle. (Though the stowage boxes are not armored, the vehicle underneath is.) Mounted on the front left of the BREM-80U is its crane; it has a capacity of 18 tons, or 30 tons with snatch blocks. Those 18 tons are easily enough to lift out the T-80Us powerpack or lift its turret, but it should be noted that the typical Western tank-based ARV has almost double this lifting power (without snatch blocks). The rear deck can carry the T-80's powerpack or other large cargoes. It can rotate 240 degrees. The main winch can pull 35 tons bare, though with sufficient block and tackle this can be increased to 140 tons. (Again, note the superior winching power of Western vehicles.) The main winch has 120 meters of cable; an auxiliary winch can pull 3.5 tons and has 320 meters of cable. The BREM-80U can easily tow a T-80-series tank, as well as similarly-sized or smaller vehicles. Tools include basic, tracked vehicle, small arms, heavy ordnance, electrical, and electronic tools; also included are two sets of pioneer tools. The BREM-80U also has an arc welder, air compressor, a tow bar, and two hydraulic jacks. A selection of spare parts is carried, usually in the outer lockers or attached directly to the hull. The BREM-80U has a front-mounted dozer blade to brace the vehicle when using the crane or winching; a bracing leg can also be lowered at the rear. The BREM-80U has a 60kW APU to allow for most operations, including crane and winch operations, without having the engine on.

The driver of the BREM-80U, due to the position of the crane, is moved to the top center of the vehicle, with three vision blocks to

the front, one of which has a night channel. The commander is behind him on a raised, rotatable cupola with a machinegun that may be aimed and fired from within the vehicle with the hatch closed. The mount has a modicum of stabilization, and the front vision block of the cupola has a night channel. On the front left side of the vehicle is a cluster of six smoke grenade launchers. The rest of the crew normally consists of two other members with seats in the hull, though there is a seat for a fifth crewmember if required. The vehicle is protected with a fire detection and suppression system, and an NBC Overpressure system. The vehicle also has air conditioning and heating. A small computer with repair and recovery solutions is mounted inside the hull on the left side. The vehicle is equipped with GPS or GLONASS, depending on the wishes of the buyer.

The BREM-80U is powered by the GTD-1250 gas turbine engine, developing 1250 horsepower. The engine is known to be difficult to maintain and has high fuel consumption; while the intervals between routine servicing is longer, when it has a problem, it's usually a big one. The BREM-80U is equipped with a deep wading kit that takes 15 minutes to install; this allows wading (but not swimming) up to 5 meters depth.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,038,199	D, G, JP, AvG, A	4.5 tons	45 tons	4+1	31	WL/IR Spotlight (C), Passive IR (D), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
186/130	52/36	1100	535	Stnd	T6	HF152Cp HS21Sp HR14

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	NSVT (C)	800x12.7mm

Kurganmashzavod BREM-L Berglianka

Notes: The BREM-L is an ARV (Armored Repair Vehicle) based on the BMP-3 chassis. It is specifically designed to take care of the BMP-3, but also has a role in taking care of other members of the BMP series. Unlike most vehicles in Russian service, the BREM-L was exported first, to several Mediterranean, South American, Middle Eastern, and Southeast Asian countries. After that, full-rate production began for the Russian Army. It is based on the BMP-3 chassis and engine, and so has decent armor protection, speed, and agility. It is regarded as one of the world's best light ARVs.

In the BREM-L, the BMP-3 turret is removed and replaced with a small armored cupola on the center right of the vehicle, mounting a PKT machinegun. The left side of the roof has a crane that can lift 6 tons, or 12 tons if a pulley block is installed first; this is to the left and rear of the commander. This crane can lift the BMP-3's entire power pack, the turret, or, with a little work, the passenger compartment of the BMP-3. The crane is capable of 360-degree slewing, and a reach of 4.852 meters. The BREM-L can move slowly (no more than Com Mov 5) with a load on the crane. The vehicle's winch has a 20-ton capacity, or 40 tons if a pulley block is installed first, or up to 80 tons with two such blocks. It has 100 meters of cable. Usually, when the winch is used, a dozer blade mounted at the front of the vehicle is first lowered; this can also be used for obstacle clearance and for general preparation of fighting positions. The blade is slightly wider than the front of the BREM-L. There is a load area on the rear hull roof for carrying large stores such as BMP engines and transmissions. Towing is up to 30 tons; however, at 20 tons, Tr Mov and Com Mov are halved. The BREM-L is equipped with two pulley blocks, a tow bar, various lengths of rope and cable, and basic tools, tracked vehicle tools, small arms tools, and heavy ordinance tools. It has welding sets for steel and aluminum. It has an air compressor, and a hydraulic jack, and a selection of spare parts. These are normally carried in external lockers or on the hull of the BREM-L. A 20kW APU is carried to run the vehicle while the engine is turned off.

The BREM-L may swim with a little preparation. If the vehicle being towed can also swim, the BREM-L may swim while towing the stricken vehicle. The engine of the BREM-L is the BMP-3's UTD-29M turbocharged multifuel developing 500 horsepower, along with an automatic transmission. To the left of the commander is a bank of four smoke grenade launchers.

As stated, the commander is on a raised cupola with all-around vision blocks. His center front block has a night channel. He is armed with a machinegun which can be aimed and fired from within the vehicle. Behind the commander is a spotlight on a mast, along with a CCTV day/night camera; this may be rotated by any crewmember needing it, except from the driver's position. The driver is on the front left; he has vision blocks to the front. The center block is a wide-angle block and has a night channel. Normally, there is only one other crewmember, seated in the hull; however, the BREM-L may carry two other crewmembers if the need arises. The large doors in the rear of the BMP-3 are deleted, but there is one smaller hatch. This does not have a firing port, but does have a vision block. Other vision blocks have been retained, but not the firing ports. The crew has air conditioning and heating and an NBC Overpressure system, as well as a fire detection and suppression system. They have a small computer loaded with manuals pertaining to its roles.

The BREM-L has a tertiary role: reconnaissance. In this role, the BREM-L uses its internal BMS and GLONASS to spot enemy groups and positions and relay them to higher units. It is also equipped with FLIR, a laser rangefinder, and a laser designator. The gun

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,409,418	D, G, AvG, A	3.3 tons	18.7 tons	3+2	11	Passive IR (D), Image Intensification (C), FLIR (C), WL Spotlight (G), Day/Night CCTV (G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
180/126	50/35/10	460	185	Stnd	T3	HF9 HS5 HR4

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	PKTM (C)	2000x7.62mm

Volgograd JSC BREhM-D

Notes: The BREhM-D is based on the BTR-D and is meant to service and recover the BMD series of IFVs. The BREhM-D entered service in the late 1990s, and is currently in service with Russia and most of the former Soviet Republics that inherited part or all of the BMD-1 and BMD-2 forces in their countries. It is a very light ARV, with construction very similar to the BTR-D and BMD-1's chassis'.

The BREhM-D uses an A-frame crane that can rotate through 150 degrees, enabling it to reach over the front or rear of the vehicle. It has a reach of 3 meters in either direction. Its base capacity is 1.5 tons, but this may be doubled, quadrupled, or octupled depending on how many times the cable is run through the pulley and the top of the vehicle. The crane rests over the rear of the vehicle and is locked down in a retaining frame for traveling or parachute drops. The crane is powered through the BREhM-D's vehicular hydraulic system, though it can be powered by a hand pump if the engine is switched off. The crane is controlled by the vehicle commander. The BREhM-D's winch is capable of a single pull of 3.5 tons, though again this may be doubled or greater through the use of successive snatch blocks, to a maximum pull of 10.5 tons. The cable is 100 meters long and runs through several internal rubber rollers in a framework inside the vehicle, ultimately unrolling from a reel inside the front of the vehicle. The dozer blade is used to brace the vehicle during crane and winch operations; the blade has no actual mechanism and is deployed by one man lifting or lowering on each side of the blade to the ground position, travel position, or obstacle-dozing position. The blade cannot be used to dig fighting positions. Instead of a towbar, the BREhM-D has twin telescoping towbars with internal shock absorbers, and powered by vehicle hydraulic power. Other tools include basic, power, electrical, electronic, tracked vehicle, small arms, and heavy ordnance tools. It also carries a welding set powered by the vehicle's electrical system (the engine must be on, as the welding set would otherwise drain the batteries almost immediately), and an air compressor. It does not carry a hydraulic jack; the crane is used for this purpose instead. A set of pioneer tools is carried, along with several ropes, cables, and snatch blocks, and a selection or spare parts.

The commander/crane operator has a cupola on the front right; this cupola is manually-rotating and has all around vision blocks. It is armed, usually with a PKT, AGS-17, or AGS-30. The commander has an elevated periscope and a spotlight on a mast. A crewmember is seated to the right of the driver; he may fire a PKMS machinegun, though this is mounted in the bow ahead of the gunner and has no more than 15 degrees of traverse and elevation. The driver is on the front left. The three firing ports on each side of the BTR-D are retained on the BREhM-D, though not normally manned. Crewmembers exit and enter through the various hatches on the roof; there is no rear hatch and the engine is in the back. The crew has a heater and a collective NBC system to plug their protective masks into.

The engine is that of the BTR-D, a Type 5D20-240 diesel engine, developing 240 horsepower. The transmission is automatic. The suspension is specially-designed for the BREhM-D's role; it is a variable-height hydropneumatic suspension that allows the BREhM-D 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 BREhM-D 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 preparation takes 10 minutes. Propulsion in the water is by hydrojets. The hydrojets have shutters which allow for surprising maneuverability when swimming – the BREhM-D 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. The BREhM-D can tow another vehicle while swimming if that vehicle is also amphibious.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$381,228	D, A	2 tons	8 tons	4	9	Passive IR (D), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
198/139	55/39/8	300	89	Stnd	T4	HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT, AGS-17, or AGS-30 (C), PKTS (Bow)	2000x7.62mm, or 1000x7.62mm and 254x30mm

Volgograd JSC RKhM-5 Povozka

Notes: The RKhM-5 is based on the BTR-D chassis and is designed to provide NBC reconnaissance to Russian Airborne troops, and to a lesser extent, Naval Infantrymen. It entered very limited service (3 vehicles) in March 2012, and the Russian Army began testing these first examples in 2011. Acquisition has been hampered by budgetary problems, and it is still in a low LRIP at this time. It is used only by Russia at this time, but is available for export, but no such orders have been made.

The NBC suite is almost the same at that of the RKhM-4-01 (see Russian Wheeled Engineer Vehicles), but it does not carry as many flags, and if airdropped the flag dispensers have to be mounted after it reaches the ground. (They are secured to the same

pallet as the RKhM-5, but they would be ripped off in the slipstream if dropped connected to the vehicle). It also carries a smaller crew of specialists, and the NBC instruments are more advanced (for the most part, the same as the RKhM-4-01 for game purposes). The RKhM-5 has a Geiger counter, two dosimeters, an automatic chemical contamination alarm, devices for determining what agent is causing chemical contamination, and devices to analyze general weather conditions, especially wind direction and speed. Gamma, beta, and alpha radiation can be detected and analyzed from within the vehicle. The RKhM-5 has special arms on one side of the vehicle to take samples and bring them into a special compartment for analysis. The RKhM-5 can detect most types of chemical contamination used or stockpiled today. The arm is dexterous enough (assuming the operator is dexterous enough) to take in leaves, earth, and reach up to two meters into a tree or other surface to take materials for analysis. The RKhM-5 can also take air samples and analyze them. It can also detect some types of biological contamination, such as bacteria and food poisoning. On the rear and sides of the RKhM-5 are three warning flag dispensers, each with 30 flags. They can be deployed from within the vehicle or set to deploy automatically at a certain interval, and come in different colors to denote radiation and chemical contamination. The RKhM-5 has an eight-barreled signal flare launcher, which may be manually triggered or set to fire automatically upon detecting chemical or radiological contamination. The RKhM-5 has a meteorological set, detecting wind speed and direction, humidity, and temperature. The RKhM-5 carries a complete set of reloads for the flare launcher. The RKhM-5 has GPS navigation and a small computer to act as a mapping module, advise the commander of the proper routes, and convert areas to map coordinates. The RKhM-5 also conducts general route reconnaissance, and can note condition of roads, bridges, and areas of high water and put them on the map. The RKhM-5 has several short-range and long-range radios, which are data-capable, and is equipped with a BMS.

The RKhM-5 has more advanced armor than the rest of the BMD series. It is spaced on the front and the body of the vehicle is made from alternating steel and aluminum plates.

The driver is on the front center, and the driver also mans an RPKS-74 automatic rifle. The RPKS-74 can be removed and used as a dismounted weapon, but doing so reportedly requires a contortionist to accomplish. The mount gives its weapon about 30 degrees of traverse and elevation and 10 degrees of depression. The commander is on the front right, and has a manually-rotating cupola with all-around vision blocks. Both have night vision. The driver has an overhead hatch, and has three vision blocks to the front. The commander is armed with a machinegun on a pintle mount connected to the cupola. The three firing ports on each side of the vehicle are retained. Three NBC specialists are in the center crew compartment of the RKhM-5, along with scads of instruments, radios, and a computer; the crew compartment is a bit cramped, and the specialists cannot stand all the way up; they normally use most of their instruments while seated or crouching. They have two hatches on the center deck.

The engine used on the RKhM-5 is a 2V-06-2 450-horsepower supercharged diesel, coupled to an automatic transmission. This gives it excellent speed, needed when conducting reconnaissance missions possibly behind enemy lines. The suspension type is the same – a hydropneumatic variable-height suspension, but the height adjustment capability is different (130-530mm, versus 100-450mm for the BMD-1 and BMD-2). The roadwheels are small, and the tracks are a mere 230mm wide. A side-effect of this suspension appears to be a relatively decent ride. Preparation for amphibious operations and amphibious performance is largely the same as the BMD-1 and BMD-2. RKhM-5 is amphibious with a little preparation – a trim vane must be erected, a periscope must be inserted into a socket and extended by the driver, and bilge pumps turned on. The bilge pump has a manual backup. This preparation takes 10 minutes. Propulsion in the water is by hydrojets. The hydrojets have shutters which allow for surprising maneuverability when swimming – the RKhM-5 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.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,259,430	D, A	500 kg	13.2 tons	5		Passive IR (D, C), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
222/155	62/43/13	300	167	Stnd	T4	HF11Sp HS7 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT (C), RPKS-74 (D)	2000x7.62mm, 2160x5.45mm

ZTS BTS-1

Notes: The BTS-1 is one of the Soviet Union's first post-war armored recovery vehicle designs. The first version, the BTS-1, is a rather primitive design with very limited capabilities. It entered service in the early 1950s. The BTS-1 underwent a long series of upgrading and refurbishment throughout its career, both in Soviet service and in the services of the many countries it was used by. The BTS-1 did establish the basic form of tank-based ARVs.

BTS-1

The BTS-1 established for basic form for tank-based ARVs: the turret removed and replaced by a raised superstructure. In the BTS-1, only the front of the vehicle is a raised superstructure; the rear has eight large stowage boxes to carry its equipment, personal equipment, and spare parts. There is no flat platform, and the BTS-1 cannot carry a powerpack on top. If it needs to bring an engine and/or transmission, it usually does this with a trailer. The BTS-1 has a light crane with a bare lift capacity of 1 ton, though by increasing cable runs between the pulley and the rear of the vehicle, up to 4 tons may be lifted. The BTS-1 is hampered in recovery

efforts by its lack of a winch; it is limited to hooking rope or cable onto the vehicle to be recovered and pulling with the BTS-1 itself. It has a dozer blade in the rear to brace itself during crane operations. Equipment carried includes most basic toolsets, an air compressor, and a hydraulic jack, along with a large selection of spare parts. Also carried is several ropes, cables of various thicknesses, snatch blocks, and a chain saw.

Notes: The driver is on the front left, and the commander is on a manually-rotating raised cupola armed with a weapon. The third crewmember is the crane operator; he has a hatch on the center left, and his seat faces to the rear. Up to two other mechanics may be carried in the hull.

The Finnish version of the BTS-1, which they designated the BTS-2, is equipped with a winch capable of a basic lift of 12 tons. It is otherwise like the BTS-1.

The engine of the BTS-1 is the same as early T-54s: a 500-horsepower diesel V-54 engine.

BTS-1M

This was an attempt to replace the BTR-1 with a vehicle capable of providing real support to T-54, T-55, and other vehicles. In the center rear deck is a flat space surrounded by drop sides. The BTS-1M has a more powerful V-55 580-horsepower engine, and a more capable crane of 20 tons (but still no winch). The superstructure is extended to the rear, and the stowage boxes are moved to the sides and the roof.

BTS-2

The BTS-2 is different largely in that is based on the T-55 hull rather than the T-54. It also adds a winch with a basic pulling force of 30 tons. The cargo capacity is greater than either iteration of the BTS-1.

BTS-4

The BTS-4 is similar to the BTS-2, but it carries a long snorkel device to allow it to crawl along the bottom of bodies of water up to 8 meters deep. The entire vehicle is watertight because of this, but it cannot actually swim. Mounting the snorkel takes 20 minutes. The snorkel connects to the commander's hatch and there is a platform at the top for the commander to stand on. On the outside of the snorkel is a ladder to allow the commander to climb to the top. Mounting the snorkel is a three-man job. Removing the snorkel is also a 3-man job, and takes 10 minutes to dismount the snorkel. At this point, the snorkel may be left behind, or 4 more minutes may be taken to lock is back down on top of the vehicle. It locks down just left of center. After the snorkel operation, the commander's machinegun must be tilted down to empty the barrel of water.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BTS-1	$521,801	D, A	1 ton	36 tons	3+2	19	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-2 (Finnish)	$586,408	D, A	1 ton	36.03 tons	3+2	19	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-1M	$633,770	D, A	1.5 tons	34 tons	3+2	19	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-2	$647,756	D, A	3 tons	32 tons	3+2	17	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-4		D, A	3 tons	32.14 tons	3+2	18	Active/Passive IR (D), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BTS-1	108/76	30/21	812	149	Stnd	T6	HF63 HS12 HR8
BTS-2 (Finnish)	108/76	30/21	812	149	Stnd	T6	HF63 HS12 HR8
BTS-1M	126/88	35/25	812	173	Stnd	T6	HF63 HS12 HR8
BTS-2	132/93	37/26	812	173	Stnd	T6	HF60 HS12 HR6
BTS-4	132/92	37/26	812	173	Stnd	T6	HF60 HS12 HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(All)	None	None	PKT (C)	2000x7.62mm

Rubisovsk RM-G

Notes: Called by the Russians the Repair Tracked Vehicle or RTV, this vehicle is in service only with the Russian Army, and has not been offered for export sales. Though specifically-designed to service the BMP series, the RM-G is capable of performing repairs on a wide variety of vehicles to one degree or another.

The RM-G is built on the chassis of the BMP-1, though it is modified almost beyond recognition. The turret is removed; the rear has a raised superstructure, and the platform for carrying powerpacks or large cargoes is on top of this superstructure. It is designed for repair, and features a complete toolkit composed of all types of tools as well as pioneer tools. The RM-G also has a welding set, air compressor, hydraulic jack, a hand-held circular cutter, and a slave cable. The RM-G has space for one ton of spare parts, including several roadwheels and track sections. The RM-G has a crane with a capacity of 3 tons and a range of 228 degrees, and a

reach of 4.01 meters. It is mounted to the left side of the turret. The RM-G is a repair vehicle, not a recovery vehicle, and does not have a winch for recovery.

The driver is on the front left, with the commander to the rear of him in a small turret (bigger than a cupola, but otherwise the same). The turret does not actually mount a weapon; the weapon is on a mount on the turret ring, Atop this turret is a hatch. The vehicle's weapon can be aimed and fired from inside the vehicle. The driver has one wide angle vision block to the front and two more to the front and two others looking left. The commander's turret is ringed with vision blocks. The driver's middle block has a night vision channel, as does the front block and gunsight on the commander's cupola. Two other mechanics are seated in the hull behind the commander's turret; one of these has a position behind the commander with a simple hatch, and he operates the crane. The crew is protected by NBC Overpressure with a collective NBC backup, and a heater. The RM-G retains the BMP-1's rear doors and firing ports.

The RM-G has the BMP-1's engine and transmission, and so has torsion bar suspension with shocks on the first and rear roadwheels. The engine is a UTD-20 diesel developing 300 horsepower. As it is amphibious, it is cable of performing repair while swimming, though the crane is not useable when swimming.6.736

Most RM-Gs are based on the BMP-1 chassis; however, newer conversions have been based on the BMP-2 chassis. This variant is nearly identical for game purposes, but does have some differences.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
RM-G	$399,701	D, A	500 kg	13.8 tons	4	9	Passive IR (D, C), WL Spotlight (C)	Shielded
RM-GM	$401,501	D, A	500 kg	14.38 tons	4	9	Passive IR (D, C), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
RM-G	155/109	43/30/4	462	111	CiH	T6	TF10 TS6 TS6 HF8 HS4 HR4
RM-GM	150/105	42/29/4	462	113	CiH	T6	TF11 TS7 TR6 HF9 HS5 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
RM-G/GM	None	None	PKT (C)	2000x7.62mm

OKB-520 IMR

Notes: This predecessor of the IMR-2MA was first seen in 1973. It is based on the chassis of a T-55. The IMR is no longer being used by Russian regular or reserve units or Eastern European countries, but still equips some Russian Mobilization-Only units. In addition, it is being used in regular or reserve units by China, several Middle Eastern nations, and some African countries. The IMR is a CEV, but has a secondary role as an NBC reconnaissance vehicle.

In the IMR, the turret of the T-55 is removed and replaced by large crane In the IMR, the T-55 turret is removed and replaced with the crane turntable (in the center of the vehicle) and other combat engineer equipment. The crane is telescoping and is normally carried back on the center, telescoped fully in. The crane head may be equipped with a standard lifting head, or other accessories, including a pincer for grabbing, a bucket, or an auger. The pincer can be used for clearing obstacles and ripping down items such as trees and building supports. The front of the IRM has a dozer blade for digging fighting positions, clearing obstacles, or other work. The IRM normally carries an assortment of tools, including basic tools, excavating tools, power tools, construction tools, and air compressor, and a welding and cutting set. The crane can turn through 360 degrees and has a capacity of 2 tons. The IMR has a winch with a basic pulling capacity of 20 tons, and the cable goes out through the front. In front is a large mine plow that can also be used to brace the vehicle during crane operations. The blade also has teeth to rip up roads and asphalt, and concrete surfaces. The crane has variable geometry and can be pulled almost straight to aid when digging fighting positions or when the crane arm is being operated. The blade may also be used with the teeth removed and used to construct dirt roads, at the rate 8 kilometers per hour. It can be used to smooth over existing roads and fill trenches, or dig fighting positions.

The commander and driver both have raised cupolas; the commander's is manually-rotating, while the driver's is non-rotating. The commander's cupola has all-around vision blocks and a night vision device, as well as a rotating periscope. The driver has vision blocks to his front and both sides; the center front vision block may be removed and replaced with a night vision block. The commander operates all of the external tools, including the crane and its accessories. The driver operates the winch, with the commander (out of the vehicle paying out the cable); he also operates the mine plow. Inside the IMR, the crew has the protection of NBC Overpressure, as well as an automatic fire detection suppression system. The commander has a rotating spotlight for use when operating the arm or clearing obstacles. The IMR also carries 20 kilograms of C4 and the equivalent of an engineer's demo kit.

The IMR, being based on the T-55, uses a V-55 580-horsepower diesel, modified to produce high torque. It has a manual transmission. The IMR can be hermetically sealed, allowing fording in water of up to 5 meters. On each side of the vehicle are banks of 4 smoke grenade launchers. The IMR can also produce a thick, oily smokescreen by injecting diesel into its exhaust. The IMR has a DP-38 retenonmeter for radiation detection and measuring the amount of contamination. The IMR has VHPR device, which detects chemical contamination and to a limited extend, the type and degree of contamination.

Twilight 2000 Notes: During the Twilight War the IMR was still being used by many second-line Warsaw pact countries, China, several Middle Eastern nations, and some African countries.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$839,014	D, A	2 tons	37.5 tons	2	24	Active/Passive IR (D), WL Searchlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
117/82	33/23	812+380	173	Stnd	T6	HF67 HS16 HR8**

Uralvagonzavod IMR-2

Notes: This is a more advanced Russian combat engineer vehicle than the IMR, being based on a T-72 chassis. That said, the IMR and IMR-2 are similar designs, except for their chassis. They entered service in 1982, and had replaced most of the IMRs in Russian, Czech, and Polish service by 1987. The IMR-2 saw some action in Chechnya and was also used to help bury the breached reactor at Chernobyl, due to its high protection against radiation.

The turret of the T-72 has been replaced by a large turntable/small turret, from which is controlled the crane. The crane is locked to the rear during traveling. The crane can be traversed through 360 degrees and has a capacity of 2 tons at a reach of 8.15 meters. The crane may use several heads, including a lifting hook, pincer claws, and an auger. The front of the IMR-2 has a V-shaped mine plow that is armored against mines and is 1 meter high and 3.38 meters wide. It has a variable geometry; angle grading as well as straight plowing is possible with this blade. The front of the blade also had an extendible probe that is used to send radio signals to trigger the fuses on mines, explosive shells, and other such hazards. It is 65% likely to detonate any such device it encounters if the fuse is a contact, tilt rod, or radio type. When not in use, the plough is raised completely upwards to the 90-degree position. The IMR-2 carries a wide assortment of tools, including basic tools, excavating tools, power tools, construction tools, and air compressor, and a welding and cutting set. The IMR-2 series does not have a winch.

The crew consists of a driver and commander/crane operator; the driver is in the center front and the commander is in the small space in front of the crane. (It really *is* cramped.) He has a pintle-mounted weapon to his front, but he is not on a cupola, though he does have a wide-angle vision block on each side of him, and his seat rotates. They are protected by an NBC Overpressure system and an automatic fire detection and suppression system. The driver and commander's positions connect through a small tunnel, and there is also a space to keep personal gear, branching off this tunnel.

The IMR-2 uses a V-84-1 turbocharged diesel engine developing 840 horsepower, modified to produce high torque, and is controlled by an automatic transmission. With preparation, the IMR-2 may ford up to 5 meters. On each side of the vehicle are banks of 4 smoke grenade launchers. At the rear of the vehicle are a pair of MICLIC launchers for minefield breaching.

There were several variants produced over the years. The IMR-2M1 is identical, except for a difference in weight and speed caused by the removal of the MICLIC launchers; the hydraulic system is also more protected and has a backup system. The IMR-2M2 is designed for NBC reconnaissance as well as normal combat engineer jobs. The IMR-2M2 has a DP-38 retenonmeter for radiation detection and measuring the amount of contamination. The IMR-2M2 has VHPR device, which detects chemical contamination and to a limited extend, the type and degree of contamination. It adds to the tool set for the crane arm with a more useful bucket. The commander's machinegun, however, is removed; the small quarters never really allowed it to be used effectively in battle; for the commander, small arms are more easily used. It also does not have the MICLIC launchers. It does, however, have extra mine protection in the form of extra armor plate for the floor. It entered service in 1990, as did the IMR-2M1.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
IMR-2	$1,286,732	D, A	1.5 tons	44.3 tons	2	28	Active/Passive IR (D), WL Spotlight (C)	Shielded
IMR-2M1	$908,965	D, A	1.5 tons	43.28 tons	2	27	Passive IR (D), WL Spotlight (C)	Shielded
IMR-2M2	$1,295,678	D, A	1.5 tons	44.28 tons	2	29	Passive IR (D), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
IMR-2	139/97	39/27	1000+400	310	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12***
IMR-2M1	142/99	39/28	1000+400	296	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12***
IMR-2M2	142/99	39/27	1000+400	296	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
IMR-2/2M1	None	None	NSVT (C)	500x12.7mm, 20 kg C4, Engineer Demo Chest

Uralvagonzavod IMR-3

Notes: This is the Russians' newest combat engineer vehicle, based on the chassis of the T-90 tank. It was in LRIP as early as

1991, but full production did not occur until 1999. It is also known as the IMR-2MA, IMR-2A and IMR-3MA. Its primary job is to clear obstacles, smooth damaged roadways, and clear rubble from urban areas. This vehicle is only in Russian service, and has seen action in Chechnya and Ukraine. The IMR-3 has always been a limited-production vehicle.

As is usual for these converted tanks, the turret is removed; in its place is the turntable for the jib and the commander's turret. The dozer blade can smooth a road of about 6 km by the width of the vehicle in one hour, depending on the degree of difficulty of the obstacles, or clear earthwork at a rate of 300 cubic meters per hour, or loose rubble at a rate of about 400 cubic meters an hour. The dozer blade is also almost mine proof for purposes of clearing mines. It uses a lighter dozer blade (though just as strong) called the KMT-3R. This blade is described by many sources as "massive" or "huge." It comes in two wings, which may be operated individually, allowing for a greater variety of obstacle-clearing scenarios. It is usually used in a V-shape, as a mine plow; it can be used straight, though, for bulldozing. Even through asphalt or concrete, the blade can dig 450 centimeters per pass. The front of both wings also had an extendible probe that is used to send radio signals to trigger the fuses on mines, explosive shells, and other such hazards. It is 85% likely to detonate any such device it encounters if the fuse is a contact, tilt rod, or radio type. This type of detonation does not damage the plow.

The IRM-2MA has a crane with a capacity of 3 tons, a main winch with a capacity of 35 tons and 100 meters of cable, and a secondary winch with a capacity of 15 tons and 120 meters of cable. Normal tools carried include basic tools, excavating tools, power tools, construction tools, an air compressor, and a welding and cutting set. The jib is designed to use three tools; an auger, a lifting hook, and a combination excavator bucket/pincers. However, replacing tool heads is a long process, requiring 15 minutes and the crew to leave the vehicle and work with tools to accomplish the task. (For some reason, the Russians chose not to use the snap-in tools they used on early versions of the IMR.) For this reason, the head normally used, the bucket/pincers, is almost always mounted. The arm is mounted on the left side of the vehicle, about one-third of the way back, next to the turret. It has a reach of 8 meters and has a swing of 360 degrees.

There are two crewmembers. The driver is in the front center; he is in the front center and has three large windows to the front, with the sides angled to the left and right sides. The windows may have armored shutters lowered over them, in which case the driver sees through vision blocks above the windows. One has a day/night channel. The driver has an overhead hatch, but getting into it past all the plow machinery is a little difficult. The commander has a conical-shaped small turret, which has a cupola at the top with all-around vision blocks and a night channel on the front block. The cupola is manually rotatable. Between the commander and driver is a small tunnel which connects the two positions, along with a space to put personal items. The commander's machinegun can be aimed and fired from under armor. The driver's and commander's position are much more roomy than on an IMR-2.

The IMR-3 has a DP-38 retenonmeter for radiation detection and measuring the amount of contamination. The IMR-3 has VHPR device, which detects chemical contamination and to a limited extend, the type and degree of contamination. There is a 5kW generator to power the tools, winches, and crane when the engine is off. The engine is the same as the early versions of the T-90 – a V-84MS 840-horsepower turbocharged diesel. The armor level is also the same. IMR-3s in service with the Russian Army have a BMS and GLONASS. The crew is protected by an NBC Overpressure system and a fire detection/suppression system.

Twilight 2000 Notes: This vehicle is extremely rare in the Twilight 2000 timeline, with perhaps 12 having been built before the start of the War.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,091,070	D, G, AvG, A	2.5 tons	47.4 tons	2	19	Passive IR (D), Image Intensification (C), Thermal Imaging (C), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
132/93	37/26	1200	311	CiH	T6	TF50Cp TS30Sp TR16 HF180Cp HS30Sp HR18

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	Kord (C)	1050x12.7mm, 20 kg C4, Engineer Demo Chest

Kurganmashzavod IRM Zhuk

Notes: This vehicle is described by the Russians as an "Engineer Reconnaissance Vehicle," and is based on a lengthened BMP-1 chassis (seven roadwheels instead of six). Used only by the Russians, the IRM's job is to conduct route reconnaissance, checking the conditions or roads, trails, bridges, and fording sites. It is also used to detect mines and minefields. It has a secondary role as an artillery observer vehicle, and can also detect radiation and chemical contamination. A tertiary role is electronic intrusion to listen into enemy radio networks.

The IRM is fully amphibious, and may operate fully submerged along the bottom of a body of water with the aid of a 10-meter snorkel. The IRM does this with small ballast tanks, a trim vane, and some sandbags in the hull. The IRM can also swim, using two propellers at the rear to propel itself and maneuver. The IRM is also equipped with two mine detectors on booms, a sensor for determining the load-bearing capacities of a piece of terrain, devices to determine water depth, surf action, terrain angles, and the thickness of ice. The vehicle is also equipped with a laser rangefinder/designator, an artillery aiming circle, and two radios with a range of 20 kilometers in addition to the normal vehicle complement. The IRM is equipped with a rocket-powered grapple for self-

recovery, even under enemy fire. At the rear is a bank of 12 solid rockets to assist in this recovery if necessary. The IRM may generate a smoke screen by injecting diesel fuel into its exhaust. Other tools consist of the vehicle's basic and tracked vehicle tools, a chainsaw, and an air compressor.

The IRM is equipped with sensors for detecting the amount or type of chemical contamination, and the amount and type of radioactive contamination. To aid in this, the IRM is equipped with a small arm that allows the crew to snag a piece of vegetation or some other interesting piece of debris. The arm is long enough to reach the ground and into the low branches of a tree. These are then brought into a special container in the vehicle's wall for analysis.

The IRM carries a crew of six; of these, one is the driver and another is the commander, who is in a small turret armed only with a medium machinegun. The other crewmembers are specialists who each have their own duties in the vehicle. The turret is in the center left of the vehicle; the driver is on the front left. Naturally, the IRM has NBC Overpressure protection; it also has an automatic fire detection/suppression system, and unusually for a Russian vehicle, air conditioning and heating. There are four MOPP suits and masks for every crewmember, as well as extra filters for the masks. The specialists have CCTV cameras on the center roof and rear roof connected to a monitor on one side of the IRM, as well as an internal computer to aid in their analyses. The commander and driver navigate with a mapping computer module and inertial navigation. Digital information may be sent back to higher HQ up to 300 kilometers away, though using this much range requires the extension of a long-range antenna.

The IRM may use BMP-1 appliqué armor on the hull, but not on the turret, which is more akin to a BTR-80's turret than a BMP-1's turret. It may also mount lugs for ERA, over the appliqué armor.

Being a BMP-1 variant, the IRM has a 300-horsepower UTD-20 diesel engine, with a manual transmission. Suspension is by torsion bar, with shocks on the first and fifth roadwheels.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,106,952	D, A	1 ton	17.2 tons	2+4	10	Passive IR (D), Image Intensification (C), FLIR (C), 4xDay/Night CCTV	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
131/92	36/25/8	600	89	CiH	T3	TF4 TS4 TR4 HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT	2000x7.62mm, 15 kg C4, Engineer Demo Kit.

Chelyabinsk MTP Technical Support Vehicle

Notes: Russia and Pact forces used this armored repair and recovery vehicle. Though it has long been out of service in Russian and Pact units, it is still being used by several Third-World nations, and some Mobilization-Only Russian units are equipped with them. It is based on the closed-top version of the BTR-50, and is used to support armored personnel carriers such as the BTR-series and BMP-series. It was used by virtually all countries who used the BTR-50 or early versions of the BMP or BTR series, though most MTPs are long out of service in the world, except in the Third World and some Russian Mobilization-Only units. Most were out service by the early 1970s. Museums are more interested in the actual BTR-50 though some are used as OPFOR vehicles when they are still running. They are old, and parts for them are difficult to find, and most ended up as range targets.

The chassis of the MTP is, for the most part, the same as the BTR-50PK, differing only in minor details. The upper hull, however, differs greatly from the BTR-50PK, as the raised superstructure of the BTR-50PK extends all the way back on the MTP, and is tall enough for crewmembers to stand within it. This allows for ample space for work and carrying of personal gear and spare parts and some tools. Other tools and spare parts are kept in boxes on the sides and rear of the MTP. There is space on the rear deck for carrying a power pack or other large spares. Recovery equipment carried includes anchors, tow bars and cables, block and tackle, oil and fuel pumps, a 5kW APU, a complete welding set, an air compressor, and a set of tools appropriate for working on wheeled and tracked vehicles. Ample room is provided for spare parts, and the MTP also has a crane with a capacity of 1.5 tons and a reach of 2.85 meters, and a winch with a capacity of 8 tons (15 tons with block and tackle installed) and 60 meters of cable.

The MTP has a raised superstructure with hatches for the crew and commander in it. The driver's hatch is in the normal place, and there are two doors in the rear. Above which is kept an extension tent to increase the available covered room for work. A folding trestle table is carried on the outside for use in these circumstances. There is a firing port in each side of the crew compartment and in one of the rear doors that can take an AK-series assault rifle or the PK machine gun. The commander's position is a simple hatch with a pintle-mounted weapon. He can also bring out an RPG-7 from a rack near his position. Three other mechanics have seats in the hull. The vehicle has no heater or air conditioner and does not even have a collective NBC system; the crew is reliant on their own MOPP gear and protective masks in case of chemical attack. There is not even an automatic fire detection/suppression system – there are five fire extinguishers instead for the crew compartment, and one mounted by the engine.

The MTP can carry bulk amounts of fuel or POL to units which are hard to reach on wheels. This necessitates removing all but the base crew, and removing the internal lockers for tools and spare parts.

As a derivative of the BTR-50PK, the MTP uses the same V-6B 240-horsepower diesel, with a manual transmission. Suspension is by torsion bars, with no shock absorbers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological

$211,738	D, A	1.5 tons	15.5 tons	5	9	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
120/84	33/23/4	400	69	Stnd	T3	HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	PK, RPG-7 (C)	1250x7.62mm, 4x73mm

Kharkiv MTP-LB Technical Support Vehicle

Notes: Similar in concept to the MTB technical support vehicle listed above, this vehicle is based on the MT-LB chassis. It was meant to be a new vehicle, replacing the MTP, and is designed to service the BMP and BTR-series of vehicles. The MTP-LB does not appear to have been exported, nor was it built in large numbers.

The basic form of the MT-LB is unchanged, except for the addition of a crane, winch, and platform on the rear deck for carrying engines and other large assemblies. The crane is driven by the winch (the winch and the crane cannot be used at the same time), and has a capacity of 1.5 tons. The crane is an A-frame structure mounted on the front of the vehicle that has a reach of 4.2 meters. The winch may be used by itself, in which case the capacity is 6.12 tons with 80 meters of cable. There is a jack located on the front of the vehicle which may jack up to 15 tons. (This jack must be moved to the cargo platform before amphibious operations can take place.) Other equipment carried by the MTP-LB includes tow bars and tow cables, chock blocks, electric and gas welding and cutting gear, a vehicle decontamination kit, and a full range of tools, including a welding set/cutter, air compressor, and tow bar.

The MTP-LB is amphibious, and can make amphibious recoveries (with the MTP-LB partially in the water, not full swimming) as well as land recoveries. The MTP-LB may tow a vehicle over water, if the vehicle can also swim or ford to depths of no more than 5 meters. (It would be a *very* slow tow.)

The MT-LBs commander's cupola has been removed and replace with a simple hatch and four vision blocks. And there are crew hatches on the roof between this area and the cargo platform; one is a position for operating the crane, with an elevated seat and four wide-angle vision blocks and a simple hatch. There are also two doors on the rear of the vehicle. The driver is in the front left; normally, no other persons are carried, but there are seats and space for two other mechanics. The vehicle has NBC Overpressure and a heater. While most versions of this vehicle are armed with a PK, the Polish version of the MTP-LB is armed with an NSV heavy machinegun.

The MTP-LB has the same engine as the MT-LB: A YaMZ-238 240-horsepower diesel. This is coupled to a manual transmission. Suspension is by torsion bar, with no shocks.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$305,608	D, A	2 tons	12.3 tons	2+2	11	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
143/100	40/28/4	450	71	Stnd	T3	HF5 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	PK (C) or NSV (C)	2500x7.62mm, or 1500x12.7mm

Omsk MTU-20

Notes: This is a tracked bridging vehicle based on a T-55 chassis. Russian and Pact forces rarely use the MTU-20, but the MTU-20 is used by Afghanistan, Egypt, Finland, India, Israel, Nigeria, and Syria. Israel uses captured versions.

The turret has been removed so the bridge span can lay flat on the deck area. The bridge can span 18 meters. It weighs 6 tons and can support 50 tons, taking 5 minutes to deploy and 7 minutes to recover. The bridge is a semi-cantilever bridge; the ends are deployed like a scissors bridge, and then the entire assembly is extended out horizontally. The bridge has a double treadway, with the treadways made of box-type aluminum girders. Two legs in the front are lowered into the ground as far as possible before bridgelaying or recovering takes place.

The crew consists of a driver on the front left and the commander/bridge operator behind and to the right of him. The commander has a rotating cupola with all-around vision blocks, and the crew need not crack their hatches to deploy the bridge. The commander has a machinegun, but due to the bridge supports and machinery, shooting while the bridge is mounted is very difficult; especially, clear shots to the front of the vehicle are virtually impossible. The MTU-20 has NBC Overpressure protection. Just behind each bumper is a cluster of four smoke grenade launchers.

Two variants of the MTU-20 were made, each differing only in their engines. The older version uses a W-2-54 diesel developing 520 horsepower. The newer versions use a W-2-55 diesel developing 580 horsepower. Both have manual transmissions.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-20 (Early)	$517,000	D, A	500 kg	34 tons	2	51	Active/Passive IR (D)	Shielded
MTU-20 (Late)	$517,240	D, A	500 kg	34.04 tons	2	51	Active/Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-20 (Early)	118/83	33/23	960	153	CiH	T6	TF4 TS4 TR4 HF67 HS16 HR8
MTU-20 (Late)	128/90	36/25	960	171	CiH	T6	TF4 TS4 TR4 HF67 HS16 HR8

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

*The Crew-in-Hull refers to the bridge as a turret. If the bridge is deployed, the Configuration is Stnd.

Uralvagonzavod MTU-72

Notes: This AVLB is based on the T-72B or T-72M1 chassis. (Some sources say that some MTU-72s were made using new-built T-72 chassis.) The MTU-72 is used only by Russian and Pact forces.

It uses a bridge similar in design, but much larger and heavier then, the bridge of the MTU-20 listed above. This bridge can span a gap of 18 meters and support 50 tons. By utilizing a second MTU-72's bridge, a gap of 30 meters can be spanned. Three minutes are required to lay the bridge, and 8 minutes to recover it. The bridge is of aluminum alloy construction and weighs 6.4 tons. The bridge is extremely strong for such an item – it was made to withstand small arms fire and some artillery and rocket attacks. The bridge is laid in the same manner as that of the MTU-20 – the center portion is slid out, and then the ends are deployed. The MTU-72 carries a dozer blade at the front to clear obstacles to bridge laying or otherwise prepare bridging sites. The MTU-72 uses the V-46-6 turbocharged diesel engine, developing 780 horsepower, unless it is T-72B-based; in this case, it has an 840-horsepower engine. These versions are known as MTU-72Ms. It has an automatic transmission.

The commander has a full, rotating cupola, but is not armed except for his small arms and some grenades. He is in the center of the vehicle. The driver is ahead of him, in the front center. The crew has a heater and NBC Overpressure protection, as well as an automatic fire detection/suppression system.

There is a similar vehicle in Czech service called the MT-72. It is essentially the same vehicle, but is heavier in weight even though the bridge is lighter. It is based on the Czech version of the base T-72, the T-72M3 CZ.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-72	$706,826	D, A	300 kg	40 tons	2	27	Passive IR (D, C)	Shielded
MTU-72M	$729,741	D, A	300 kg	41.1 tons	2	27	Passive IR (D, C)	Shielded
MT-72	$721,880	D, A	300 kg	41.5 tons	2	35	Passive IR (D), Image Intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-72	142/100	40/28	1000	288	CiH	T6	TF20 TS20 TR20 HF138Cp HS20Sp HR12
MTU-72M	147/103	41/29	1000	310	CiH	T6	TF20 TS20 TR20 HF148Cp HS24Sp HR12
MT-72	138/97	38/27	1000	299	CiH	T6	TF20 TS20 TR20 HF129Cp HS17Sp HR12

*The Crew-in-Hull refers to the bridge as a turret. If the bridge is deployed, the Configuration is Stnd.

Uralvagonzavod MTU-90

Notes: This is an AVLB based on the T-90 chassis. It is being looked at by many of the same countries that use the T-90S export version of the T-90 tank. The Russians meant to replace the MTU-72 with the MTU-90, but budgetary versions kept them from acquiring more than just a few, even though it was approved for service with the Russian Army in 1997. So far, the MTU-90 is officially in LRIP, but it has received no production orders as of yet.

This bridge weighs 6.62 tons and can span a 23-meter obstacle, supporting a vehicle weighing 50 tons. The bridge is easy to lay and recover, requiring only 2 minutes to lay and 2.5 minutes to recover. The MTU-90 offers the same armor protection as the early T-90, and the chassis is in fact nearly identical to the early T-90. It can also be fitted with appliqué armor, track skirts, and ERA. The bridge is strong – similar in protection to the MTU-72. It is laid by unfolding the rear section, lowering the two sections across the obstacle, and as this is done, the third section automatically swings into position. The crew need not open the hatches to lay or recover the bridge. The crew has night vision channels to their vision blocks and the bridge can be lain and recovered at night, still without the crew opening the hatches. The bridge is operationally compatible with the bridge on the truck-mounted TMM-6, though they are different chassis.

The commander/bridge operator is in the center of the vehicle; he is in a manually-rotating cupola with the center front vision block being a wide-angle block that has a night vision channel. The driver is in the center front. The vehicle has air conditioning, heating, and an NBC Overpressure system, as well as an automatic fire detection/suppression system. The commander's cupola is not armed; the crew relies on their small arms and grenades for defense. The MTU-90 has a BMS and GPS.

The MTU-90 uses the same 840-horsepower turbocharged multifuel, coupled with an automatic transmission. It can use a deep wading kit allowing submerging up to 5 meters, but cannot actually swim. The wading kit takes 5 minutes to mount.

The MTU-90M was designed to attract export customers; the Russian Army cannot afford them, even though they were accepted for service in 2013. Azerbaijan ordered an undisclosed number of MTU-90Ms in 2014, and they go into service as soon as they are received and readied. It uses a shorter bridge able to span 19 meters, but is an MLC-60 bridge. The bridge is essentially like the standard MTU-90 bridge, but the center section is much shorter, as are the wings; they unfold in the same manner. The MTU-90M is based on the T-90S chassis, but it is identical to the T-90 chassis for game purposes.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-90	$1,400,997	D, G, AvG, A	300 kg	45.5 tons	2	25	Passive IR (D), Image intensification (C)	Shielded
MTU-90M	$1,344,351	D, G, AvG, A	300 kg	45.3 tons	2		Passive IR (D), Image intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-90	136/95	38/27	1200	310	CiH	T6	TF20 TS20 TR20 HF180Cp HS30Sp HR18
MTU-90M	137/96	38/27	1200	309	CiH	T6	TF20 TS20 TR20 HF180Cp HS30Sp HR18

*The Crew-in-Hull refers to the bridge as a turret. If the bridge is deployed, the Configuration is Stnd.

KVZ PMM-2

Notes: This Russian vehicle has the tracks and suspension of the T-64 tank, and upper chassis of the PTS-2 amphibious carrier; it also uses components of the MDK-5 trench-digger and the MT-T tracked transporter. It is service only with Russia. Production is now complete, but the assembly lines can resume at any time if necessary.

The PMM-2 is used as a floating bridge, and may be used as either a bridge or ferry, or grounded at the bottom of a body of water. The vehicle opens like a clamshell when being used. When used as a bridge or ferry, the PMM-2 can carry 42.5 tons, but it is unable to carry this weight on land. Up to 10 PMM-2 vehicles can be latched together to form long bridges; each PMM-2 unit can bridge a gap 17 meters wide (or float vehicles that long). This does not require anyone to leave the vehicles, but they must be maneuvered in such a way that the vehicles latch together. PMM-2s can operate in bodies of water with currents of up to 2 meters per second. The PMM-2 uses retractable anchors and waterjets at the rear corners to maintain position if being used as a ferry or floating bridge. When the bridge is opened, it has a width of 20 meters; it can carry vehicles that wide, but practically only 17 meters are useful. Vehicles, troops, or cargo can be loaded via loading ramps which are 5 meters long and pull back into the platform for travel. A similar ramp is at the front for unloading. The vehicle takes 10 minutes to ready for use as a ferry or bridge.

The cab is at the front, with large bullet-resistant windows to the front and sides. They are watertight; in fact, the entire vehicle is watertight down to a depth of 3.6 meters. The cab carries 3: the driver, the commander, and the bridge/ferry operator. The bridge/ferry operator is responsible for unfolding the sections above, and re-readying it for travel. The other crewmembers are in the hull, and they monitor the integrity of the vehicle when the vehicle is submerged and ensure the engine and batteries operate properly. The PMM-2 is not armed. The engine used is a variant of the T-64's V-64-4 diesel engine, with 710 horsepower and turbocharging. Transmission is automatic. When submerged, the PMM-2 is powered by banks of batteries that are the equivalent of a 20kW generator, though they discharge in 1 hour and must be recharged or the vehicle recovered at that point. The PMM-2 has an air conditioner, heating, and NBC Overpressure. The PMM-2 has inertial positioning, GPS, and a map computer. The PMM-2 has an automatic fire detection/suppression system.

The new version, the PMM-2M, has a load carrying capacity when used as a bridge or ferry of 85 tons. However, the spotters have been removed and there are only three crewmembers. It is otherwise the same as the PMM-2 for game purposes.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PMM-2	$908,232	D, A	500 kg	30 tons	5	21	Headlights	Enclosed
PMM-2M	$1,439,520	D, A	500 kg	29.86 tons	3	21	Headlights	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
PMM-2	165/115	46/32/8	1000	261	Stnd	T6	HF6 HS3 HR2
PMM-2M	166/116	46/32/8	1000	261	Stnd	T6	HF6 HS3 HR2

Morozov BAT-2

Notes: The BAT-2 is a combat engineer vehicle used by Russian and Pact forces. The vehicle is based on a T-64 chassis, and has a large V-shaped dozer blade mounted at the front, used primarily as a mine plow. It is a little wider than the width of the vehicle, and has a variable bow to the "V" shape; the plow can actually be pulled into a dozer shape. In mine plow shape, the blade is 4.2 meters wide, while in dozer configuration, it is 4.5 meters wide. The mine plow may be lifted to 90 degrees, entirely clear of the front.

At the rear is a soil ripping blade, which may be lowered or raised, and is the width of the vehicle. The BAT-2 has a crane with a capacity of 2 tons that may reach out 7.3 meters from the vehicle, and may be fitted with pincer-type tools, an auger, and a bucket. Mounted on the same platform as the crane is a 25-ton capacity winch with 100 meters of cable. The BAT-2 has a cab up front with large bullet-resistant windows on the front and sides, and it contains the driver on the left and commander on the right. In the rear section is an entire combat engineer squad; they have bullet-resistant windows on either side of the front of their compartment. The vehicle is protected by an NBC Overpressure system.

The BAT-2 is equipped with a V-64-5 710 horsepower turbocharged diesel. This engine is derived from the one on the T-72.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$698,604	D, G, AvG, A	6 tons	39.7 tons	2+8	27	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
130/91	38/27	1000	262	Stnd	T6	HF8 HS3 HR3

Uralvagonzavod BREM-1 ARRV

Notes: This is an ARRV (Armored Repair and Recovery Vehicle) based on the T-72A. The basic BREM-1 is designed to support the T-72, T-64, and T-80. Though the Soviets reported it as entering service in 1975, other official sources state that is did not enter full production until 1984. In either case, 342 were built by 1990 when production stopped. Besides Russia, the BREM-1 is used by various African nations, India, Venezuela, and several former Soviet Republics. Most these are the improved BREM-1M, designed to support the T-90S tanks that many of these countries also field. It's main role is to recover damaged or stuck or overturned tanks and IFVs from the battlefield, and its armor suite helps in this regard, as it is meant to work on the front lines.

BREM-1

The turret of the T-72A has been removed and replaced with a raised superstructure. The main vehicular repair tool is a 4.4-meter crane, able to lift 19 tons at 2.2 meters and 3 tons at its maximum reach of 4.4 meters. It can be used to help recover stuck or overturned vehicles, but it's main role is to lift turrets clear of a tank for repair and to acts as a jack to facilitate roadwheel, suspension, and track repairs (though the BREM-1 also carries two hydraulic jacks). The BREM-1 may move if the crane is lifting no more than 3 tons, but the suspension locks if the BREM-1 tries to move with more than 3 tons on the crane. The main winch has a base pull of 25 tons, but this may be doubled with block and tackle, or quadruple that with double blocks and tackle. The cable is 200 meters. An auxiliary winch can pull 530 kg, with 425 meters of cable. The BREM-1 can tow vehicles of up to 50 tons, at a Tr Mov of 48/33. The dozer blade is primarily used to brace the BREM-1 when using the crane or winches, but can also be used to clear obstacles and dig fighting positions. It is 3.1 meters wide.

The BREM-1 has a full complement of tools, including all basic types of tools, an arc welder, and an air compressor. On the roof is a flat area large enough for a full tank powerplant or 1.5 tons. A selection of spare parts, including several roadwheels and track sections, are carried. A 5kW APU is carried to power the equipment without turning on the engine.

The driver is on the front left, with the commander on the front right. The crane operator is on the top of the superstructure in a cupola with all-around vision blocks. A fourth mechanic can be carried inside the vehicle as necessary.

The engine is a V-46 780-horsepower turbocharged diesel engine developing 780 horsepower, with an automatic transmission.

BREM-1M

The BREM-1M is the same base vehicle, but is more powerful to support the T-90S tank. The main improvement is the use of a V-92S2 engine, developing 1000 horsepower. The crane is improved to be able to lift a base weight of 28 tons at 2.2 meters or 4.4 tons at 4.4 meters. The BREM-1M is BMS-compatible, as well as having a GPS and a small computer with repair solutions. Other details are as per the BREM-1.

Vehicles	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BREM-1	$1,317,201	D, A	2 tons	41 tons	3+1	27	Active/Passive IR (D)	Shielded
BREM-1M	$2,174,544	D, A	1.6 tons	41.8 tons	3+1	29	Passive IR (D)	Shielded

Vehicles	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor**
BREM-1	137/96	38/27	1000+400	289	Stnd	T6	HF140Cp* HS22Sp HR12**
BREM-1M	165/115	46/32	1000+400	371	Stnd	T6	HF140Cp* HS22Sp HR12**

Vehicles	Fire Control	Stabilization	Armament	Ammunition
BREM-1/1M	None	None	NSVT (C)	840x12.7mm

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

Kurganmashzavod BREM-2

Notes: This is a recovery vehicle based on the BMP-1, in the same way that the BREM-1 is based on the T-72. It is intended for recovery and repair of the BMP-series of infantry fighting vehicles. It saw first service in 1982. Some BMP-1s were also converted to BREM-2s, starting in 1986.

The turret of the BMP-1 is replaced with an armored plate, and the rear of the vehicle is fitted with a load-carrying platform able to carry a BMP powerpack or something of equivalent weight (1.5 tons). The upper hull mounts a crane with a capacity of 1.5 tons. An auxiliary crane may be mounted to increase this weight to 7 tons, though this crane may not work on its own. The interior of the vehicle houses a 6.5-ton capacity winch, which may be lead out the sides or front or rear. It's pulling capacity may be raised to 19.5 tons with two sets of snatch blocks. Various recovery tools are placed in stowage positions at various locations on the hull roof and sides, including a tow bar, 200 meters of rope, basic, tracked vehicle, small arms, and heavy ordinance tools, and excavating tools. In addition, a hydraulic jack, arc welder, and air compressor is carried, along with a selection of spare parts. The front of the vehicle has a large dozer blade which is used to brace the BREM-2 in recovery operations and when using the crane. Russia and other Pact forces use the BREM-2.

There are 12 smoke grenade launchers on the BREM-2, in two clusters. One of these clusters is a standard 902V Tuchna smoke grenade cluster, while the second cluster is a TDA thermal grenade launcher. The layout leaves the driver in his standard position on the front left. The commander is in the front, slightly offset to the right; he has a pintle-mounted machinegun. The other crewmembers are in seats in the hull; the firing ports of the BMP-1 have been deleted, but the vision blocks are retained. The rear doors, with their fuel tanks, were also retained, and like the BMP-1, their crews often fill them with water or sand to stop rear hits from setting them on fire. The BREM-2 carries a lightweight folding table and a tent to extend the work area at the rear of it. Later, the sideskirts/mudflaps of the BMP-2 were added, making it more stable when swimming. The crew is protected by an NBC Overpressure system.

The engine is inherited from the BMP-1, and is a UTD-20 multifuel developing 300 horsepower. The BREM-2 also inherits the BMP-1's manual transmission, and its torsion-bar suspension with shocks on the first and last roadwheels.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$488,738	D, G, AvG, A	2 tons	13.6 tons	4	8	Active/Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
154/108	43/30/5	460	89	Stnd	T3	HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT (C)	2000x7.62mm

Omsk BREM-80U

Notes: The intent of the BREM-80U is to replace the BREM-1 with a much improved recovery vehicle based on the T-80U tank chassis. It's specific design role was to provide a recovery vehicle for the T-80 series, though it has a secondary role of recovering other tanks and some smaller vehicles. It was designed in the late 1980s, but did not enter service until 1998. The advent of the T-80, with its gas turbine engine, introduced complexities in recovery and repair efforts that it was felt only a new ARV could address. The BREM-80U has its own deficiencies (including its faulty gas turbine engine) and many feel that the need would be better met by a set of improvements to the BREM-1. The need for the BREM-80 was made more acute by the introduction of the T-80 series onto the international market. Many say that while the BREM-80U is an important step, and will do as a stopgap, it cannot meet the needs for which it was designed and may soon have to be upgraded or replaced. The only export customer so far is Cyprus, who also run a number of T-80Us. It should be noted that the BREM-80U received only low-rate production orders, and never entered full production.

The BREM-80U is generally similar in layout to the BREM-1, but is greatly improved. The turret of the T-80U is removed and replaced by a raised superstructure. There are several external stowage boxes on the sides, and roof of the vehicle. (Though the stowage boxes are not armored, the vehicle underneath is.) Mounted on the front left of the BREM-80U is its crane; it has a capacity of 18 tons, or 30 tons with snatch blocks. Those 18 tons are easily enough to lift out the T-80Us powerpack or lift its turret, but it should be noted that the typical Western tank-based ARV has almost double this lifting power (without snatch blocks). The rear deck can carry the T-80's powerpack or other large cargoes. It can rotate 240 degrees. The main winch can pull 35 tons bare, though with sufficient block and tackle this can be increased to 140 tons. (Again, note the superior winching power of Western vehicles.) The main winch has 120 meters of cable; an auxiliary winch can pull 3.5 tons and has 320 meters of cable. The BREM-80U can easily tow a T-80-series tank, as well as similarly-sized or smaller vehicles. Tools include basic, tracked vehicle, small arms, heavy ordnance, electrical, and electronic tools; also included are two sets of pioneer tools. The BREM-80U also has an arc welder, air compressor, a tow bar, and two hydraulic jacks. A selection of spare parts is carried, usually in the outer lockers or attached directly to the hull. The BREM-80U has a front-mounted dozer blade to brace the vehicle when using the crane or winching; a bracing leg can also be lowered at the rear. The BREM-80U has a 60kW APU to allow for most operations, including crane and winch operations, without having the engine on.

The driver of the BREM-80U, due to the position of the crane, is moved to the top center of the vehicle, with three vision blocks to the front, one of which has a night channel. The commander is behind him on a raised, rotatable cupola with a machinegun that may be aimed and fired from within the vehicle with the hatch closed. The mount has a modicum of stabilization, and the front vision block of the cupola has a night channel. On the front left side of the vehicle is a cluster of six smoke grenade launchers. The rest of the crew normally consists of two other members with seats in the hull, though there is a seat for a fifth crewmember if required. The

vehicle is protected with a fire detection and suppression system, and an NBC Overpressure system. The vehicle also has air conditioning and heating. A small computer with repair and recovery solutions is mounted inside the hull on the left side. The vehicle is equipped with GPS or GLONASS, depending on the wishes of the buyer.

The BREM-80U is powered by the GTD-1250 gas turbine engine, developing 1250 horsepower. The engine is known to be difficult to maintain and has high fuel consumption; while the intervals between routine servicing is longer, when it has a problem, it's usually a big one. The BREM-80U is equipped with a deep wading kit that takes 15 minutes to install; this allows wading (but not swimming) up to 5 meters depth.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,038,199	D, G, JP, AvG, A	4.5 tons	45 tons	4+1	31	WL/IR Spotlight (C), Passive IR (D), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
186/130	52/36	1100	535	Stnd	T6	HF152Cp HS21Sp HR14

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	NSVT (C)	800x12.7mm

Kurganmashzavod BREM-L Berglianka

Notes: The BREM-L is an ARV (Armored Repair Vehicle) based on the BMP-3 chassis. It is specifically designed to take care of the BMP-3, but also has a role in taking care of other members of the BMP series. Unlike most vehicles in Russian service, the BREM-L was exported first, to several Mediterranean, South American, Middle Eastern, and Southeast Asian countries. After that, full-rate production began for the Russian Army. It is based on the BMP-3 chassis and engine, and so has decent armor protection, speed, and agility. It is regarded as one of the world's best light ARVs.

In the BREM-L, the BMP-3 turret is removed and replaced with a small armored cupola on the center right of the vehicle, mounting a PKT machinegun. The left side of the roof has a crane that can lift 6 tons, or 12 tons if a pulley block is installed first; this is to the left and rear of the commander. This crane can lift the BMP-3's entire power pack, the turret, or, with a little work, the passenger compartment of the BMP-3. The crane is capable of 360-degree slewing, and a reach of 4.852 meters. The BREM-L can move slowly (no more than Com Mov 5) with a load on the crane. The vehicle's winch has a 20-ton capacity, or 40 tons if a pulley block is installed first, or up to 80 tons with two such blocks. It has 100 meters of cable. Usually, when the winch is used, a dozer blade mounted at the front of the vehicle is first lowered; this can also be used for obstacle clearance and for general preparation of fighting positions. The blade is slightly wider than the front of the BREM-L. There is a load area on the rear hull roof for carrying large stores such as BMP engines and transmissions. Towing is up to 30 tons; however, at 20 tons, Tr Mov and Com Mov are halved. The BREM-L is equipped with two pulley blocks, a tow bar, various lengths of rope and cable, and basic tools, tracked vehicle tools, small arms tools, and heavy ordinance tools. It has welding sets for steel and aluminum. It has an air compressor, and a hydraulic jack, and a selection of spare parts. These are normally carried in external lockers or on the hull of the BREM-L. A 20kW APU is carried to run the vehicle while the engine is turned off.

The BREM-L may swim with a little preparation. If the vehicle being towed can also swim, the BREM-L may swim while towing the stricken vehicle. The engine of the BREM-L is the BMP-3's UTD-29M turbocharged multifuel developing 500 horsepower, along with an automatic transmission. To the left of the commander is a bank of four smoke grenade launchers.

As stated, the commander is on a raised cupola with all-around vision blocks. His center front block has a night channel. He is armed with a machinegun which can be aimed and fired from within the vehicle. Behind the commander is a spotlight on a mast, along with a CCTV day/night camera; this may be rotated by any crewmember needing it, except from the driver's position. The driver is on the front left; he has vision blocks to the front. The center block is a wide-angle block and has a night channel. Normally, there is only one other crewmember, seated in the hull; however, the BREM-L may carry two other crewmembers if the need arises. The large doors in the rear of the BMP-3 are deleted, but there is one smaller hatch. This does not have a firing port, but does have a vision block. Other vision blocks have been retained, but not the firing ports. The crew has air conditioning and heating and an NBC Overpressure system, as well as a fire detection and suppression system. They have a small computer loaded with manuals pertaining to its roles.

The BREM-L has a tertiary role: reconnaissance. In this role, the BREM-L uses its internal BMS and GLONASS to spot enemy groups and positions and relay them to higher units. It is also equipped with FLIR, a laser rangefinder, and a laser designator. The gun

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,409,418	D, G, AvG, A	3.3 tons	18.7 tons	3+2	11	Passive IR (D), Image Intensification (C), FLIR (C), WL Spotlight (G), Day/Night CCTV (G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
180/126	50/35/10	460	185	Stnd	T3	HF9 HS5 HR4

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	PKTM (C)	2000x7.62mm

Volgograd JSC BREhM-D

Notes: The BREhM-D is based on the BTR-D and is meant to service and recover the BMD series of IFVs. The BREhM-D entered service in the late 1990s, and is currently in service with Russia and most of the former Soviet Republics that inherited part or all of the BMD-1 and BMD-2 forces in their countries. It is a very light ARV, with construction very similar to the BTR-D and BMD-1's chassis'.

The BREhM-D uses an A-frame crane that can rotate through 150 degrees, enabling it to reach over the front or rear of the vehicle. It has a reach of 3 meters in either direction. Its base capacity is 1.5 tons, but this may be doubled, quadrupled, or octupled depending on how many times the cable is run through the pulley and the top of the vehicle. The crane rests over the rear of the vehicle and is locked down in a retaining frame for traveling or parachute drops. The crane is powered through the BREhM-D's vehicular hydraulic system, though it can be powered by a hand pump if the engine is switched off. The crane is controlled by the vehicle commander. The BREhM-D's winch is capable of a single pull of 3.5 tons, though again this may be doubled or greater through the use of successive snatch blocks, to a maximum pull of 10.5 tons. The cable is 100 meters long and runs through several internal rubber rollers in a framework inside the vehicle, ultimately unrolling from a reel inside the front of the vehicle. The dozer blade is used to brace the vehicle during crane and winch operations; the blade has no actual mechanism and is deployed by one man lifting or lowering on each side of the blade to the ground position, travel position, or obstacle-dozing position. The blade cannot be used to dig fighting positions. Instead of a towbar, the BREhM-D has twin telescoping towbars with internal shock absorbers, and powered by vehicle hydraulic power. Other tools include basic, power, electrical, electronic, tracked vehicle, small arms, and heavy ordnance tools. It also carries a welding set powered by the vehicle's electrical system (the engine must be on, as the welding set would otherwise drain the batteries almost immediately), and an air compressor. It does not carry a hydraulic jack; the crane is used for this purpose instead. A set of pioneer tools is carried, along with several ropes, cables, and snatch blocks, and a selection or spare parts.

The commander/crane operator has a cupola on the front right; this cupola is manually-rotating and has all around vision blocks. It is armed, usually with a PKT, AGS-17, or AGS-30. The commander has an elevated periscope and a spotlight on a mast. A crewmember is seated to the right of the driver; he may fire a PKMS machinegun, though this is mounted in the bow ahead of the gunner and has no more than 15 degrees of traverse and elevation. The driver is on the front left. The three firing ports on each side of the BTR-D are retained on the BREhM-D, though not normally manned. Crewmembers exit and enter through the various hatches on the roof; there is no rear hatch and the engine is in the back. The crew has a heater and a collective NBC system to plug their protective masks into.

The engine is that of the BTR-D, a Type 5D20-240 diesel engine, developing 240 horsepower. The transmission is automatic. The suspension is specially-designed for the BREhM-D's role; it is a variable-height hydropneumatic suspension that allows the BREhM-D 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 BREhM-D 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 preparation takes 10 minutes. Propulsion in the water is by hydrojets. The hydrojets have shutters which allow for surprising maneuverability when swimming – the BREhM-D 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. The BREhM-D can tow another vehicle while swimming if that vehicle is also amphibious.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$381,228	D, A	2 tons	8 tons	4	9	Passive IR (D), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
198/139	55/39/8	300	89	Stnd	T4	HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT, AGS-17, or AGS-30 (C), PKTS (Bow)	2000x7.62mm, or 1000x7.62mm and 254x30mm

Volgograd JSC RKhM-5 Povozka

Notes: The RKhM-5 is based on the BTR-D chassis and is designed to provide NBC reconnaissance to Russian Airborne troops, and to a lesser extent, Naval Infantrymen. It entered very limited service (3 vehicles) in March 2012, and the Russian Army began testing these first examples in 2011. Acquisition has been hampered by budgetary problems, and it is still in a low LRIP at this time. It is used only by Russia at this time, but is available for export, but no such orders have been made.

The NBC suite is almost the same at that of the RKhM-4-01 (see Russian Wheeled Engineer Vehicles), but it does not carry as many flags, and if airdropped the flag dispensers have to be mounted after it reaches the ground. (They are secured to the same pallet as the RKhM-5, but they would be ripped off in the slipstream if dropped connected to the vehicle). It also carries a smaller crew of specialists, and the NBC instruments are more advanced (for the most part, the same as the RKhM-4-01 for game purposes). The RKhM-5 has a Geiger counter, two dosimeters, an automatic chemical contamination alarm, devices for determining what agent is causing chemical contamination, and devices to analyze general weather conditions, especially wind direction and speed. Gamma,

beta, and alpha radiation can be detected and analyzed from within the vehicle. The RKhM-5 has special arms on one side of the vehicle to take samples and bring them into a special compartment for analysis. The RKhM-5 can detect most types of chemical contamination used or stockpiled today. The arm is dexterous enough (assuming the operator is dexterous enough) to take in leaves, earth, and reach up to two meters into a tree or other surface to take materials for analysis. The RKhM-5 can also take air samples and analyze them. It can also detect some types of biological contamination, such as bacteria and food poisoning. On the rear and sides of the RKhM-5 are three warning flag dispensers, each with 30 flags. They can be deployed from within the vehicle or set to deploy automatically at a certain interval, and come in different colors to denote radiation and chemical contamination. The RKhM-5 has an eight-barreled signal flare launcher, which may be manually triggered or set to fire automatically upon detecting chemical or radiological contamination. The RKhM-5 has a meteorological set, detecting wind speed and direction, humidity, and temperature. The RKhM-5 carries a complete set of reloads for the flare launcher. The RKhM-5 has GPS navigation and a small computer to act as a mapping module, advise the commander of the proper routes, and convert areas to map coordinates. The RKhM-5 also conducts general route reconnaissance, and can note condition of roads, bridges, and areas of high water and put them on the map. The RKhM-5 has several short-range and long-range radios, which are data-capable, and is equipped with a BMS.

The RKhM-5 has more advanced armor than the rest of the BMD series. It is spaced on the front and the body of the vehicle is made from alternating steel and aluminum plates.

The driver is on the front center, and the driver also mans an RPKS-74 automatic rifle. The RPKS-74 can be removed and used as a dismounted weapon, but doing so reportedly requires a contortionist to accomplish. The mount gives its weapon about 30 degrees of traverse and elevation and 10 degrees of depression. The commander is on the front right, and has a manually-rotating cupola with all-around vision blocks. Both have night vision. The driver has an overhead hatch, and has three vision blocks to the front. The commander is armed with a machinegun on a pintle mount connected to the cupola. The three firing ports on each side of the vehicle are retained. Three NBC specialists are in the center crew compartment of the RKhM-5, along with scads of instruments, radios, and a computer; the crew compartment is a bit cramped, and the specialists cannot stand all the way up; they normally use most of their instruments while seated or crouching. They have two hatches on the center deck.

The engine used on the RKhM-5 is a 2V-06-2 450-horsepower supercharged diesel, coupled to an automatic transmission. This gives it excellent speed, needed when conducting reconnaissance missions possibly behind enemy lines. The suspension type is the same – a hydropneumatic variable-height suspension, but the height adjustment capability is different (130-530mm, versus 100-450mm for the BMD-1 and BMD-2). The roadwheels are small, and the tracks are a mere 230mm wide. A side-effect of this suspension appears to be a relatively decent ride. Preparation for amphibious operations and amphibious performance is largely the same as the BMD-1 and BMD-2. RKhM-5 is amphibious with a little preparation – a trim vane must be erected, a periscope must be inserted into a socket and extended by the driver, and bilge pumps turned on. The bilge pump has a manual backup. This preparation takes 10 minutes. Propulsion in the water is by hydrojets. The hydrojets have shutters which allow for surprising maneuverability when swimming – the RKhM-5 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.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,259,430	D, A	500 kg	13.2 tons	5		Passive IR (D, C), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
222/155	62/43/13	300	167	Stnd	T4	HF11Sp HS7 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT (C), RPKS-74 (D)	2000x7.62mm, 2160x5.45mm

ZTS BTS-1

Notes: The BTS-1 is one of the Soviet Union's first post-war armored recovery vehicle designs. The first version, the BTS-1, is a rather primitive design with very limited capabilities. It entered service in the early 1950s. The BTS-1 underwent a long series of upgrading and refurbishment throughout its career, both in Soviet service and in the services of the many countries it was used by. The BTS-1 did establish the basic form of tank-based ARVs.

BTS-1

The BTS-1 established for basic form for tank-based ARVs: the turret removed and replaced by a raised superstructure. In the BTS-1, only the front of the vehicle is a raised superstructure; the rear has eight large stowage boxes to carry its equipment, personal equipment, and spare parts. There is no flat platform, and the BTS-1 cannot carry a powerpack on top. If it needs to bring an engine and/or transmission, it usually does this with a trailer. The BTS-1 has a light crane with a bare lift capacity of 1 ton, though by increasing cable runs between the pulley and the rear of the vehicle, up to 4 tons may be lifted. The BTS-1 is hampered in recovery efforts by its lack of a winch; it is limited to hooking rope or cable onto the vehicle to be recovered and pulling with the BTS-1 itself. It has a dozer blade in the rear to brace itself during crane operations. Equipment carried includes most basic toolsets, an air compressor, and a hydraulic jack, along with a large selection of spare parts. Also carried is several ropes, cables of various

thicknesses, snatch blocks, and a chain saw.

Notes: The driver is on the front left, and the commander is on a manually-rotating raised cupola armed with a weapon. The third crewmember is the crane operator; he has a hatch on the center left, and his seat faces to the rear. Up to two other mechanics may be carried in the hull.

The Finnish version of the BTS-1, which they designated the BTS-2, is equipped with a winch capable of a basic lift of 12 tons. It is otherwise like the BTS-1.

The engine of the BTS-1 is the same as early T-54s: a 500-horsepower diesel V-54 engine.

BTS-1M

This was an attempt to replace the BTR-1 with a vehicle capable of providing real support to T-54, T-55, and other vehicles. In the center rear deck is a flat space surrounded by drop sides. The BTS-1M has a more powerful V-55 580-horsepower engine, and a more capable crane of 20 tons (but still no winch). The superstructure is extended to the rear, and the stowage boxes are moved to the sides and the roof.

BTS-2

The BTS-2 is different largely in that is based on the T-55 hull rather than the T-54. It also adds a winch with a basic pulling force of 30 tons. The cargo capacity is greater than either iteration of the BTS-1.

BTS-4

The BTS-4 is similar to the BTS-2, but it carries a long snorkel device to allow it to crawl along the bottom of bodies of water up to 8 meters deep. The entire vehicle is watertight because of this, but it cannot actually swim. Mounting the snorkel takes 20 minutes. The snorkel connects to the commander's hatch and there is a platform at the top for the commander to stand on. On the outside of the snorkel is a ladder to allow the commander to climb to the top. Mounting the snorkel is a three-man job. Removing the snorkel is also a 3-man job, and takes 10 minutes to dismount the snorkel. At this point, the snorkel may be left behind, or 4 more minutes may be taken to lock is back down on top of the vehicle. It locks down just left of center. After the snorkel operation, the commander's machinegun must be tilted down to empty the barrel of water.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BTS-1	$521,801	D, A	1 ton	36 tons	3+2	19	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-2 (Finnish)	$586,408	D, A	1 ton	36.03 tons	3+2	19	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-1M	$633,770	D, A	1.5 tons	34 tons	3+2	19	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-2	$647,756	D, A	3 tons	32 tons	3+2	17	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-4		D, A	3 tons	32.14 tons	3+2	18	Active/Passive IR (D), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BTS-1	108/76	30/21	812	149	Stnd	T6	HF63 HS12 HR8
BTS-2 (Finnish)	108/76	30/21	812	149	Stnd	T6	HF63 HS12 HR8
BTS-1M	126/88	35/25	812	173	Stnd	T6	HF63 HS12 HR8
BTS-2	132/93	37/26	812	173	Stnd	T6	HF60 HS12 HR6
BTS-4	132/92	37/26	812	173	Stnd	T6	HF60 HS12 HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(All)	None	None	PKT (C)	2000x7.62mm

Rubisovsk RM-G

Notes: Called by the Russians the Repair Tracked Vehicle or RTV, this vehicle is in service only with the Russian Army, and has not been offered for export sales. Though specifically-designed to service the BMP series, the RM-G is capable of performing repairs on a wide variety of vehicles to one degree or another.

The RM-G is built on the chassis of the BMP-1, though it is modified almost beyond recognition. The turret is removed; the rear has a raised superstructure, and the platform for carrying powerpacks or large cargoes is on top of this superstructure. It is designed for repair, and features a complete toolkit composed of all types of tools as well as pioneer tools. The RM-G also has a welding set, air compressor, hydraulic jack, a hand-held circular cutter, and a slave cable. The RM-G has space for one ton of spare parts, including several roadwheels and track sections. The RM-G has a crane with a capacity of 3 tons and a range of 228 degrees, and a reach of 4.01 meters. It is mounted to the left side of the turret. The RM-G is a repair vehicle, not a recovery vehicle, and does not have a winch for recovery.

The driver is on the front left, with the commander to the rear of him in a small turret (bigger than a cupola, but otherwise the same). The turret does not actually mount a weapon; the weapon is on a mount on the turret ring, Atop this turret is a hatch. The vehicle's weapon can be aimed and fired from inside the vehicle. The driver has one wide angle vision block to the front and two more to the front and two others looking left. The commander's turret is ringed with vision blocks. The driver's middle block has a night vision channel, as does the front block and gunsight on the commander's cupola. Two other mechanics are seated in the hull behind the commander's turret; one of these has a position behind the commander with a simple hatch, and he operates the crane. The crew is protected by NBC Overpressure with a collective NBC backup, and a heater. The RM-G retains the BMP-1's rear doors and firing ports.

The RM-G has the BMP-1's engine and transmission, and so has torsion bar suspension with shocks on the first and rear roadwheels. The engine is a UTD-20 diesel developing 300 horsepower. As it is amphibious, it is cable of performing repair while swimming, though the crane is not useable when swimming.6.736

Most RM-Gs are based on the BMP-1 chassis; however, newer conversions have been based on the BMP-2 chassis. This variant is nearly identical for game purposes, but does have some differences.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
RM-G	$399,701	D, A	500 kg	13.8 tons	4	9	Passive IR (D, C), WL Spotlight (C)	Shielded
RM-GM	$401,501	D, A	500 kg	14.38 tons	4	9	Passive IR (D, C), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
RM-G	155/109	43/30/4	462	111	CiH	T6	TF10 TS6 TS6 HF8 HS4 HR4
RM-GM	150/105	42/29/4	462	113	CiH	T6	TF11 TS7 TR6 HF9 HS5 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
RM-G/GM	None	None	PKT (C)	2000x7.62mm

OKB-520 IMR

Notes: This predecessor of the IMR-2MA was first seen in 1973. It is based on the chassis of a T-55. The IMR is no longer being used by Russian regular or reserve units or Eastern European countries, but still equips some Russian Mobilization-Only units. In addition, it is being used in regular or reserve units by China, several Middle Eastern nations, and some African countries. The IMR is a CEV, but has a secondary role as an NBC reconnaissance vehicle.

In the IMR, the turret of the T-55 is removed and replaced by large crane In the IMR, the T-55 turret is removed and replaced with the crane turntable (in the center of the vehicle) and other combat engineer equipment. The crane is telescoping and is normally carried back on the center, telescoped fully in. The crane head may be equipped with a standard lifting head, or other accessories, including a pincer for grabbing, a bucket, or an auger. The pincer can be used for clearing obstacles and ripping down items such as trees and building supports. The front of the IRM has a dozer blade for digging fighting positions, clearing obstacles, or other work. The IRM normally carries an assortment of tools, including basic tools, excavating tools, power tools, construction tools, and air compressor, and a welding and cutting set. The crane can turn through 360 degrees and has a capacity of 2 tons. The IMR has a winch with a basic pulling capacity of 20 tons, and the cable goes out through the front. In front is a large mine plow that can also be used to brace the vehicle during crane operations. The blade also has teeth to rip up roads and asphalt, and concrete surfaces. The crane has variable geometry and can be pulled almost straight to aid when digging fighting positions or when the crane arm is being operated. The blade may also be used with the teeth removed and used to construct dirt roads, at the rate 8 kilometers per hour. It can be used to smooth over existing roads and fill trenches, or dig fighting positions.

The commander and driver both have raised cupolas; the commander's is manually-rotating, while the driver's is non-rotating. The commander's cupola has all-around vision blocks and a night vision device, as well as a rotating periscope. The driver has vision blocks to his front and both sides; the center front vision block may be removed and replaced with a night vision block. The commander operates all of the external tools, including the crane and its accessories. The driver operates the winch, with the commander (out of the vehicle paying out the cable); he also operates the mine plow. Inside the IMR, the crew has the protection of NBC Overpressure, as well as an automatic fire detection suppression system. The commander has a rotating spotlight for use when operating the arm or clearing obstacles. The IMR also carries 20 kilograms of C4 and the equivalent of an engineer's demo kit.

The IMR, being based on the T-55, uses a V-55 580-horsepower diesel, modified to produce high torque. It has a manual transmission. The IMR can be hermetically sealed, allowing fording in water of up to 5 meters. On each side of the vehicle are banks of 4 smoke grenade launchers. The IMR can also produce a thick, oily smokescreen by injecting diesel into its exhaust. The IMR has a DP-38 retenonmeter for radiation detection and measuring the amount of contamination. The IMR has VHPR device, which detects chemical contamination and to a limited extend, the type and degree of contamination.

Twilight 2000 Notes: During the Twilight War the IMR was still being used by many second-line Warsaw pact countries, China, several Middle Eastern nations, and some African countries.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$839,014	D, A	2 tons	37.5 tons	2	24	Active/Passive IR (D), WL Searchlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
117/82	33/23	812+380	173	Stnd	T6	HF67 HS16 HR8**

Uralvagonzavod IMR-2

Notes: This is a more advanced Russian combat engineer vehicle than the IMR, being based on a T-72 chassis. That said, the IMR and IMR-2 are similar designs, except for their chassis. They entered service in 1982, and had replaced most of the IMRs in Russian, Czech, and Polish service by 1987. The IMR-2 saw some action in Chechnya and was also used to help bury the breached reactor at Chernobyl, due to its high protection against radiation.

The turret of the T-72 has been replaced by a large turntable/small turret, from which is controlled the crane. The crane is locked to the rear during traveling. The crane can be traversed through 360 degrees and has a capacity of 2 tons at a reach of 8.15 meters. The crane may use several heads, including a lifting hook, pincer claws, and an auger. The front of the IMR-2 has a V-shaped mine plow that is armored against mines and is 1 meter high and 3.38 meters wide. It has a variable geometry; angle grading as well as straight plowing is possible with this blade. The front of the blade also had an extendible probe that is used to send radio signals to trigger the fuses on mines, explosive shells, and other such hazards. It is 65% likely to detonate any such device it encounters if the fuse is a contact, tilt rod, or radio type. When not in use, the plough is raised completely upwards to the 90-degree position. The IMR-2 carries a wide assortment of tools, including basic tools, excavating tools, power tools, construction tools, and air compressor, and a welding and cutting set. The IMR-2 series does not have a winch.

The crew consists of a driver and commander/crane operator; the driver is in the center front and the commander is in the small space in front of the crane. (It really *is* cramped.) He has a pintle-mounted weapon to his front, but he is not on a cupola, though he does have a wide-angle vision block on each side of him, and his seat rotates. They are protected by an NBC Overpressure system and an automatic fire detection and suppression system. The driver and commander's positions connect through a small tunnel, and there is also a space to keep personal gear, branching off this tunnel.

The IMR-2 uses a V-84-1 turbocharged diesel engine developing 840 horsepower, modified to produce high torque, and is controlled by an automatic transmission. With preparation, the IMR-2 may ford up to 5 meters. On each side of the vehicle are banks of 4 smoke grenade launchers. At the rear of the vehicle are a pair of MICLIC launchers for minefield breaching.

There were several variants produced over the years. The IMR-2M1 is identical, except for a difference in weight and speed caused by the removal of the MICLIC launchers; the hydraulic system is also more protected and has a backup system. The IMR-2M2 is designed for NBC reconnaissance as well as normal combat engineer jobs. The IMR-2M2 has a DP-38 retenonmeter for radiation detection and measuring the amount of contamination. The IMR-2M2 has VHPR device, which detects chemical contamination and to a limited extend, the type and degree of contamination. It adds to the tool set for the crane arm with a more useful bucket. The commander's machinegun, however, is removed; the small quarters never really allowed it to be used effectively in battle; for the commander, small arms are more easily used. It also does not have the MICLIC launchers. It does, however, have extra mine protection in the form of extra armor plate for the floor. It entered service in 1990, as did the IMR-2M1.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
IMR-2	$1,286,732	D, A	1.5 tons	44.3 tons	2	28	Active/Passive IR (D), WL Spotlight (C)	Shielded
IMR-2M1	$908,965	D, A	1.5 tons	43.28 tons	2	27	Passive IR (D), WL Spotlight (C)	Shielded
IMR-2M2	$1,295,678	D, A	1.5 tons	44.28 tons	2	29	Passive IR (D), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
IMR-2	139/97	39/27	1000+400	310	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12***
IMR-2M1	142/99	39/28	1000+400	296	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12***
IMR-2M2	142/99	39/27	1000+400	296	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
IMR-2/2M1	None	None	NSVT (C)	500x12.7mm, 20 kg C4, Engineer Demo Chest

Uralvagonzavod IMR-3

Notes: This is the Russians' newest combat engineer vehicle, based on the chassis of the T-90 tank. It was in LRIP as early as

1991, but full production did not occur until 1999. It is also known as the IMR-2MA, IMR-2A and IMR-3MA. Its primary job is to clear obstacles, smooth damaged roadways, and clear rubble from urban areas. This vehicle is only in Russian service, and has seen action in Chechnya and Ukraine. The IMR-3 has always been a limited-production vehicle.

As is usual for these converted tanks, the turret is removed; in its place is the turntable for the jib and the commander's turret. The dozer blade can smooth a road of about 6 km by the width of the vehicle in one hour, depending on the degree of difficulty of the obstacles, or clear earthwork at a rate of 300 cubic meters per hour, or loose rubble at a rate of about 400 cubic meters an hour. The dozer blade is also almost mine proof for purposes of clearing mines. It uses a lighter dozer blade (though just as strong) called the KMT-3R. This blade is described by many sources as "massive" or "huge." It comes in two wings, which may be operated individually, allowing for a greater variety of obstacle-clearing scenarios. It is usually used in a V-shape, as a mine plow; it can be used straight, though, for bulldozing. Even through asphalt or concrete, the blade can dig 450 centimeters per pass. The front of both wings also had an extendible probe that is used to send radio signals to trigger the fuses on mines, explosive shells, and other such hazards. It is 85% likely to detonate any such device it encounters if the fuse is a contact, tilt rod, or radio type. This type of detonation does not damage the plow.

The IRM-2MA has a crane with a capacity of 3 tons, a main winch with a capacity of 35 tons and 100 meters of cable, and a secondary winch with a capacity of 15 tons and 120 meters of cable. Normal tools carried include basic tools, excavating tools, power tools, construction tools, an air compressor, and a welding and cutting set. The jib is designed to use three tools; an auger, a lifting hook, and a combination excavator bucket/pincers. However, replacing tool heads is a long process, requiring 15 minutes and the crew to leave the vehicle and work with tools to accomplish the task. (For some reason, the Russians chose not to use the snap-in tools they used on early versions of the IMR.) For this reason, the head normally used, the bucket/pincers, is almost always mounted. The arm is mounted on the left side of the vehicle, about one-third of the way back, next to the turret. It has a reach of 8 meters and has a swing of 360 degrees.

There are two crewmembers. The driver is in the front center; he is in the front center and has three large windows to the front, with the sides angled to the left and right sides. The windows may have armored shutters lowered over them, in which case the driver sees through vision blocks above the windows. One has a day/night channel. The driver has an overhead hatch, but getting into it past all the plow machinery is a little difficult. The commander has a conical-shaped small turret, which has a cupola at the top with all-around vision blocks and a night channel on the front block. The cupola is manually rotatable. Between the commander and driver is a small tunnel which connects the two positions, along with a space to put personal items. The commander's machinegun can be aimed and fired from under armor. The driver's and commander's position are much more roomy than on an IMR-2.

The IMR-3 has a DP-38 retenonmeter for radiation detection and measuring the amount of contamination. The IMR-3 has VHPR device, which detects chemical contamination and to a limited extend, the type and degree of contamination. There is a 5kW generator to power the tools, winches, and crane when the engine is off. The engine is the same as the early versions of the T-90 – a V-84MS 840-horsepower turbocharged diesel. The armor level is also the same. IMR-3s in service with the Russian Army have a BMS and GLONASS. The crew is protected by an NBC Overpressure system and a fire detection/suppression system.

Twilight 2000 Notes: This vehicle is extremely rare in the Twilight 2000 timeline, with perhaps 12 having been built before the start of the War.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,091,070	D, G, AvG, A	2.5 tons	47.4 tons	2	19	Passive IR (D), Image Intensification (C), Thermal Imaging (C), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
132/93	37/26	1200	311	CiH	T6	TF50Cp TS30Sp TR16 HF180Cp HS30Sp HR18

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	Kord (C)	1050x12.7mm, 20 kg C4, Engineer Demo Chest

Kurganmashzavod IRM Zhuk

Notes: This vehicle is described by the Russians as an "Engineer Reconnaissance Vehicle," and is based on a lengthened BMP-1 chassis (seven roadwheels instead of six). Used only by the Russians, the IRM's job is to conduct route reconnaissance, checking the conditions or roads, trails, bridges, and fording sites. It is also used to detect mines and minefields. It has a secondary role as an artillery observer vehicle, and can also detect radiation and chemical contamination. A tertiary role is electronic intrusion to listen into enemy radio networks.

The IRM is fully amphibious, and may operate fully submerged along the bottom of a body of water with the aid of a 10-meter snorkel. The IRM does this with small ballast tanks, a trim vane, and some sandbags in the hull. The IRM can also swim, using two propellers at the rear to propel itself and maneuver. The IRM is also equipped with two mine detectors on booms, a sensor for determining the load-bearing capacities of a piece of terrain, devices to determine water depth, surf action, terrain angles, and the thickness of ice. The vehicle is also equipped with a laser rangefinder/designator, an artillery aiming circle, and two radios with a

range of 20 kilometers in addition to the normal vehicle complement. The IRM is equipped with a rocket-powered grapple for self-recovery, even under enemy fire. At the rear is a bank of 12 solid rockets to assist in this recovery if necessary. The IRM may generate a smoke screen by injecting diesel fuel into its exhaust. Other tools consist of the vehicle's basic and tracked vehicle tools, a chainsaw, and an air compressor.

The IRM is equipped with sensors for detecting the amount or type of chemical contamination, and the amount and type of radioactive contamination. To aid in this, the IRM is equipped with a small arm that allows the crew to snag a piece of vegetation or some other interesting piece of debris. The arm is long enough to reach the ground and into the low branches of a tree. These are then brought into a special container in the vehicle's wall for analysis.

The IRM carries a crew of six; of these, one is the driver and another is the commander, who is in a small turret armed only with a medium machinegun. The other crewmembers are specialists who each have their own duties in the vehicle. The turret is in the center left of the vehicle; the driver is on the front left. Naturally, the IRM has NBC Overpressure protection; it also has an automatic fire detection/suppression system, and unusually for a Russian vehicle, air conditioning and heating. There are four MOPP suits and masks for every crewmember, as well as extra filters for the masks. The specialists have CCTV cameras on the center roof and rear roof connected to a monitor on one side of the IRM, as well as an internal computer to aid in their analyses. The commander and driver navigate with a mapping computer module and inertial navigation. Digital information may be sent back to higher HQ up to 300 kilometers away, though using this much range requires the extension of a long-range antenna.

The IRM may use BMP-1 appliqué armor on the hull, but not on the turret, which is more akin to a BTR-80's turret than a BMP-1's turret. It may also mount lugs for ERA, over the appliqué armor.

Being a BMP-1 variant, the IRM has a 300-horsepower UTD-20 diesel engine, with a manual transmission. Suspension is by torsion bar, with shocks on the first and fifth roadwheels.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,106,952	D, A	1 ton	17.2 tons	2+4	10	Passive IR (D), Image Intensification (C), FLIR (C), 4xDay/Night CCTV	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
131/92	36/25/8	600	89	CiH	T3	TF4 TS4 TR4 HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	PKT	2000x7.62mm, 15 kg C4, Engineer Demo Kit.

Chelyabinsk MTP Technical Support Vehicle

Notes: Russia and Pact forces used this armored repair and recovery vehicle. Though it has long been out of service in Russian and Pact units, it is still being used by several Third-World nations, and some Mobilization-Only Russian units are equipped with them. It is based on the closed-top version of the BTR-50, and is used to support armored personnel carriers such as the BTR-series and BMP-series. It was used by virtually all countries who used the BTR-50 or early versions of the BMP or BTR series, though most MTPs are long out of service in the world, except in the Third World and some Russian Mobilization-Only units. Most were out service by the early 1970s. Museums are more interested in the actual BTR-50 though some are used as OPFOR vehicles when they are still running. They are old, and parts for them are difficult to find, and most ended up as range targets.

The chassis of the MTP is, for the most part, the same as the BTR-50PK, differing only in minor details. The upper hull, however, differs greatly from the BTR-50PK, as the raised superstructure of the BTR-50PK extends all the way back on the MTP, and is tall enough for crewmembers to stand within it. This allows for ample space for work and carrying of personal gear and spare parts and some tools. Other tools and spare parts are kept in boxes on the sides and rear of the MTP. There is space on the rear deck for carrying a power pack or other large spares. Recovery equipment carried includes anchors, tow bars and cables, block and tackle, oil and fuel pumps, a 5kW APU, a complete welding set, an air compressor, and a set of tools appropriate for working on wheeled and tracked vehicles. Ample room is provided for spare parts, and the MTP also has a crane with a capacity of 1.5 tons and a reach of 2.85 meters, and a winch with a capacity of 8 tons (15 tons with block and tackle installed) and 60 meters of cable.

The MTP has a raised superstructure with hatches for the crew and commander in it. The driver's hatch is in the normal place, and there are two doors in the rear. Above which is kept an extension tent to increase the available covered room for work. A folding trestle table is carried on the outside for use in these circumstances. There is a firing port in each side of the crew compartment and in one of the rear doors that can take an AK-series assault rifle or the PK machine gun. The commander's position is a simple hatch with a pintle-mounted weapon. He can also bring out an RPG-7 from a rack near his position. Three other mechanics have seats in the hull. The vehicle has no heater or air conditioner and does not even have a collective NBC system; the crew is reliant on their own MOPP gear and protective masks in case of chemical attack. There is not even an automatic fire detection/suppression system – there are five fire extinguishers instead for the crew compartment, and one mounted by the engine.

The MTP can carry bulk amounts of fuel or POL to units which are hard to reach on wheels. This necessitates removing all but the base crew, and removing the internal lockers for tools and spare parts.

As a derivative of the BTR-50PK, the MTP uses the same V-6B 240-horsepower diesel, with a manual transmission. Suspension

is by torsion bars, with no shock absorbers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$211,738	D, A	1.5 tons	15.5 tons	5	9	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
120/84	33/23/4	400	69	Stnd	T3	HF3 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	PK, RPG-7 (C)	1250x7.62mm, 4x73mm

Kharkiv MTP-LB Technical Support Vehicle

Notes: Similar in concept to the MTB technical support vehicle listed above, this vehicle is based on the MT-LB chassis. It was meant to be a new vehicle, replacing the MTP, and is designed to service the BMP and BTR-series of vehicles. The MTP-LB does not appear to have been exported, nor was it built in large numbers.

The basic form of the MT-LB is unchanged, except for the addition of a crane, winch, and platform on the rear deck for carrying engines and other large assemblies. The crane is driven by the winch (the winch and the crane cannot be used at the same time), and has a capacity of 1.5 tons. The crane is an A-frame structure mounted on the front of the vehicle that has a reach of 4.2 meters. The winch may be used by itself, in which case the capacity is 6.12 tons with 80 meters of cable. There is a jack located on the front of the vehicle which may jack up to 15 tons. (This jack must be moved to the cargo platform before amphibious operations can take place.) Other equipment carried by the MTP-LB includes tow bars and tow cables, chock blocks, electric and gas welding and cutting gear, a vehicle decontamination kit, and a full range of tools, including a welding set/cutter, air compressor, and tow bar.

The MTP-LB is amphibious, and can make amphibious recoveries (with the MTP-LB partially in the water, not full swimming) as well as land recoveries. The MTP-LB may tow a vehicle over water, if the vehicle can also swim or ford to depths of no more than 5 meters. (It would be a *very* slow tow.)

The MT-LBs commander's cupola has been removed and replace with a simple hatch and four vision blocks. And there are crew hatches on the roof between this area and the cargo platform; one is a position for operating the crane, with an elevated seat and four wide-angle vision blocks and a simple hatch. There are also two doors on the rear of the vehicle. The driver is in the front left; normally, no other persons are carried, but there are seats and space for two other mechanics. The vehicle has NBC Overpressure and a heater. While most versions of this vehicle are armed with a PK, the Polish version of the MTP-LB is armed with an NSV heavy machinegun.

The MTP-LB has the same engine as the MT-LB: A YaMZ-238 240-horsepower diesel. This is coupled to a manual transmission. Suspension is by torsion bar, with no shocks.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$305,608	D, A	2 tons	12.3 tons	2+2	11	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
143/100	40/28/4	450	71	Stnd	T3	HF5 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	PK (C) or NSV (C)	2500x7.62mm, or 1500x12.7mm

Omsk MTU-20

Notes: This is a tracked bridging vehicle based on a T-55 chassis. Russian and Pact forces rarely use the MTU-20, but the MTU-20 is used by Afghanistan, Egypt, Finland, India, Israel, Nigeria, and Syria. Israel uses captured versions.

The turret has been removed so the bridge span can lay flat on the deck area. The bridge can span 18 meters. It weighs 6 tons and can support 50 tons, taking 5 minutes to deploy and 7 minutes to recover. The bridge is a semi-cantilever bridge; the ends are deployed like a scissors bridge, and then the entire assembly is extended out horizontally. The bridge has a double treadway, with the treadways made of box-type aluminum girders. Two legs in the front are lowered into the ground as far as possible before bridgelaying or recovering takes place.

The crew consists of a driver on the front left and the commander/bridge operator behind and to the right of him. The commander has a rotating cupola with all-around vision blocks, and the crew need not crack their hatches to deploy the bridge. The commander has a machinegun, but due to the bridge supports and machinery, shooting while the bridge is mounted is very difficult; especially, clear shots to the front of the vehicle are virtually impossible. The MTU-20 has NBC Overpressure protection. Just behind each bumper is a cluster of four smoke grenade launchers.

Two variants of the MTU-20 were made, each differing only in their engines. The older version uses a W-2-54 diesel developing 520 horsepower. The newer versions use a W-2-55 diesel developing 580 horsepower. Both have manual transmissions.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-20	$517,000	D, A	500 kg	34 tons	2	51	Active/Passive IR (D)	Shielded

(Early) MTU-20 (Late)	$517,240	D, A	500 kg	34.04 tons	2	51	Active/Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-20 (Early)	118/83	33/23	960	153	CiH	T6	TF4 TS4 TR4 HF67 HS16 HR8
MTU-20 (Late)	128/90	36/25	960	171	CiH	T6	TF4 TS4 TR4 HF67 HS16 HR8

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

*The Crew-in-Hull refers to the bridge as a turret. If the bridge is deployed, the Configuration is Stnd.

Uralvagonzavod MTU-72

Notes: This AVLB is based on the T-72B or T-72M1 chassis. (Some sources say that some MTU-72s were made using new-built T-72 chassis.) The MTU-72 is used only by Russian and Pact forces.

It uses a bridge similar in design, but much larger and heavier then, the bridge of the MTU-20 listed above. This bridge can span a gap of 18 meters and support 50 tons. By utilizing a second MTU-72's bridge, a gap of 30 meters can be spanned. Three minutes are required to lay the bridge, and 8 minutes to recover it. The bridge is of aluminum alloy construction and weighs 6.4 tons. The bridge is extremely strong for such an item – it was made to withstand small arms fire and some artillery and rocket attacks. The bridge is laid in the same manner as that of the MTU-20 – the center portion is slid out, and then the ends are deployed. The MTU-72 carries a dozer blade at the front to clear obstacles to bridge laying or otherwise prepare bridging sites. The MTU-72 uses the V-46-6 turbocharged diesel engine, developing 780 horsepower, unless it is T-72B-based; in this case, it has an 840-horsepower engine. These versions are known as MTU-72Ms. It has an automatic transmission.

The commander has a full, rotating cupola, but is not armed except for his small arms and some grenades. He is in the center of the vehicle. The driver is ahead of him, in the front center. The crew has a heater and NBC Overpressure protection, as well as an automatic fire detection/suppression system.

There is a similar vehicle in Czech service called the MT-72. It is essentially the same vehicle, but is heavier in weight even though the bridge is lighter. It is based on the Czech version of the base T-72, the T-72M3 CZ.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-72	$706,826	D, A	300 kg	40 tons	2	27	Passive IR (D, C)	Shielded
MTU-72M	$729,741	D, A	300 kg	41.1 tons	2	27	Passive IR (D, C)	Shielded
MT-72	$721,880	D, A	300 kg	41.5 tons	2	35	Passive IR (D), Image Intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-72	142/100	40/28	1000	288	CiH	T6	TF20 TS20 TR20 HF138Cp HS20Sp HR12
MTU-72M	147/103	41/29	1000	310	CiH	T6	TF20 TS20 TR20 HF148Cp HS24Sp HR12
MT-72	138/97	38/27	1000	299	CiH	T6	TF20 TS20 TR20 HF129Cp HS17Sp HR12

*The Crew-in-Hull refers to the bridge as a turret. If the bridge is deployed, the Configuration is Stnd.

Uralvagonzavod MTU-90

Notes: This is an AVLB based on the T-90 chassis. It is being looked at by many of the same countries that use the T-90S export version of the T-90 tank. The Russians meant to replace the MTU-72 with the MTU-90, but budgetary versions kept them from acquiring more than just a few, even though it was approved for service with the Russian Army in 1997. So far, the MTU-90 is officially in LRIP, but it has received no production orders as of yet.

This bridge weighs 6.62 tons and can span a 23-meter obstacle, supporting a vehicle weighing 50 tons. The bridge is easy to lay and recover, requiring only 2 minutes to lay and 2.5 minutes to recover. The MTU-90 offers the same armor protection as the early T-90, and the chassis is in fact nearly identical to the early T-90. It can also be fitted with appliqué armor, track skirts, and ERA. The bridge is strong – similar in protection to the MTU-72. It is laid by unfolding the rear section, lowering the two sections across the obstacle, and as this is done, the third section automatically swings into position. The crew need not open the hatches to lay or recover the bridge. The crew has night vision channels to their vision blocks and the bridge can be lain and recovered at night, still without the crew opening the hatches. The bridge is operationally compatible with the bridge on the truck-mounted TMM-6, though they are different chassis.

The commander/bridge operator is in the center of the vehicle; he is in a manually-rotating cupola with the center front vision block

being a wide-angle block that has a night vision channel. The driver is in the center front. The vehicle has air conditioning, heating, and an NBC Overpressure system, as well as an automatic fire detection/suppression system. The commander's cupola is not armed; the crew relies on their small arms and grenades for defense. The MTU-90 has a BMS and GPS.

The MTU-90 uses the same 840-horsepower turbocharged multifuel, coupled with an automatic transmission. It can use a deep wading kit allowing submerging up to 5 meters, but cannot actually swim. The wading kit takes 5 minutes to mount.

The MTU-90M was designed to attract export customers; the Russian Army cannot afford them, even though they were accepted for service in 2013. Azerbaijan ordered an undisclosed number of MTU-90Ms in 2014, and they go into service as soon as they are received and readied. It uses a shorter bridge able to span 19 meters, but is an MLC-60 bridge. The bridge is essentially like the standard MTU-90 bridge, but the center section is much shorter, as are the wings; they unfold in the same manner. The MTU-90M is based on the T-90S chassis, but it is identical to the T-90 chassis for game purposes.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-90	$1,400,997	D, G, AvG, A	300 kg	45.5 tons	2	25	Passive IR (D), Image intensification (C)	Shielded
MTU-90M	$1,344,351	D, G, AvG, A	300 kg	45.3 tons	2		Passive IR (D), Image intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-90	136/95	38/27	1200	310	CiH	T6	TF20 TS20 TR20 HF180Cp HS30Sp HR18
MTU-90M	137/96	38/27	1200	309	CiH	T6	TF20 TS20 TR20 HF180Cp HS30Sp HR18

*The Crew-in-Hull refers to the bridge as a turret. If the bridge is deployed, the Configuration is Stnd.

KVZ PMM-2

Notes: This Russian vehicle has the tracks and suspension of the T-64 tank, and upper chassis of the PTS-2 amphibious carrier; it also uses components of the MDK-5 trench-digger and the MT-T tracked transporter. It is service only with Russia. Production is now complete, but the assembly lines can resume at any time if necessary.

The PMM-2 is used as a floating bridge, and may be used as either a bridge or ferry, or grounded at the bottom of a body of water. The vehicle opens like a clamshell when being used. When used as a bridge or ferry, the PMM-2 can carry 42.5 tons, but it is unable to carry this weight on land. Up to 10 PMM-2 vehicles can be latched together to form long bridges; each PMM-2 unit can bridge a gap 17 meters wide (or float vehicles that long). This does not require anyone to leave the vehicles, but they must be maneuvered in such a way that the vehicles latch together. PMM-2s can operate in bodies of water with currents of up to 2 meters per second. The PMM-2 uses retractable anchors and waterjets at the rear corners to maintain position if being used as a ferry or floating bridge. When the bridge is opened, it has a width of 20 meters; it can carry vehicles that wide, but practically only 17 meters are useful. Vehicles, troops, or cargo can be loaded via loading ramps which are 5 meters long and pull back into the platform for travel. A similar ramp is at the front for unloading. The vehicle takes 10 minutes to ready for use as a ferry or bridge.

The cab is at the front, with large bullet-resistant windows to the front and sides. They are watertight; in fact, the entire vehicle is watertight down to a depth of 3.6 meters. The cab carries 3: the driver, the commander, and the bridge/ferry operator. The bridge/ferry operator is responsible for unfolding the sections above, and re-readying it for travel. The other crewmembers are in the hull, and they monitor the integrity of the vehicle when the vehicle is submerged and ensure the engine and batteries operate properly. The PMM-2 is not armed. The engine used is a variant of the T-64's V-64-4 diesel engine, with 710 horsepower and turbocharging. Transmission is automatic. When submerged, the PMM-2 is powered by banks of batteries that are the equivalent of a 20kW generator, though they discharge in 1 hour and must be recharged or the vehicle recovered at that point. The PMM-2 has an air conditioner, heating, and NBC Overpressure. The PMM-2 has inertial positioning, GPS, and a map computer. The PMM-2 has an automatic fire detection/suppression system.

The new version, the PMM-2M, has a load carrying capacity when used as a bridge or ferry of 85 tons. However, the spotters have been removed and there are only three crewmembers. It is otherwise the same as the PMM-2 for game purposes.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PMM-2	$908,232	D, A	500 kg	30 tons	5	21	Headlights	Enclosed
PMM-2M	$1,439,520	D, A	500 kg	29.86 tons	3	21	Headlights	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
PMM-2	165/115	46/32/8	1000	261	Stnd	T6	HF6 HS3 HR2
PMM-2M	166/116	46/32/8	1000	261	Stnd	T6	HF6 HS3 HR2

STK Bionix RCV

Notes: The Bionix RCV (Recovery Combat Vehicle) is the service vehicle of the Bionix family, and it has seen several bulk sales to countries who have already bought the various RCV versions of the Bionix, countries who have a lot of light vehicles, and countries who have decided to replace their old M-113-series vehicles with the Bionix. Vickers of the UK is negotiating a license for production of the Bionix RCV, and the vehicle is becoming a common sight in Southeast Asia, the Middle East, and to an extent, Africa, and reportedly some European countries are also interested in the Bionix RCV.

The Bionix RCV uses as many common components with the other Bionix-series vehicles as possible. The turret is removed, and replaced with a raised superstructure – but unlike most such vehicles, the roof is raised by only about half a meter. As with most such vehicles, the primary role of the RCV is to recover light vehicles bogged down in much or debris; it also is used to repair such vehicles, though it is a relatively small vehicle and carries a limited amount of spare parts and tools.

The driver is on the front left of the vehicle; behind him is the commander. The commander has a raised manually-operated cupola with all around vision blocks, and one front block with a night channel. His weapon can be aimed and fired from within the vehicle with the hatch shut; he often does this to use the reticle on the front vision block. The driver has three vision blocks: one wide-angle one to the front that has a night channel, and one normal block on either side of the front block and angled, giving the driver vision to each side. To the right of the commander is the crane/winch operator, who also has a raised, manually-rotating cupola with all-around vision blocks. He does not, however, have a night channel, though he has a WL/IR spotlight. Inside, there is room for another mechanic or specialist, but he has no seat and must simply hold on during travel. The crew has a collective vehicular NBC System and an air conditioner and heater.

For its mission, the primary tool is the recovery winch, with a capacity of 25 tons, or double that with block and tackle, and useable cable of 90 meters. For repairs or to act as a jack, the crane has a capacity 30 tons, though at more than 0.8 meters reach, this is reduced to 12 tons. (Maximum reach is 6.5 meters.) Toolsets include all basic-type tools kits, except large-caliber weapon tools and small arms tools. It also carries an air compressor and an electric hand-held saw.

A stated above, the RCV uses a mostly Bionix APC/AFV chassis, including the same tracks, roadwheels and suspension, fuel tanks, and engine and transmission. The engine is a license-produced 475-horsepower Detroit Diesel DDC-6V-92TA supercharged diesel engine, along with an HMPT-500EC automatic transmission (a modified form of the transmission found in the M-2 Bradley) and a driver's compartment that has a conventional steering yoke, gas pedal, and brake pedal. The armor suite is the same as on the Bionic APC/AFV, and the same appliqué and ERA can be added for additional protection. Construction is largely of all-welded steel.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$420,455	D, A	2.4 tons	24 tons	3+1	17	Passive IR (D), Image Intensification (C), WL/IR Spotlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
141/99	39/27	527	176	Stnd	T3	HF16Sp HS7Sp HR4*

Fire Control	Stabilization	Armament	Ammunition
+1	None	CIS-50 or CIS-40 or MAG (C)	3000x.50 or 950x40mm or 5000x7.62mm

*Belly AV is 3.

STK Bionix AVLB

The Bionix AVLB was first revealed at an arms show in 2000, but they also said that the AVLB had been in production and use in Singapore for three years by that point. It is designed to be a light assault bridge, as it is only MLC 30, so the heaviest vehicles it can accommodate are heavy trucks and the Bionix series.

The bridge of the Bionix is, as stated, MLC-30, and is a two-part bridge to fit on the Bionix hull. It is 22 meters long, but has a usable span of 20 meters. Two such bridges may be laid side-by-side to form one MLC 60 bridge. The bridge is a push-pull bridge, and is laid like the German Biber, with the top part sliding out from the top section of the bridge sliding out, and then the bottom part sliding into place. This is done automatically, with the crew not having to leave the vehicle.

Like the RCV above, as many components of the Bionix AFV/APC are used as possible, including the entire chassis, with the including the same tracks, roadwheels and suspension, fuel tanks, and engine and transmission. The engine is a license-produced 475-horsepower Detroit Diesel DDC-6V-92TA supercharged diesel engine, along with an HMPT-500EC automatic transmission (a modified form of the transmission found in the M-2 Bradley) and a driver's compartment that has a conventional steering yoke, gas pedal, and brake pedal. The armor suite is the same as on the Bionic APC/AFV, and the same appliqué and ERA can be added for additional protection. Construction is largely of all-welded steel.

Crew consists of the driver in front left and the commander/bridgelayer to his right. The driver has three vision blocks to his front and slightly to his sides; the commander has all-around vision blocks with day/night CCTV cameras around the vehicle to watch the deployment and recovery and a night vision channel to the front, The driver also has a night channel. The commander operates the bridge by remote control, with a control box that has two joysticks and several buttons to start and stop the deployment and recovery process. The vehicle is unarmed, and the crew has only their small arms and perhaps some grenades, and possibly something like an Armbrust or M-72 LAW. The crew is protected by a collective vehicular NBC system, an air conditioner, and a heater. On each

bumper is a cluster of four smoke grenade launchers. The driver has access to a GPS and mapping module.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$362,682	D, A	400 kg	28.3 tons	2	21	Passive IR (D), Image Intensification (C), 3xDay/Night CCTV Cameras (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
123/86	34/24	527	140	Stnd	T3	TF4 TS4 TR4 HF16Sp HS7Sp HR4**

*The CiH Config rating is for when the bridge is mounted. In such a state, no crew hits are possible; these are treated as misses. When the bridge is deployed, the Config is Stnd.

**Belly AV is 3.

PSD VPV

Notes: This Czech vehicle is used for support of BMP-series, BRDM-series, and BTR-series vehicles, and other vehicles with weights up to 15 tons. It has an unofficial designation of BREM-4. It is based on the BVP-2 chassis (the Czech and Slovakian version of the BMP-2), and is very similar in layout and equipment carried to the Russian BREM-2. The crane is operated by the commander, there is a mechanic that has controls over the winches, and the driver, who is also a mechanic. Production began in 1984 and 363 VPVs were built.

The turret is removed and replaced with a cable drum and a hatch to access the winch and crew compartment. The winch can pull 17 tons, or more with the use of return pulleys; this winch has 120 meters of cable. The VPV has a dozer blade that is lowered to brace the vehicle in winching and craning operations. The VPV has a crane mounted at the right rear of the vehicle that can lift 6.5 tons and has a reach of 4.5 meters. The vehicle is equipped with full tool sets for work on tracked and wheeled vehicles, as well as a tow bar, welding set and cutting tools, a hydraulic jack, and an air compressor. The cargo platform in the rear has a capacity of 1.5 tons. The VPV carries a small computer that has repair and recovery solutions.

The driver is on the front left, with three vision blocks to the front, with the two end vision blocks turned slightly to the outside. The front block has a night channel. The commander is to his left, with the same vision block arrangement, except that there is also a vision block to each side. However, the commander and driver's positions use primarily the two large windows to the front, and smaller windows to the side. All are bullet-resistant. The windows may be protected by an armored shutter, at which point the commander and gunner see through the vision blocks. They have no overhead hatches; instead, they enter and exit through the rear doors. The remaining mechanic also acts as a gunner; he is equipped with a heavy machinegun is a small-BTR-80-like turret. The gunner also has night vision through his gunsight, and the machinegun has a collimator-type sight. The gunner enters and leaves through the rear doors; there are no roof hatches except the gunner's. The gunner is also the crane operator. The crew is protected via an NBC Overpressure system, with a vehicular NBC backup, and has a GLONASS receiver and a mapping computer (it is not a full BMS). The compartments of the VPV include the powerpack compartment, crew compartment, and the repair and cargo compartment. Each has an automatic fire detection/suppression system. Protection is topped off by 4 clusters of four smoke grenade launchers at the space between the glacis and front windows. The VPV is wider than the BVP-2, giving the crew more room to work; an extension tent normally kept above the rear doors can be erected. It is two meters long and gives the crew more room to work. The VPV also carries a small folding trestle table.

The engine is a UTD-20/3 multifuel developing 300 horsepower, and the transmission is manual. Fuel capacity has been increased to power all the various mechanized tools.

The VPV retains the amphibious capability of the BVP-2, but will swamp if waves more than 100mm or currents over 1.2 meters per second are encountered. Czech forces use the VPV, as does Hungary (where it is known as the BMP-2VPV); a few are also used by Russia to supplement their BREM-2s.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$769,144	D, G, AvG, A	3 tons	14.3 tons	3	11	Passive IR (D, G), Image Intensification (C, G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
148/103	41/29/4	480	111	CiH	T2	TF4 TS4 TR4 HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	PKT (G)	2000x7.62mm

ZTS VT-72B

Notes: Also known as the BRAM-72B, the VT-72B is a recovery vehicle based on the T-72 chassis, built by Slovakia. It is very similar to the BREM-1 in many respects; visually, the biggest difference is that the VT-72B's crane is on the right side of the superstructure instead of the left. The VT-72C is a version designed specifically for the Indian Army, and has a more powerful engine and a revised interior arrangement and a BMS. First deliveries began in 1999. The VT-72 series has a secondary role as a mine plow, and a tertiary role of digging large fighting positions. The Czech Republic and Slovakia use the VT-72B in place of the BREM-1; the vehicle is also used by India in a modified form.

The VT-72B

The T-72's turret is removed and replaced with an armored, raised superstructure. The crane, on the front right and folding along the right side, can lift 19 tons and has a reach of 7.6 meters, though beyond 2.24 meters, lifting capacity is reduced to 18 tons. There is a load platform on the rear of the superstructure that can carry a load of 4 tons. The winch is located in the center of the vehicle, has 200 meters of 29-millimeter cable and can pull 40 tons without snatch blocks; the actual drum is in front of the engine. There is also a secondary winch that can pull 2.5 tons and has 400 meters of 6.3-millimeter cable. Its full width dozer blade located at the front of the vehicle can brace the vehicle. The dozer blade is normally kept straight, but can also bend in the middle for use as a mine plow. The dozer is also used to dig defensive positions for itself and other vehicles. There is also a rack at the rear of the vehicle for fuel and POL drums and jerry cans; up to 200 liters of various substances may be carried in this rack, and the VT-72B has three pumps

which can be attached to the drums or cans to pump their contents as necessary. Two grease guns are also provided. The VT-72B carries a 5kW generator for use with power tools or the welding equipment and air compressor (both issued with the vehicle). Other equipment also includes tools appropriate for working on tanks, like excavating tools, a hydraulic jack and a tow bar.

The driver is on front left at the top of the superstructure (and raised significantly from the driver's position on the T-72). The commander is to his left and the machinegun is equipped with a cupola with all-around vision blocks and a night channel for the front block. The weapon is in a cradle and has a collimator sight. It can be aimed and fired from within the vehicle. The commander normally controls the plow, the winches, and the crane, though in practice one or more are controlled by a control box outside the vehicle on a 7.6-meter cable. The other three crewmen are inside the center of the hull; all crewmembers are mechanics, and one is often specifically a turret mechanic. The third crewmember normally operates the crane through a large hatch on the center right roof. The VT-72B has an NBC Overpressure system and a GPS with a mapping computer. There is also a small computer that has the manuals with recovery and repair suggestions. The VT-72B also carries two dismount-versions of the PKM, and an RPG-7 with six rounds. There is an NBC Overpressure system for the crew, with a vehicular NBC backup. There are no smoke grenade launchers, but the VT-72B can inject diesel fuel (but not alcohol) into its exhaust to create a smoke screen.

The VT-72C

The VT-72C has a Polish S-12U turbocharged diesel. This engine develops 850 horsepower, and a decent amount of torque. This new engine needed a new transmission, cooling system, radiator and fan, and gear boxes. Tools carried now include a welding and cutting set. The interior is rearranged and revised to create 15% more usable room inside the working compartment; instead of increasing crew comfort, however, the extra room is taken up with spare parts and a BMS and GPS, with the extra radios needed for that system. The new engine is smaller, so there is a space next to the driver for personal gear. There are three thermal insulated (essentially large thermoses), with each containing 80 liters of drinking water. There is also a ration heater and water heater.

The VT-72M4 CZ

The VT-72M4 CZ was originally a Czech project, but they ran into budgetary problems and Slovakia had some money from NATO to upgrade their military vehicles, so they took over the project from the Czechs. The project was begun in the Czech Republic in 1999, though its development was slow, and development stopped in 2004 for about five years. The T-72M4 CZ is in limited use by Slovakia and the Czech Republic, but is being actively shopped internationally, and India is reportedly interested.

The Czechs used used the chassis from a Czech T-72M4 CZ tank as a base, and developed the VT-72M4 CZ. The VT-72M4 CZ reduces the crew to two, with a third seat available if another mechanic is needed for a mission. It is a larger and heavier vehicle, carrying more spare parts, computer gear, a BMS and GLONASS with a mapping computer, and tools. The VT-72M4 CZ has two clusters of five thermal smoke grenade launchers on the left side of the superstructure, able to block IR and thermal imaging as well as image intensification and lasers. It has a primary winch with a capacity of 31 tons, and up to 93 tons with snatch blocks, with 200 meters of useable cable. The secondary winch can pull 1.02 tons with 400 meters of useable cable. The crane has a capacity of 19 tons, and has a reach of five meters with a traverse of 280 degrees. The crane and winch can also be controlled through a remote control, though it is wireless and has a range of about 8 meters. Also available is a dozer blade on the front which can be used to brace the vehicle or dig at the rate of 126 cubic meters per hour.

The VT-72M4 CZ has updated versions of the VT-72B's tool set, but also include an air compressor, a chainsaw, a large hand circular saw, and a welding set. A work table and small shelter can be folded out from the rear. The tool sets are more compact than the earlier ones and fit into a smaller space. Eight fire extinguishers are also carried. The vehicle has the three insulated drinking water containers, ration heater, and water heater of the VT-72C. An updated 5kW APU is carried, more compact and reliable than the one on the VT-72B. The rear of the superstructure is a pad for the carrying of a T-72 powerpack or other large cargo, and can carry up to four tons. The engine of the VT-72M4 CZ is larger than that of the VT-72C, so the space next to the driver is about half as large and used to carry portions of the GPS and BMS. The interior is likewise rearranged and revised, and as the VT-72M4 CZ carries a maximum of three crewmembers, there is a lot more room for tools, spare parts, and even personal equipment, as well as the new equipment required by the BMS and GLONASS, as well as a small computer to help the crew with recovery and repair situations.

The driver and commander have advanced vision equipment, including image intensification to the front and rear, and color CCTV to the front and rear. The commander's equipment also allows him to aim and fire his machinegun when buttoned up. NBC overpressure protection is provided, as well as a heater and air conditioner. The powerpack has been replaced by one with a British-made CV-12 1000-horsepower supercharged diesel engine and US-made Allison XTG-411-6 fully automatic transmission.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
VT-72B	$1,242,245	D, A	8 tons	46.5 tons	5	31	Passive IR (D, C), Image Intensification (C)	Shielded
VT-72C	$1,769,185	D. A	8 tons	46.7 tons	6	31	Passive IR (D, C), Image Intensification (C)	Shielded
VT-72M4 CZ	$1,932,919	D, A	8 tons	51.5 tons	2+1	36	Passive IR (C), Image Intensification (Dx2, Cx2)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
VT-72B	125/87	35/24	1000+400	290	Stnd	T6	HF120Cp HS18Sp HR8
VT-72C	132/93	37/26	1000+400	314	Stnd	T6	HF120Cp HS18Sp HR8
VT-72M4 CZ	139/97	39/27	1000+400	371	Stnd	T6	HF 129Cp HS17Sp HR 12*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
VT-72B/C	+1	Basic	NSV (C)	500x12.7mm
VT-72M4 CZ	+1	Fair	NSV (C)	960x12.7mm

*Belly armor for the VT-72M4 is 7. The bracing blade may contribute to frontal armor; where is contributes depends upon how the blade is raised. The blade, when it contributes, has an AV of 6Sp.

ZTS MT-72 AVLB

Notes: As the Slovakians locally produce the T-72, it was natural for them to choose it as a base for an AVLB. They chose the Czech T-72M4 CZ as a base chassis. The MT-72 is thusfar used only by Slovakia and the Czech Republic, though it is available for export sales.

The bridge designed for the MT-72 spans 20 meters; if necessary, two bridges may be laid on top of each other to span 34 meters. The bridge weighs 4 tons and can support 50 tons. If necessary, the MT-72 can use the bridge of the MT-55A designed by the Czech Republic (which is also used by Slovakia). The MT-55A bridge spans 18 tons and two can be laid together to span 30 meters. Laying the bridge takes 3 minutes, while recovering it takes 5 minutes. The bridge is a scissors-type bridge. It can be laid at an angle of plus or minus 50 degrees and a side slope of 6 degrees to either side. The surface is textured to provide a better gripping surface. The total width is 3.3 meters, but this is split into two trackways of 1.1 meters, with a space in the middle. If necessary (usually for camouflage) the bridge can be laid below the surface of water up to 4.2 meters deep, this can also be used when the surface that needs to be spanned is lower than the MT-72. This, however, takes twice as long.

The MT-72 cannot swim, but with a special adapter, can ford up to 4.2 meters. Smoke grenade launchers are not normally mounted, but the MT-72 can inject diesel fuel into its exhaust to create a thick, oily smoke screen. The T-72M4 CZ is also about a third of a meter longer than the T-72; the powerpack remains the V-64-4Turbochaged diesel developing 840 horsepower and an automatic transmission. This enables it to keep up with assaulting troops.

The commander and driver are in the center of the vehicle, with the driver ahead of the commander/bridgelayer. They have a more comprehensive night vision suite than most engineer vehicles, inherited partially from the T-72M4 CZ. The commander is not, however, armed with a vehicular weapon, though he typically has his assault rifle or submachinegun outside of the vehicle and a couple of fragmentation grenades handy for local defense. The commander also typically carries night vision goggles to allow him to supervise deployment of the bridge at night using a remote control connected to the vehicle with an 8-meter cable from outside of the vehicle. The MT-72 has an NBC Overpressure system, an automatic fire detection/suppression system, and a BMS with GLONASS and a mapping computer, along with extra radios.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,123,924	D, A	400 kg	41.5 tons	2	38	Passive IR (D), Image Intensification (C), WL/IR Searchlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
143/100	40/28	1000+400	210	CiH	T6	TF6 TS6 TR6 HF129Cp HS17Sp HR 12

*The configuration of CiH is when the bridge is on top of the vehicle, and if hit, no crew hits are possible (they are ignored).
**Floor AV is 8Sp.

PSD VPV

Notes: This Czech vehicle is used for support of BMP-series, BRDM-series, and BTR-series vehicles, and other vehicles with weights up to 15 tons. It has an unofficial designation of BREM-4. It is based on the BVP-2 chassis (the Czech and Slovakian version of the BMP-2), and is very similar in layout and equipment carried to the Russian BREM-2. The crane is operated by the commander, there is a mechanic that has controls over the winches, and the driver, who is also a mechanic. Production began in 1984 and 363 VPVs were built.

The turret is removed and replaced with a cable drum and a hatch to access the winch and crew compartment. The winch can pull 17 tons, or more with the use of return pulleys; this winch has 120 meters of cable. The VPV has a dozer blade that is lowered to brace the vehicle in winching and craning operations. The VPV has a crane mounted at the right rear of the vehicle that can lift 6.5 tons and has a reach of 4.5 meters. The vehicle is equipped with full tool sets for work on tracked and wheeled vehicles, as well as a tow bar, welding set and cutting tools, a hydraulic jack, and an air compressor. The cargo platform in the rear has a capacity of 1.5 tons. The VPV carries a small computer that has repair and recovery solutions.

The driver is on the front left, with three vision blocks to the front, with the two end vision blocks turned slightly to the outside. The

front block has a night channel. The commander is to his left, with the same vision block arrangement, except that there is also a vision block to each side. However, the commander and driver's positions use primarily the two large windows to the front, and smaller windows to the side. All are bullet-resistant. The windows may be protected by an armored shutter, at which point the commander and gunner see through the vision blocks. They have no overhead hatches; instead, they enter and exit through the rear doors. The remaining mechanic also acts as a gunner; he is equipped with a heavy machinegun is a small-BTR-80-like turret. The gunner also has night vision through his gunsight, and the machinegun has a collimator-type sight. The gunner enters and leaves through the rear doors; there are no roof hatches except the gunner's. The gunner is also the crane operator. The crew is protected via an NBC Overpressure system, with a vehicular NBC backup, and has a GLONASS receiver and a mapping computer (it is not a full BMS). The compartments of the VPV include the powerpack compartment, crew compartment, and the repair and cargo compartment. Each has an automatic fire detection/suppression system. Protection is topped off by 4 clusters of four smoke grenade launchers at the space between the glacis and front windows. The VPV is wider than the BVP-2, giving the crew more room to work; an extension tent normally kept above the rear doors can be erected. It is two meters long and gives the crew more room to work. The VPV also carries a small folding trestle table.

The engine is a UTD-20/3 multifuel developing 300 horsepower, and the transmission is manual. Fuel capacity has been increased to power all the various mechanized tools.

The VPV retains the amphibious capability of the BVP-2, but will swamp if waves more than 100mm or currents over 1.2 meters per second are encountered. Czech forces use the VPV, as does Hungary (where it is known as the BMP-2VPV); a few are also used by Russia to supplement their BREM-2s.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$769,144	D, G, AvG, A	3 tons	14.3 tons	3	11	Passive IR (D, G), Image Intensification (C, G)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
148/103	41/29/4	480	111	CiH	T2	TF4 TS4 TR4 HF8 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	PKT (G)	2000x7.62mm

ZTS VT-72B

Notes: Also known as the BRAM-72B, the VT-72B is a recovery vehicle based on the T-72 chassis, built by Slovakia. It is very similar to the BREM-1 in many respects; visually, the biggest difference is that the VT-72B's crane is on the right side of the superstructure instead of the left. The VT-72C is a version designed specifically for the Indian Army, and has a more powerful engine and a revised interior arrangement and a BMS. First deliveries began in 1999. The VT-72 series has a secondary role as a mine plow, and a tertiary role of digging large fighting positions. The Czech Republic and Slovakia use the VT-72B in place of the BREM-1; the vehicle is also used by India in a modified form.

The VT-72B

The T-72's turret is removed and replaced with an armored, raised superstructure. The crane, on the front right and folding along the right side, can lift 19 tons and has a reach of 7.6 meters, though beyond 2.24 meters, lifting capacity is reduced to 18 tons. There is a load platform on the rear of the superstructure that can carry a load of 4 tons. The winch is located in the center of the vehicle, has 200 meters of 29-millimeter cable and can pull 40 tons without snatch blocks; the actual drum is in front of the engine. There is also a secondary winch that can pull 2.5 tons and has 400 meters of 6.3-millimeter cable. Its full width dozer blade located at the front of the vehicle can brace the vehicle. The dozer blade is normally kept straight, but can also bend in the middle for use as a mine plow. The dozer is also used to dig defensive positions for itself and other vehicles. There is also a rack at the rear of the vehicle for fuel and POL drums and jerry cans; up to 200 liters of various substances may be carried in this rack, and the VT-72B has three pumps which can be attached to the drums or cans to pump their contents as necessary. Two grease guns are also provided. The VT-72B carries a 5kW generator for use with power tools or the welding equipment and air compressor (both issued with the vehicle). Other equipment also includes tools appropriate for working on tanks, like excavating tools, a hydraulic jack and a tow bar.

The driver is on front left at the top of the superstructure (and raised significantly from the driver's position on the T-72). The commander is to his left and the machinegun is equipped with a cupola with all-around vision blocks and a night channel for the front block. The weapon is in a cradle and has a collimator sight. It can be aimed and fired from within the vehicle. The commander normally controls the plow, the winches, and the crane, though in practice one or more are controlled by a control box outside the vehicle on a 7.6-meter cable. The other three crewmen are inside the center of the hull; all crewmembers are mechanics, and one is often specifically a turret mechanic. The third crewmember normally operates the crane through a large hatch on the center right roof. The VT-72B has an NBC Overpressure system and a GPS with a mapping computer. There is also a small computer that has the manuals with recovery and repair suggestions. The VT-72B also carries two dismount-versions of the PKM, and an RPG-7 with six rounds. There is an NBC Overpressure system for the crew, with a vehicular NBC backup. There are no smoke grenade launchers, but the VT-72B can inject diesel fuel (but not alcohol) into its exhaust to create a smoke screen.

The VT-72C

The VT-72C has a Polish S-12U turbocharged diesel. This engine develops 850 horsepower, and a decent amount of torque. This new engine needed a new transmission, cooling system, radiator and fan, and gear boxes. Tools carried now include a welding and cutting set. The interior is rearranged and revised to create 15% more usable room inside the working compartment; instead of increasing crew comfort, however, the extra room is taken up with spare parts and a BMS and GPS, with the extra radios needed for that system. The new engine is smaller, so there is a space next to the driver for personal gear. There are three thermal insulated (essentially large thermoses), with each containing 80 liters of drinking water. There is also a ration heater and water heater.

The VT-72M4 CZ

The VT-72M4 CZ was originally a Czech project, but they ran into budgetary problems and Slovakia had some money from NATO to upgrade their military vehicles, so they took over the project from the Czechs. The project was begun in the Czech Republic in 1999, though its development was slow, and development stopped in 2004 for about five years. The T-72M4 CZ is in limited use by Slovakia and the Czech Republic, but is being actively shopped internationally, and India is reportedly interested.

The Czechs used used the chassis from a Czech T-72M4 CZ tank as a base, and developed the VT-72M4 CZ. The VT-72M4 CZ reduces the crew to two, with a third seat available if another mechanic is needed for a mission. It is a larger and heavier vehicle, carrying more spare parts, computer gear, a BMS and GLONASS with a mapping computer, and tools. The VT-72M4 CZ has two clusters of five thermal smoke grenade launchers on the left side of the superstructure, able to block IR and thermal imaging as well as image intensification and lasers. It has a primary winch with a capacity of 31 tons, and up to 93 tons with snatch blocks, with 200 meters of useable cable. The secondary winch can pull 1.02 tons with 400 meters of useable cable. The crane has a capacity of 19 tons, and has a reach of five meters with a traverse of 280 degrees. The crane and winch can also be controlled through a remote control, though it is wireless and has a range of about 8 meters. Also available is a dozer blade on the front which can be used to brace the vehicle or dig at the rate of 126 cubic meters per hour.

The VT-72M4 CZ has updated versions of the VT-72B's tool set, but also include an air compressor, a chainsaw, a large hand circular saw, and a welding set. A work table and small shelter can be folded out from the rear. The tool sets are more compact than the earlier ones and fit into a smaller space. Eight fire extinguishers are also carried. The vehicle has the three insulated drinking water containers, ration heater, and water heater of the VT-72C. An updated 5kW APU is carried, more compact and reliable than the one on the VT-72B. The rear of the superstructure is a pad for the carrying of a T-72 powerpack or other large cargo, and can carry up to four tons. The engine of the VT-72M4 CZ is larger than that of the VT-72C, so the space next to the driver is about half as large and used to carry portions of the GPS and BMS. The interior is likewise rearranged and revised, and as the VT-72M4 CZ carries a maximum of three crewmembers, there is a lot more room for tools, spare parts, and even personal equipment, as well as the new equipment required by the BMS and GLONASS, as well as a small computer to help the crew with recovery and repair situations.

The driver and commander have advanced vision equipment, including image intensification to the front and rear, and color CCTV to the front and rear. The commander's equipment also allows him to aim and fire his machinegun when buttoned up. NBC overpressure protection is provided, as well as a heater and air conditioner. The powerpack has been replaced by one with a British-made CV-12 1000-horsepower supercharged diesel engine and US-made Allison XTG-411-6 fully automatic transmission.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
VT-72B	$1,242,245	D, A	8 tons	46.5 tons	5	31	Passive IR (D, C), Image Intensification (C)	Shielded
VT-72C	$1,769,185	D. A	8 tons	46.7 tons	6	31	Passive IR (D, C), Image Intensification (C)	Shielded
VT-72M4 CZ	$1,932,919	D, A	8 tons	51.5 tons	2+1	36	Passive IR (C), Image Intensification (Dx2, Cx2)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
VT-72B	125/87	35/24	1000+400	290	Stnd	T6	HF120Cp HS18Sp HR8
VT-72C	132/93	37/26	1000+400	314	Stnd	T6	HF120Cp HS18Sp HR8
VT-72M4 CZ	139/97	39/27	1000+400	371	Stnd	T6	HF 129Cp HS17Sp HR 12*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
VT-72B/C	+1	Basic	NSV (C)	500x12.7mm
VT-72M4 CZ	+1	Fair	NSV (C)	960x12.7mm

*Belly armor for the VT-72M4 is 7. The bracing blade may contribute to frontal armor; where is contributes depends upon how the blade is raised. The blade, when it contributes, has an AV of 6Sp.

ZTS MT-72 AVLB

Notes: As the Slovakians locally produce the T-72, it was natural for them to choose it as a base for an AVLB. They chose the Czech T-72M4 CZ as a base chassis. The MT-72 is thusfar used only by Slovakia and the Czech Republic, though it is available for export sales.

The bridge designed for the MT-72 spans 20 meters; if necessary, two bridges may be laid on top of each other to span 34 meters. The bridge weighs 4 tons and can support 50 tons. If necessary, the MT-72 can use the bridge of the MT-55A designed by the Czech Republic (which is also used by Slovakia). The MT-55A bridge spans 18 tons and two can be laid together to span 30 meters. Laying the bridge takes 3 minutes, while recovering it takes 5 minutes. The bridge is a scissors-type bridge. It can be laid at an angle of plus or minus 50 degrees and a side slope of 6 degrees to either side. The surface is textured to provide a better gripping surface. The total width is 3.3 meters, but this is split into two trackways of 1.1 meters, with a space in the middle. If necessary (usually for camouflage) the bridge can be laid below the surface of water up to 4.2 meters deep, this can also be used when the surface that needs to be spanned is lower than the MT-72. This, however, takes twice as long.

The MT-72 cannot swim, but with a special adapter, can ford up to 4.2 meters. Smoke grenade launchers are not normally mounted, but the MT-72 can inject diesel fuel into its exhaust to create a thick, oily smoke screen. The T-72M4 CZ is also about a third of a meter longer than the T-72; the powerpack remains the V-64-4Turbochaged diesel developing 840 horsepower and an automatic transmission. This enables it to keep up with assaulting troops.

The commander and driver are in the center of the vehicle, with the driver ahead of the commander/bridgelayer. They have a more comprehensive night vision suite than most engineer vehicles, inherited partially from the T-72M4 CZ. The commander is not, however, armed with a vehicular weapon, though he typically has his assault rifle or submachinegun outside of the vehicle and a couple of fragmentation grenades handy for local defense. The commander also typically carries night vision goggles to allow him to supervise deployment of the bridge at night using a remote control connected to the vehicle with an 8-meter cable from outside of the vehicle. The MT-72 has an NBC Overpressure system, an automatic fire detection/suppression system, and a BMS with GLONASS and a mapping computer, along with extra radios.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,123,924	D, A	400 kg	41.5 tons	2	38	Passive IR (D), Image Intensification (C), WL/IR Searchlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
143/100	40/28	1000+400	210	CiH	T6	TF6 TS6 TR6 HF129Cp HS17Sp HR 12

*The configuration of CiH is when the bridge is on top of the vehicle, and if hit, no crew hits are possible (they are ignored).
**Floor AV is 8Sp.

Denel Olifant ARV

Notes: This is an Armored Recovery Vehicle variant of the Olifant 1 main battle tank. These were conversions of existing Olifant tanks and were done only for the SANDF, with no exports being sought or done. 16 Oliifant ARVs were built in the late 1990s and early 2000s. They are primarily meant to service Olifaunt tanks, but are also used to recover other vehicles.

In this role, the turret is removed and replaced with a raised superstructure. A crane with a capacity of 10 tons is mounted on the left side of the raised superstructure; it has a traverse of 270 degrees. An extendible boom crane reaches over the entire vehicle, with a capacity of 30 tons. The front has a dozer blade for bracing, and can also be used for obstacle-clearing. The internally-mounted main winch can be led out the front or the rear and has a capacity of 60 tons (115 tons with block and tackle) and 80 meters of cable. The Olifant ARV is equipped with tools for tank repair including basic tools, tracked vehicle tools, small arms tools, heavy ordinance tools, and an arc welder. There are also three hand-held WL spotlights. There also scads of spare parts both inside and attached to the outside of the vehicle, or in exterior lockers. Larger tools are also carried inside these lockers. There are two cupolas on the roof with machineguns and there are four sets of four-barreled smoke grenade launchers, one on each corner of the superstructure. There is a flat area on the rear of the superstructure, which is able to carry up to a complete Olifaunt powerpack.

During the conversion, Olifaunt 1A fuel tanks were put into the vehicle. The engine is a Teledyne AVDS-1790-2A 12-cylinder 750-horsepower diesel integrated powerpack with a semiautomatic transmission. All electrical systems were also upgraded, and the ARV received a small computer to assist the mechanics with information about the SANDF's vehicles.

The driver's seat is raised further up, as the roofline of the superstructure is also raised. The commander has a cupola with all-around vision and a night vision channel; this position is unarmed. One of the mechanics acts as gunner with a weapon on a pintle mount; this is usually a double weapon. He has a cupola. The same as the commander’s, and also has a pintle-mounted weapon. One mechanic rides in the center of the hull; he usually mans the radios when traveling. The Olifaunt ARV has a 90-liter insulated drinking water tank. The night vision suite is somewhat improved.

At least one ARV based on the Olifant 1A was built for trials. It uses the armor suite of the Olifant 1A, and the roof and floor armor of the Olifaunt 1B. It adds a long-range radio, which is data-capable. As of 2016, no more have been built, though it remains in trials, awaiting the money to replace or upgrade earlier versions of the Olifant ARV. For other game puposes, the Olifant 1A ARV is the same as the Olifant 1 ARV.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Olifant 1 ARV	$660,862	D, A	5.42 tons	57.5 tons	4	27	Passive IR (D), Image Intensification (G, C)***	Shielded
Olifant 1A ARV	$666,457	D, A	5.42 tons	57.5 tons	4	29	Passive IR (D), Image Intensification (G, C)***	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Olifant 1 ARV	115/81	32/22	1240	254	Stnd	T6	HF60 HS13 HR8**
Olifant 1A ARV	115/81	32/22	1240	254	Stnd	T6	HF64Sp HS14 HR10**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Olifant 1/1A ARV	None	None	2xSS-77 or 2xM-2HB or SS-77 and M-2HB	5000x7.62mm or 1500x.50 or 2500x7.62mm and 750x.50

*Depending how high the dozer blade is raised, the blade may act as armor for the part of front end. The blade has an AV of 5Sp.
**The floor armor for the Olifant floor is 8Sp.
***The commander and gunner have hand-held Image Intensifiers; they are not mounted in the vehicle, though they may be mounted on the cupola or the gun shield of the gunner’s position.

Hyundai K-1 ARV

Notes: This South Korean armored recovery vehicle is based on the chassis of the K-1 main battle tank. However, it uses a large number of components of German origin, particularly from the Buffel, and leaving to a marked resemblance to the Buffel. The Malaysians also use the K-1 ARV, which they designate the K-1M.

The K-1 ARV is a powerful vehicle capable of towing a tank the size of the M-1A1, or the K-1 (the vehicle it is meant to recover). The K-1 ARV's winch can pull 35 tons, or tow 70 tons when the guide pulley is installed, and has 150 meters of cable. It is of the dual capstan type. The vehicle also has an auxiliary winch with a capacity of 20 tons and 260 meters of cable. The K-1 has no turret, but has a superstructure in its place. The crane is on the right of this superstructure, has a capacity of 25 tons, has a traverse of 270 degrees, and can be raised to 70 degrees angle. The K-1 ARV has a dozer blade on the front of the vehicle for earth clearing or bracing, and can move 170 cubic meters per hour. The K-1 ARV has a 60kW auxiliary power unit that can power all machinery except the tracks. The crane and winches cannot be overloaded as the devices will automatically power off in an overload situation. The crane, however, is sufficient for lifting almost all turrets and can also lift one end of t vehicle for repairs underneath. There is a platform on the rear deck that can carry an M-1 or K-1 power pack (about 5 tons). On the hull front are eight smoke grenade launchers. It normally carries a tow bar and a full range of tools, ropes, cables, and excavating tools.

The K-1 ARV has a crew heater, air conditioner, and NBC Overpressure system; the vehicle has three doors in each side of the hull to allow access to crewmembers and storage for equipment. The driver is at the top of the glacis on the left, while the commander is in the front center, with his weapon on a pintle mount. A small computer helps the crew by storing documents, plans, and especially, with tech information on all of the country's military vehicles.

The engine is the K-1's MTU MB 871 Ka-501 diesel, developing 1200 horsepower. The transmission is not only automatic, it is adjustable hydropneumatically. The vehicle is divided into five sections for the automatic fire detection and suppression systems' purposes. The K-1 ARV is not amphibious, though with short preparation, a depth of 2.3 meters can be forded.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$148,534	D, A	5 tons	51.1 tons	33	19	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
159/111	44/31	1815	395	Stnd	T6	HF75 HS12Sp HR12

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

Hyndai K-1-M AVLB

Notes: This is a South Korean armored vehicle-launched bridge based on the chassis of the K-1 main battle tank. The bridge is a British design, but the vehicles and bridges are built in South Korea.

In this role, the K-1's turret is removed and replaced with the bridge and launching equipment. The bridge weighs 12.9 tons, can support 66 tons, and is 20.5 meters long. Deploying takes 3 minutes, and recovery 10 minutes. There is a small cupola below the folder bridge that has a small hatch, all-around vision blocks, and a pintle mount for it's machinegun. This gun may remain mounted while the bridges are carried, though field of fire is severely restricted while the bridges are on top of the vehicle. On each front fender is a cluster of six smoke grenade launchers,

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$615,427	D, A	400 kg	54.7 tons	2	23	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
162/113	45/31	1815	433	CiH	T6	TF4 TS4 TR4 HF75 HS12Sp HR12*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-60 (D)	1650x7.62mm

Daewoo K-288A1

Notes: This South Korean armored recovery vehicle is based on the Korean Infantry Fighting Vehicle. The turret is removed, and in its place is a crane with a lifting capacity of 6 tons, and a platform for a KIFV power pack. The firing ports of the KIFV are deleted. The recovery winch is located internally, has a capacity of 10 tons, (20 tons with block and tackle) and has 150 meters of cable. The K-288A1 carries tools appropriate to its task of recovering and repairing KIFVs, such as tow cables and a bar, and basic, electronic, tracked vehicle, small arms, and heavy ordinance tools. It has a small computer with a library of tech manuals and such documents. At the front of the superstructure on the left side is a small floodlight for working at night. The driver's position remains on the front left deck, and the commander remains the same spot as on the K-200A1. The rear door and ramp remain on the vehicle. There are no other hatches on the roof, and the remaining two crewmembers usually leave and enter through the rear door or ramp.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$94,873	D, A	1.7 tons	14.5 tons	4	9	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
124/87	34/24/3	400	78	Stnd	T3	HF8Sp HS5Sp HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	600x.50

Peugeot Talbot CZ-10/25E Alacran

Notes: This CEV was converted from older M-60 stocks in Spain with the help of General Dynamics. The first prototype was built in 1995, with first issue being in 1997 and deliveries being complete in 1999. The Spanish had 50 M-60A1s when the modification process began; 38 were modified into Alacrans and the rest were modified into AVLBs (as per the standard M-60 AVLB. They were built only for the Spanish Army, and Peugeot Talbot can resume conversions if necessary, either for Spain or other countries who wish to convert their M-60 tank-series vehicles.

For this conversion, the turret is retained, but the gun is replaced by a Pace Poclain crane arm with a bucket capable of digging 420 liters at one scrape and capable of lifting 7 tons, and can dig to 2.65 meters in earth per swipe. As the arm is on a modified M-60 turret, it can be rotated 360 degrees. The shovel may be replaced by a NPC hydraulic hammer or a VTC-30 cutting tool, used to cut into thick roadway, concrete, rocks, water mains, etc. The extra tools are carried in cradles on the rear left side; the crew can change tools using the arm at its inner extension. The crane operator puts one tool into its cradle, unlocks it, then locks another tool onto the crane. The arm has a maximum reach of 7.2 meters

The vehicle has a dozer blade able to be set at very low angles and can rip the top 0.3 meters of asphalt off the top of a roadway, for example. The blade is 4 meters wide. The blade may be replaced by a mineclearing plow and an automatic flag dispenser at the rear and sides; the rear dispensers have a magazine of 160. The side flag dispensers have a magazine of 40 each. These flags are used to mark lanes clear of mines, and they are not normally put on unless the mineclearing plow is mounted. Optionally, the Alacran may be equipped with a mine roller or flail instead of a dozer/plow blade.

At the rear is a 25-ton winch, which can doubled by use of black and tackle, and is normally used to create or to clear obstacles, though it can tow vehicles by locking the cable reel. The Alacran has a number of mines that it can set; this must be done manually. Likewise, it carries explosives and the equivalent of an engineer demo kit.

The crew retains there M-60 positions, with the "gunner" controlling the crane, the commander in the same cupola as in the M-60 tank, and the driver in the center front hull. There are banks of four smoke grenade launchers on each side of the turret. The vehicle has a heater, air conditioner with NBC filters, and a vehicular collective NBC system. The Alacrans are equipped with two long-range data-capable radios and a GPS mapping system. Most crew equipment is carried on the outside, as the turret bustle of the M-60 is retained.

The engine is a Continental AVDS-1790-2 750-horsepower turbocharged diesel, with an automatic transmission. The engine is a Continental AVDS-1790-2 750-horsepower turbocharged diesel, with an automatic transmission.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,562,445	D, A	1.8 tons	53 tons	3	27	Passive IR (D, C), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
110/77	30/21	1420	278	Stnd	T6	HF56 HS15 HR8*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	600x.50, 40xAPERS Mines, 40xAT Mines, Engineer Demo Chest, 40 kg C4.

*The dozer blade, if mounted, protects the front to an extent. The standard blade has an AV of 7Sp, and protects the lower front or glacis, depending on how high it is raised. The mine roller has an AV of 20. The mine flail has an AV of 6Sp.

GAMESA M-47 VR

Notes: In 1994, the Spanish Army decided to rework a number of their aging or obsolete vehicles; one of these was the M-47E1 main battle tank. The tank was rebuilt into the M-47 VR, an armored recovery vehicle. In this task, they had the help of the German company of Krauss-Maffei Wegmann. Some 22 of these conversions were made, with deliveries being completed in 1996. Though intended solely for the recovery of M-48s and M-60s, it has been discovered that they are capable of recovering Spain's new Leopard 2s. This has given the Spanish Army extra time to decide what will replace them. It has not been offered on the export market, and the M-47 VR is used only by the Spanish Army.

Unlike most such vehicles, the M-47 VR does not have a large raised superstructure; the turret is still removed, but the opening is covered by a welded-in plate covering steel bars, and a small, low superstructure is mounted on the front third of the vehicle (offset to the right, as the crane is on the left), primarily used for the driver and commander. It also has some storage space. The former turret basket is also removed and made a part of the crew and storage compartment.

The front of the vehicle has a dozer blade 3.7 meters wide and 0.9 meters high; this is normally for bracing while using the crane or winches, but has a secondary role of clearing obstacles and digging fighting positions. The blade also has ripping teeth on its bottom; these are normally driven into the ground to provide more stable bracing, but can also rip up road surfaces. The main winch is inside the hull and can pull 35 tons, or 70 tons with block and tackle, and with 120 meters of cable. It can be led out through the front and rear of the M-47 VR. In the front of the vehicle is an auxiliary winch with a capacity of 4 tons, or 8 with block and tackle. On the front right side of the M-47 VR is its crane, which can be rotated through 360 degrees, even over the vehicle. It has a capacity of 22 tons. In the case of the winch and crane, there are automatic overload prevention devices that stop the devices if they hit their load limits.

The crane can lift a full load up to 9.75 meters. The M-47 VR carries a full set of tools for vehicular work, including power tools, basic tools, a welder, a hand circular saw, and a “jaws of life,” and places to plug them in are on the right rear side of the vehicle. The tools can be powered by the engine, or by an APU with 5kW power. In case of breakdown of the engine and APU, there is a small power unit with just enough power to return the dozer blade, winches, and crane to the travel position in preparation of its towing by another ARV. A complete M-48, M-60, or Leopard 2 powerpack can be carried on the flat rear deck.

The M-47 VR has received a power pack upgrade, with the engine, transmission, transfer case, brakes, steering systems, and driver controls being replaced with those from an M-48 tank. The transmission is still manual. The engine is a GDLS AVDS-1790-2D turbocharged diesel developing 760 horsepower.

The driver's position is at the front of the left superstructure. The commander is in the center front with a pintle-mounted weapon. The other two crewmembers ride inside the vehicle, though sometimes, a light machinegun is mounted on a pintle near one of the roof hatches to keep guard in the rear. The crew has an NBC overpressure system, and the main compartments of the M-47 VR have fire detection and suppression systems. A small computer with technical information for Spanish Army vehicles is also installed. On each side of the superstructure is a cluster of four smoke grenade launchers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,204,994	D, A	6.05 tons	48.5 tons	4	25	Passive IR (D), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
118/83	33/23	1514	282	Stnd	T6	HF50 HS14 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C), MG-3 (R)	1000x.50, 3000x7.62mm

Peugeot Talbot CZ-10/25E Alacran

Notes: This CEV was converted from older M-60 stocks in Spain with the help of General Dynamics. The first prototype was built in 1995, with first issue being in 1997 and deliveries being complete in 1999. The Spanish had 50 M-60A1s when the modification process began; 38 were modified into Alacrans and the rest were modified into AVLBs (as per the standard M-60 AVLB. They were built only for the Spanish Army, and Peugeot Talbot can resume conversions if necessary, either for Spain or other countries who wish to convert their M-60 tank-series vehicles.

For this conversion, the turret is retained, but the gun is replaced by a Pace Poclain crane arm with a bucket capable of digging 420 liters at one scrape and capable of lifting 7 tons, and can dig to 2.65 meters in earth per swipe. As the arm is on a modified M-60 turret, it can be rotated 360 degrees. The shovel may be replaced by a NPC hydraulic hammer or a VTC-30 cutting tool, used to cut into thick roadway, concrete, rocks, water mains, etc. The extra tools are carried in cradles on the rear left side; the crew can change tools using the arm at its inner extension. The crane operator puts one tool into its cradle, unlocks it, then locks another tool onto the crane. The arm has a maximum reach of 7.2 meters

The vehicle has a dozer blade able to be set at very low angles and can rip the top 0.3 meters of asphalt off the top of a roadway, for example. The blade is 4 meters wide. The blade may be replaced by a mineclearing plow and an automatic flag dispenser at the rear and sides; the rear dispensers have a magazine of 160. The side flag dispensers have a magazine of 40 each. These flags are used to mark lanes clear of mines, and they are not normally put on unless the mineclearing plow is mounted. Optionally, the Alacran may be equipped with a mine roller or flail instead of a dozer/plow blade.

At the rear is a 25-ton winch, which can doubled by use of black and tackle, and is normally used to create or to clear obstacles, though it can tow vehicles by locking the cable reel. The Alacran has a number of mines that it can set; this must be done manually. Likewise, it carries explosives and the equivalent of an engineer demo kit.

The crew retains there M-60 positions, with the "gunner" controlling the crane, the commander in the same cupola as in the M-60 tank, and the driver in the center front hull. There are banks of four smoke grenade launchers on each side of the turret. The vehicle has a heater, air conditioner with NBC filters, and a vehicular collective NBC system. The Alacrans are equipped with two long-range data-capable radios and a GPS mapping system. Most crew equipment is carried on the outside, as the turret bustle of the M-60 is retained.

The engine is a Continental AVDS-1790-2 750-horsepower turbocharged diesel, with an automatic transmission. The engine is a Continental AVDS-1790-2 750-horsepower turbocharged diesel, with an automatic transmission.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,562,445	D, A	1.8 tons	53 tons	3	27	Passive IR (D, C), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
110/77	30/21	1420	278	Stnd	T6	HF56 HS15 HR8*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	600x.50, 40xAPERS Mines,

40xAT Mines, Engineer Demo Chest, 40 kg C4.

*The dozer blade, if mounted, protects the front to an extent. The standard blade has an AV of 7Sp, and protects the lower front or glacis, depending on how high it is raised. The mine roller has an AV of 20. The mine flail has an AV of 6Sp.

GAMESA M-47 VR

Notes: In 1994, the Spanish Army decided to rework a number of their aging or obsolete vehicles; one of these was the M-47E1 main battle tank. The tank was rebuilt into the M-47 VR, an armored recovery vehicle. In this task, they had the help of the German company of Krauss-Maffei Wegmann. Some 22 of these conversions were made, with deliveries being completed in 1996. Though intended solely for the recovery of M-48s and M-60s, it has been discovered that they are capable of recovering Spain's new Leopard 2s. This has given the Spanish Army extra time to decide what will replace them. It has not been offered on the export market, and the M-47 VR is used only by the Spanish Army.

Unlike most such vehicles, the M-47 VR does not have a large raised superstructure; the turret is still removed, but the opening is covered by a welded-in plate covering steel bars, and a small, low superstructure is mounted on the front third of the vehicle (offset to the right, as the crane is on the left), primarily used for the driver and commander. It also has some storage space. The former turret basket is also removed and made a part of the crew and storage compartment.

The front of the vehicle has a dozer blade 3.7 meters wide and 0.9 meters high; this is normally for bracing while using the crane or winches, but has a secondary role of clearing obstacles and digging fighting positions. The blade also has ripping teeth on its bottom; these are normally driven into the ground to provide more stable bracing, but can also rip up road surfaces. The main winch is inside the hull and can pull 35 tons, or 70 tons with block and tackle, and with 120 meters of cable. It can be led out through the front and rear of the M-47 VR. In the front of the vehicle is an auxiliary winch with a capacity of 4 tons, or 8 with block and tackle. On the front right side of the M-47 VR is its crane, which can be rotated through 360 degrees, even over the vehicle. It has a capacity of 22 tons. In the case of the winch and crane, there are automatic overload prevention devices that stop the devices if they hit their load limits. The crane can lift a full load up to 9.75 meters. The M-47 VR carries a full set of tools for vehicular work, including power tools, basic tools, a welder, a hand circular saw, and a “jaws of life,” and places to plug them in are on the right rear side of the vehicle. The tools can be powered by the engine, or by an APU with 5kW power. In case of breakdown of the engine and APU, there is a small power unit with just enough power to return the dozer blade, winches, and crane to the travel position in preparation of its towing by another ARV. A complete M-48, M-60, or Leopard 2 powerpack can be carried on the flat rear deck.

The M-47 VR has received a power pack upgrade, with the engine, transmission, transfer case, brakes, steering systems, and driver controls being replaced with those from an M-48 tank. The transmission is still manual. The engine is a GDLS AVDS-1790-2D turbocharged diesel developing 760 horsepower.

The driver's position is at the front of the left superstructure. The commander is in the center front with a pintle-mounted weapon. The other two crewmembers ride inside the vehicle, though sometimes, a light machinegun is mounted on a pintle near one of the roof hatches to keep guard in the rear. The crew has an NBC overpressure system, and the main compartments of the M-47 VR have fire detection and suppression systems. A small computer with technical information for Spanish Army vehicles is also installed. On each side of the superstructure is a cluster of four smoke grenade launchers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,204,994	D, A	6.05 tons	48.5 tons	4	25	Passive IR (D), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
118/83	33/23	1514	282	Stnd	T6	HF50 HS14 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C), MG-3 (R)	1000x.50, 3000x7.62mm

Hagglunds Bgbv-82

Notes: This is a Swedish armored recovery vehicle that bears a passing resemblance to an M-113, but is in fact a different vehicle; the chassis is in fact related to that of the Brobv-941. It was designed in 1973 to recover the S-Tank and similar-sized armored vehicles. (Hagglunds was bought by Alvis of the UK in 1997, though repairs and parts and overhauls are still done in the Hagglunds facilities in Sweden.) The Bgbv-82 will be one of the vehicles replaced by the Buffel (designated Bgv-120 by the Swedish); the Swedes started receiving the Buffels in 2003, but the Bgbv-82's have not been phased out yet.

The Bgbv-82 can also double as an engineer vehicle to clear obstacles and to prepare river-crossing points. The Bgbv-82 shares many automotive components with the Ikv-91 tank destroyer. It has a weakness, however: the fuel tanks are under the crew compartment floor. The track tension can be adjusted hydraulically by the driver. The engine is a Volvo-Penta THD 100C turbocharged diesel developing 310 horsepower, coupled to a manual Volvo-Penta R61 transmission.

When two ground spades are lowered at the rear of the vehicle, the HM-20 winch may pull with 60 tons of force and 145 meters of cable. (Block and tackle is not normally carried.) It the stabilizing legs are not deployed, the winch may pull only 20 tons. The Bgbv-82s HIAB-Foco 9000 crane may lift 5 tons if extended 1.8 meters, 3.5 tons if extended 2.5 meters, and 1.5 tons if extended 5.5 meters. This is enough for most of the components of the vehicles it is designed to service. The Bgbv-82 also has a dozer blade in the front of the vehicle for bracing, digging, and area preparation; it is 3.25 meters wide and is designed primarily for bracing, though it can also be used to prepare fording and fighting positions. The Bgbv-82 is equipped with a large selection of tools, such as wheeled vehicle, tracked vehicle, basic, and excavation tools. The powerpack of the Bgbv-82 (or Brobv-941) consists of a unit including the engine, transmission, torque converter, clutch, steering clutch, gearbox, and steering gearbox. Amphibious operation requires only the erection of a trim vane, switching on a bilge pump, and erecting a low floatation screen.

The driver has a hatch in the center front of the deck, the commander is to the right of the driver with his own hatch, and the turret is to the left and rear of the driver. The winch operator is to the rear of the driver inside the hull, and has an overhead hatch on the deck. The Bgbv-82 mounts a cupola with a 20mm autocannon (identical to that on the Pbv-302). The gunner has an 8x scope for ground targets and a x17 scope for aerial targets, along with a special reticle; he must, however, expose his head and chest above the cupola to engage aerial targets with the special reticle and sight. On each side of the turret are eight smoke grenade launchers.

Oddly enough, the Bgbv-82 does not have a vehicular NBC scrubber, though plans for installing one were made during the design phase and the hookups for one are still found on the hull.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$399,230	D, A	6.5 tons	19.8 tons	4	17	Passive IR (D), Telescopic Sight (G)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
130/91	36/25/4	550	109	CiH	T3	HF3Sp HS2Sp HR2*

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	20mm Rh-202 (G)	505x20mm

*Floor and Roof AV are 2Sp.

Hagglunds Brobv-941

Notes: This is a Swedish short-span AVLB mounted on the same chassis as the Bgbv-82 recovery vehicle. In this role, the vehicle is topped with the equipment to launch a single span bridge that is 15 meters long and has a capacity of 50 tons. The bridge is made of strong light alloy. Before the bridge is deployed, a forward dozer blade is lowered to brace the vehicle; this can also be used for general earthmoving and to prepare bridging sites. The bridge weighs 7 tons. The bridge takes 5 minutes to lay or recover, and the crew may remain under armor protection during these operations. When the bridge is to be laid or recovered, a telescopic boom is laid over the obstacle and the bridge then slid out over the beam, and the beam withdrawn. The Brobv-941 is amphibious; when it swims, the bridge is towed floating behind the vehicle. The chassis of this AVLB is the same as that used by the Bgbv-82, but the Brobv-941 has no autocannon turret. The fuel tank is moved to the rear under the engine.

The gunner has a pintle-mounted weapon, and the commander has a standard machinegun, not on a pintle mount. After the bridge is laid, the commander may move to an alternate position on the bridgelaying beam. The driver is on the front right, and the gunner behind him. The commander is where the turret usually is, on the front right. Two other crewmembers are inside the vehicle; one is the bridge layer, and the other a spotter. The spotter gives instructions to the bridge layer via a commo wire link and a headset. They have two hatches on the roof of the vehicle. The hatches can be used while the bridge is mounted.

Like the Bgbv-82, the Brobv-941 has provisions for an NBC pack, though none was ever fitted to the vehicle. The powerpack of the Bgbv-82 (or Brobv-941) consists of a unit including the engine, transmission, torque converter, clutch, steering clutch, gearbox, and steering gearbox. Amphibious operation requires only the erection of a trim vane, switching on a bilge pump, and erecting a low floatation screen. The engine is a Volvo-Penta THD 100C turbocharged diesel developing 310 horsepower, coupled to a manual Volvo-Penta R61 transmission.

The Brobv-941 was requested in 1968, and all 17 vehicles in Swedish Army service were built in 1972.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$621,003	D, A	400 kg	28.4 tons	4	21	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config**	Susp	Armor
102/72	28/20/3	550	113	CiH	T3	TF4 TS4 TR4 HF3Sp HS2Sp HR2*

Fire Control	Stabilization	Armament	Ammunition
None	None	MAG, MAG (C)	1500x7.62mm

Hagglunds Bgbv-90 ARV

Notes: It is an armored recovery variant of the CV-90 IFV. In addition to Sweden, the Bgbv-90 is used by Norway and Finland.

In this role, the turret is deleted, and a crane and winches are mounted in the vehicle. The Bgbv-90 is equipped with a crane able to lift 6 tons, and each of two Rotzler ITAG winches is able to pull 61 tons to the front, 33 tons to the rear, and 8.4 tons to the side. The winches are operated via two capstans inside the vehicle at the rear of the crew compartment. For maximum pulling efforts, the vehicle must be braced with the dozer blade. The Bgbv-90 may optionally be equipped with a heavier crane able to lift the entire powerpack of a CV-90-series vehicle or the turret and basket. This crane can lift 13 tons. Two banks of six smoke grenade launchers are provided.

The Bgbv-90 has the sort of tool set one would expect to be on such a vehicle, from basic tools to power tools to an arc welder and air compressor. It also carries a selection of spare parts -- the exact mix and nature depends upon the vehicles it is supporting. A ruggedized laptop is carried that has most of the tech manuals written by the Swedish Army.

The driver is in the front right, and a commander's cupola is in the center to the rear of the driver. The rear ramp is retained along with the door set in it, and the roof has a second hatchway in it. The commander has a raised cupola, but the vehicle's machinegun is a simple infantry model, not on a pintle mount or part of the cupola. (The Bgbv-90 does have an obscene amount of ammunition as a part of its basic load, though.) The commander does have a night/distance vision viewer, but it is a part of the cupola and cannot be used to make the machinegun more accurate. Other crewmembers sit in the hull; there are several vision blocks around the crew compartment, but no firing ports. The vehicle has air conditioning, heating, and an NBC overpressure suite. It has an automatic fire detection and suppression suite for the vehicle. Normally only a crew of four is carried, but often a fifth crewmember is carried when a specialist crewmember is needed. The vehicle has a BMS and GPS system. The Bgbv-90 also has a small computer loaded with tech manuals for most of the vehicles in the Swedish Military.

The Bgbv-90 has a Scania DS-14 turbocharged diesel engine developing 550 horsepower. This is coupled to a Perkins X-300-5N automatic transmission with a torque converter to use engine power to increase the pulling power of the winches.

The Swedish Army is upgrading some of the Bgbv-90s to the Caesar ("C") standard; the resulting vehicle is designated the Bgbv-90C ARV. The main difference is the large increase in armor protection, including lugs for ERA and attachment points for slat/cage armor; other differences include a tropical-grade air conditioner, an improved suspension, new seatbelts, and laser filtering for the vision blocks. The driver has a rear CCTV camera for backing up unassisted. The weight of the increased armor suite drastically affects for cargo-carrying capacity, but not as much as you might think – the engine has been replaced with a more powerful one, a Scania DSI-16 turbocharged diesel developing 810 horsepower. The heavy-duty crane is standard. Three of these upgrades have been done so far; one was sent to Afghanistan along with Sweden's contribution to ISAF.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Bgbv-90	$1,664,338	D, A	4.5 tons	23.6 tons	5	31	Passive IR (D), Image Intensification (C), WL Spotlight	Shielded
Bgbv-90 with Heavy Crane	$1,690,508	D, A	4.5 tons	24.1 tons	5	31	Passive IR (D), Image Intensification (C), WL Spotlight	Shielded
Bgbv-90C	$1,750,499	D, A	3.73 tons	26.7 tons	5	33	Passive IR (D), CCTV Backup Camera (D), Image Intensification (C), WL Spotlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Bgbv-90	161/113	45/31	610	199	Stnd	T4	HF18 HS7 HR4
Bgbv-90 with Heavy Crane	158/111	44/31	610	204	Stnd	T4	HF18 HS7 HR4
Bgbv-90C	201/140	56/23	610	301	Stnd	T4	HF23Sp HS11Sp HR5*

Vehicle	Fire Control	Stabilization	Armament	Ammunition

Bgbv-90 (All)	None	None	Ksp m/58	4000x7.62mm

**The Bgbv-90C has a deck AV of 3, and a hull floor AV of 5Sp.

Hagglunds Bgbv-82

Notes: This is a Swedish armored recovery vehicle that bears a passing resemblance to an M-113, but is in fact a different vehicle; the chassis is in fact related to that of the Brobv-941. It was designed in 1973 to recover the S-Tank and similar-sized armored vehicles. (Hagglunds was bought by Alvis of the UK in 1997, though repairs and parts and overhauls are still done in the Hagglunds facilities in Sweden.) The Bgbv-82 will be one of the vehicles replaced by the Buffel (designated Bgv-120 by the Swedish); the Swedes started receiving the Buffels in 2003, but the Bgbv-82's have not been phased out yet.

The Bgbv-82 can also double as an engineer vehicle to clear obstacles and to prepare river-crossing points. The Bgbv-82 shares many automotive components with the Ikv-91 tank destroyer. It has a weakness, however: the fuel tanks are under the crew compartment floor. The track tension can be adjusted hydraulically by the driver. The engine is a Volvo-Penta THD 100C turbocharged diesel developing 310 horsepower, coupled to a manual Volvo-Penta R61 transmission.

When two ground spades are lowered at the rear of the vehicle, the HM-20 winch may pull with 60 tons of force and 145 meters of cable. (Block and tackle is not normally carried.) It the stabilizing legs are not deployed, the winch may pull only 20 tons. The Bgbv-82s HIAB-Foco 9000 crane may lift 5 tons if extended 1.8 meters, 3.5 tons if extended 2.5 meters, and 1.5 tons if extended 5.5 meters. This is enough for most of the components of the vehicles it is designed to service. The Bgbv-82 also has a dozer blade in the front of the vehicle for bracing, digging, and area preparation; it is 3.25 meters wide and is designed primarily for bracing, though it can also be used to prepare fording and fighting positions. The Bgbv-82 is equipped with a large selection of tools, such as wheeled vehicle, tracked vehicle, basic, and excavation tools. The powerpack of the Bgbv-82 (or Brobv-941) consists of a unit including the engine, transmission, torque converter, clutch, steering clutch, gearbox, and steering gearbox. Amphibious operation requires only the erection of a trim vane, switching on a bilge pump, and erecting a low floatation screen.

The driver has a hatch in the center front of the deck, the commander is to the right of the driver with his own hatch, and the turret is to the left and rear of the driver. The winch operator is to the rear of the driver inside the hull, and has an overhead hatch on the deck. The Bgbv-82 mounts a cupola with a 20mm autocannon (identical to that on the Pbv-302). The gunner has an 8x scope for ground targets and a x17 scope for aerial targets, along with a special reticle; he must, however, expose his head and chest above the cupola to engage aerial targets with the special reticle and sight. On each side of the turret are eight smoke grenade launchers.

Oddly enough, the Bgbv-82 does not have a vehicular NBC scrubber, though plans for installing one were made during the design phase and the hookups for one are still found on the hull.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$399,230	D, A	6.5 tons	19.8 tons	4	17	Passive IR (D), Telescopic Sight (G)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
130/91	36/25/4	550	109	CiH	T3	HF3Sp HS2Sp HR2*

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	20mm Rh-202 (G)	505x20mm

*Floor and Roof AV are 2Sp.

Hagglunds Brobv-941

Notes: This is a Swedish short-span AVLB mounted on the same chassis as the Bgbv-82 recovery vehicle. In this role, the vehicle is topped with the equipment to launch a single span bridge that is 15 meters long and has a capacity of 50 tons. The bridge is made of strong light alloy. Before the bridge is deployed, a forward dozer blade is lowered to brace the vehicle; this can also be used for general earthmoving and to prepare bridging sites. The bridge weighs 7 tons. The bridge takes 5 minutes to lay or recover, and the crew may remain under armor protection during these operations. When the bridge is to be laid or recovered, a telescopic boom is laid over the obstacle and the bridge then slid out over the beam, and the beam withdrawn. The Brobv-941 is amphibious; when it swims, the bridge is towed floating behind the vehicle. The chassis of this AVLB is the same as that used by the Bgbv-82, but the Brobv-941 has no autocannon turret. The fuel tank is moved to the rear under the engine.

The gunner has a pintle-mounted weapon, and the commander has a standard machinegun, not on a pintle mount. After the bridge is laid, the commander may move to an alternate position on the bridgelaying beam. The driver is on the front right, and the gunner behind him. The commander is where the turret usually is, on the front right. Two other crewmembers are inside the vehicle; one is the bridge layer, and the other a spotter. The spotter gives instructions to the bridge layer via a commo wire link and a headset. They have two hatches on the roof of the vehicle. The hatches can be used while the bridge is mounted.

Like the Bgbv-82, the Brobv-941 has provisions for an NBC pack, though none was ever fitted to the vehicle. The powerpack of the Bgbv-82 (or Brobv-941) consists of a unit including the engine, transmission, torque converter, clutch, steering clutch, gearbox, and

steering gearbox. Amphibious operation requires only the erection of a trim vane, switching on a bilge pump, and erecting a low floatation screen. The engine is a Volvo-Penta THD 100C turbocharged diesel developing 310 horsepower, coupled to a manual Volvo-Penta R61 transmission.

The Brobv-941 was requested in 1968, and all 17 vehicles in Swedish Army service were built in 1972.

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$621,003	D, A	400 kg	28.4 tons	4	21	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config**	Susp	Armor
102/72	28/20/3	550	113	CiH	T3	TF4 TS4 TR4 HF3Sp HS2Sp HR2*

Fire Control	Stabilization	Armament	Ammunition
None	None	MAG, MAG (C)	1500x7.62mm

Hagglunds Bgbv-90 ARV

Notes: It is an armored recovery variant of the CV-90 IFV. In addition to Sweden, the Bgbv-90 is used by Norway and Finland.

In this role, the turret is deleted, and a crane and winches are mounted in the vehicle. The Bgbv-90 is equipped with a crane able to lift 6 tons, and each of two Rotzler ITAG winches is able to pull 61 tons to the front, 33 tons to the rear, and 8.4 tons to the side. The winches are operated via two capstans inside the vehicle at the rear of the crew compartment. For maximum pulling efforts, the vehicle must be braced with the dozer blade. The Bgbv-90 may optionally be equipped with a heavier crane able to lift the entire powerpack of a CV-90-series vehicle or the turret and basket. This crane can lift 13 tons. Two banks of six smoke grenade launchers are provided.

The Bgbv-90 has the sort of tool set one would expect to be on such a vehicle, from basic tools to power tools to an arc welder and air compressor. It also carries a selection of spare parts -- the exact mix and nature depends upon the vehicles it is supporting. A ruggedized laptop is carried that has most of the tech manuals written by the Swedish Army.

The driver is in the front right, and a commander's cupola is in the center to the rear of the driver. The rear ramp is retained along with the door set in it, and the roof has a second hatchway in it. The commander has a raised cupola, but the vehicle's machinegun is a simple infantry model, not on a pintle mount or part of the cupola. (The Bgbv-90 does have an obscene amount of ammunition as a part of its basic load, though.) The commander does have a night/distance vision viewer, but it is a part of the cupola and cannot be used to make the machinegun more accurate. Other crewmembers sit in the hull; there are several vision blocks around the crew compartment, but no firing ports. The vehicle has air conditioning, heating, and an NBC overpressure suite. It has an automatic fire detection and suppression suite for the vehicle. Normally only a crew of four is carried, but often a fifth crewmember is carried when a specialist crewmember is needed. The vehicle has a BMS and GPS system. The Bgbv-90 also has a small computer loaded with tech manuals for most of the vehicles in the Swedish Military.

The Bgbv-90 has a Scania DS-14 turbocharged diesel engine developing 550 horsepower. This is coupled to a Perkins X-300-5N automatic transmission with a torque converter to use engine power to increase the pulling power of the winches.

The Swedish Army is upgrading some of the Bgbv-90s to the Caesar ("C") standard; the resulting vehicle is designated the Bgbv-90C ARV. The main difference is the large increase in armor protection, including lugs for ERA and attachment points for slat/cage armor; other differences include a tropical-grade air conditioner, an improved suspension, new seatbelts, and laser filtering for the vision blocks. The driver has a rear CCTV camera for backing up unassisted. The weight of the increased armor suite drastically affects for cargo-carrying capacity, but not as much as you might think – the engine has been replaced with a more powerful one, a Scania DSI-16 turbocharged diesel developing 810 horsepower. The heavy-duty crane is standard. Three of these upgrades have been done so far; one was sent to Afghanistan along with Sweden's contribution to ISAF.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Bgbv-90	$1,664,338	D, A	4.5 tons	23.6 tons	5	31	Passive IR (D), Image Intensification (C), WL Spotlight	Shielded
Bgbv-90 with Heavy Crane	$1,690,508	D, A	4.5 tons	24.1 tons	5	31	Passive IR (D), Image Intensification (C), WL Spotlight	Shielded
Bgbv-90C	$1,750,499	D, A	3.73 tons	26.7 tons	5	33	Passive IR (D), CCTV Backup Camera (D), Image Intensification (C), WL Spotlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Bgbv-90	161/113	45/31	610	199	Stnd	T4	HF18 HS7 HR4
Bgbv-90 with	158/111	44/31	610	204	Stnd	T4	HF18 HS7 HR4

Heavy Crane Bgbv-90C	201/140	56/23	610	301	Stnd	T4	HF23Sp	HS11Sp	HR5*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Bgbv-90 (All)	None	None	Ksp m/58	4000x7.62mm

**The Bgbv-90C has a deck AV of 3, and a hull floor AV of 5Sp.

EKT Brückenlegepanzer 68/88

Notes: In the original design for the BruPz, the AVLB was meant to be based on the Pz-61 MBT. There were, however, considerable design and production delays, and when it came time for a prototype, the Pz-68 MBT became available. SW dispensed with the original design and based it on the chassis of the more powerful Pz-68 instead. There have been no export sales, and Switzerland has never put it on the export market. Germany offers the bridge and bridgelaying machinery for export along with its own design, but no sales of the Swiss-designed system have been sold.

The turret is removed and replaced with a single-span bridge and laying machinery. The bridge and bridgelaying machinery were designed by SW, but used a German Jung-Jungenthal design as a base, the one used on German conversions of the Leopard 1 and M-48 in their conversions to the AVLB role. The bridge has a weight of 9.8 tons, has a length of 18.23 meters, and can carry 60 tons in an emergency, though Swiss regulations normally limit the load carried to 50 tons. The trackway is 3.55 meters wide. The laying and recovery is fully automatic once started and can be done without the crew leaving the vehicle or unbuttoning. The laying and recovering system is completely hydraulic, powered by a power take-off from the engine. The bridge takes 2 minutes to lay and 5 minutes to recover. The bridge is deployed by the bridge operator sliding a beam across the gap to be crossed, then using it as a guide rod to lay the bridge.

The BruPz-68/88 is not normally armed as a part of the vehicle, except for the personal weapons of the crew and one infantry-type machinegun on a bipod for the commander. The crew also has 20 grenades as part of its basic load, like most armored vehicles. The driver is in front behind a large windshield in the front to keep the driver from being sprayed by water or mud. He is otherwise in a normal driver's type compartment, with vision blocks and a hatch. The driver is in the same center front of the hull, with three vision blocks; the center one of the driver can be replaced with a night vision block. The commander and bridge operator are seated side by side in the center of the hull; the commander has vision blocks on all but the right side, and the bridge operator has vision blocks to all but the left side. The bridge operator is to the rear of the commander; he has a simple hatch and vision blocks that are high enough to allow him to deploy the bridge from inside the vehicle with the hatch closed. A fourth crewmember is in the hull; he also has high vision blocks, and can assist the bridge operator or get out of the vehicle and be employed as a spotter. There are small storage at each crew position for the storage of personal gear. There are four smoke grenade launchers on each side of the glacis. The BruPz-68/88 has a vehicular collective NBC system, as well as a heater.

The chassis is almost unchanged from that of the Pz-68, with an MTU MB-837 diesel developing 660 horsepower. The transmission is semiautomatic and allows the driver to pick a gear without pushing a clutch pedal, but is not fully automatic. The BruPz-68/88 has a Bellville-type suspension and each roadwheel is independently sprung, giving a decent ride. The 68/88 improvements gave the bridge its fully hydraulic bridge deployment mechanism, and several other engine, transmission, and electrical improvements, which are not important for game purposes.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
314,569	D, A	600 kg	47 tons	4	33	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
120/84	33/23	855	243	CiH	T6	TF4 TS4 TR4 HF43 HS13 HR8*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-51 (C)	1000x7.5mm

*The bridge has an AV-4. When the bridge is mounted, the Config is CiH, though no crew hits are possible is the bridge is hit. When the bridge is deployed, the vehicle has a Config of Stnd, and the bridge must be targeted independently.

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EKT Entpannungspanzer 65/88

Notes: Similar to the story of the BruPz, the EntpPz was originally to be based on the chassis of the Pz-61 MBT. Long lags in development, prototyping, and production led to the adoption of the Pz-68 chassis instead of the older Pz-61. The EntpPz-68 is not only used to recover and repair the Pz-61 and Pz-68, but also the M-109 and the Swiss variant of the Leopard 2.

The hull is of sheets of steel, with the crew at the front and the engine at the rear. The crew has a door on the left side of the hull towards the front, and there are hatches for the driver and commander on the front deck. To the rear of the driver is a second cupola for the crane operator. The commander's cupola is armed with an M-51. The rear area is mostly open, with sides of sheet steel.

The driver is in the front left, and he has three vision blocks; the center one can be exchanged for a night vision block. The commander is behind him and on the right. The crane operator's cupola has all-around vision blocks, as does the commander. The commander also has two vision blocks on the front of the hull at the top of the glacis. The crane operator's position faces to the rear and is behind the driver. The driver and crane operator have armored enclosures consisting of AV2 gun shields, though the bridge operators gun shields may be easily removed to give him more visibility for operating the crane. (The gun shields are not normally mounted in peacetime.) The driver is in the same center front of the hull, with three vision blocks; the center one can be replaced with a night vision block. Four smoke grenade launchers are found on the front left side, and are launched over the front of the vehicle. The crew compartment has an NBC overpressure suite and a heater. The crew has a small computer with most tech manuals of most Swiss Army vehicles, as well as large caliber guns used by those vehicles. There are two clusters of five smoke grenade launchers

on each side of the glacis. In the crew compartment of the vehicle is an 18-liter drinking water tank.

The main winch has 120 meters of cable and has a capacity of 25 tons, or 75 tons with block and tackle. The auxiliary winch has 240 meters of cable and has a capacity of 10 tons. On top of the vehicle is an A-frame crane with a capacity of 15 tons, enough to lift the complete turret of most vehicles in Swiss service. At each base of the A-frame is a hydraulic jack, used to make minor adjustments while lifting. At the front is a dozer blade for bracing, and with a secondary purpose of digging vehicular fighting positions. The Entp Pz 65/88 is normally equipped with excavating tools, basic tools, tracked vehicle tools, wheeled vehicle tools, welding gear, an air compressor, a tow bar, and various ropes, chains, and pulleys.

Being a subtype of the Pz-68, the EntpPz-68 is powered with an MTU MB-837 diesel developing 660 horsepower. An auxiliary power unit is used to power the tools at a halt and develops 28.3kW. The transmission is semiautomatic and allows the driver to pick a gear without pushing a clutch pedal, but is not fully automatic. The BruPz-68/88 has a Bellville-type suspension and each roadwheel is independently sprung, giving a decent ride. The 68/88 improvements gave the bridge its fully hydraulic bridge deployment mechanism, and several other engine, transmission, and electrical improvements, which are not important for game purposes.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$703,021	D, A	6 tons	39.8 tons	5	31	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
135/95	38/26	870	244	Stnd	T6	HF43 HS13 HR8*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-51 (C)	3200x7.5mm

*The rearmost working area has no roof and therefore no roof AV. The dozer blade can protect the front and has an AV of 4Sp.

FNSS ACV-300 ARV

Notes: This is basically a more capable variant of the AIFV ARV, and is designed for the repair and recovery of like-sized vehicles, including light and medium wheeled vehicles. The ACV-300 ARV has a winch has a capacity of 9.07 tons and 100 meters of cable and can be pulled to the front or rear, with the drum inside the lower hull. The ACV-300 ARV has a crane has a capacity of 3.09 tons and a reach of 5 meters at full power; lifting power decreases as the crane approaches 7 meters, which it is maximum reach. The vehicle is equipped with the following tools: basic, excavating, tracked vehicle, wheeled vehicle, small arms, heavy ordinance, and an air compressor. The ACV-300 ARV can replace up to 5 ERA blocks, and carries a selection of spare parts. It can tow a trailer that is designed to take no driving ability away from the ACV-300 ARV, and normally carries more spare parts and a small workshop for more detailed work. There is no blade or outriggers for stability, but the treads and wheels can be positively locked in place. The rear retains the rear ramp that the ACV has, along with the door in the ramp.

The gunner's cupola remains, and is armed with a heavy machinegun or automatic grenade launcher. The commander's position is likewise retained, and has its own weapon; both the gunner and commander's cupola have all-around vision blocks, and can replace the middle vision block with a night vision block. The driver has vision blocks in a semicircle around the front and sides, and the middle one can be replaced with a night vision block. The commander's machinegun may aim and fire (but not reload) under fire.

ACV-300-based vehicles, in general, use 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 ARV is fully amphibious, propelled in water by its tracks. The firing ports, except for the one in the rear door, have been deleted. Only one passenger seat is provided; normally he monitors the vehicle's position and where they are supposed to be, and gives the correct courses to the driver. He has the equivalent of a BMS and a GPS, as well as a laptop with digital versions or field and tech manuals. He is facing to the rear at a sort of desk.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$952,600	D, A	1.2 tons	14 tons	4	12	Passive IR (D, G, C), WL/IR Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
155/108	43/30/4	410	111	Stnd	T2	HF6Sp HS4Sp HR4Sp*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB or Mk 19 (G), M2HB (C)	4000x.50 or 2000x.50 and 635x40mm

Belly armor is 4Sp; roof armor is 4

FNSS ACV-15-AEV

The ACV-15 AEV is based on the stretched ACV-15 chassis, and was built not only to give the crew more room to work but carry engineer supplies. Engineer supplies include two engineer demo chests and 40 kilograms of C4 to remove obstacles; other supplies include a chain saw, a round saw, and numerous chains and ropes for dragging obstacles free. Also included is an enhanced pioneer tool kit, and a non-powered tool to split logs which is more efficient than simply wailing on it with an axe. (An axe and an adze are part of the pioneer tool package, of course.) The armor package is improved in the same manner as the ACV-15, and the gunner has an OHWS with a modernized version of the M-2HB, with a QCB modification.

The driver and commander are in the same place as on the ACV-300 ARC, except that the commander is on a raised cupola that can be manually rotated. The gunner's position is replaced with the OHWS station. The vehicle is heated and air-conditioned, and it has a collective NBC system for the crew to hook up when on board. The vehicle has a raised roof similar to the CPV version, and a winch with a capacity of 10 tons and 100 meters of cable.

The vehicle is powered by a Detroit Diesel 6V-53T, an upgraded version which develops 350 horsepower. Transmission is automatic, and a mine rake can be attacked to the drive sprocket which has an AV of 8 vs. mines (it will not protect the vehicle).

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,249,169	D, A	3 tons	20 tons	4	12	Passive IR (D, G, C), Thermal Imaging (G), WL/IR Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
128/90	36/25	501	125	Stnd	T2	TF6Sp TS5Sp TR4 HF12Sp HS9Sp HR7Sp*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB	3000x.50, 20 kg C4, Engineer Demo Chest

*Belly armor is 5Sp, except under the driver and gunner, where it is 6Sp.

United Defense AAVR7A1

Notes: Originally designated the LVTR7A1, this vehicle is the recovery version of the AAVP7A1 amphibious APC used by the US Marines and other countries. (The US Marines, Argentina, Brazil, Italy, South Korea, Spain, Thailand, and Venezuela use the AAVP7A1 and the AAVR7A1.) The cupola of the AAVP7A1 is not present on this vehicle; instead, the AAVR7A1 has a mount on the commander's position for an M-60D machinegun. On the right side of the hull is a crane with a telescoping arm that reaches 6.55 meters and can lift 6 tons. The winch is at the rear and has a capacity of 13.61 tons. Also installed in the vehicle is an air compressor, 5 kW generator, workbenches, welding gear, and a complete range of tools. A tent comes with the vehicle that can be erected at the rear to extend the workspace. A range of commonly-used spare parts is also carried, including often a powerpack on top if necessary.

The engine and transmission are removable as a unit, like on the AAVP7A1. The lifting capacity of the crane is approximately that of an AAVP7A1's power pack. The driver is on the front left behind the glacis plate and has a single hatch that opens to the rear. He has vision blocks to the front and left side; one of the front vision blocks may be swapped out for night vision block. The commander is to the rear of the driver and has a cupola with all-around vision blocks. The commander's cupola is high enough that he can fire over the open hatch cover of the driver. The crane operator is opposite the commander on the right side, and also has a raised cupola with all-around vision blocks. The entire crew are mechanics and recovery specialists. At the rear is a power-operated ramp. Over the top of the repair is a large hatch, but normal means of exit and entry are via the ramp with its door set in it.

Applique armor is commonly used today, and consists of corrugated aluminum sheets on the sides and front. The extra weight means that a bow plane has to be used when swimming, and one was added for this purpose, which is operated by the driver from inside his position.

The AAVR7A1 is fully amphibious, powered in the water via water jets. The jets have deflectors enabling the AAVR7A1 to turn in the water. If a slower, more controlled transit is desired, the water jets can be shut off and the vehicle propelled in water via its tracks, which is the second swimming speed listed below. Engine is a Cummins VT-400 developing 400 horsepower. The transmission is manual, but with a power assist.

Newer versions under the AAV RAM/RS Program version use an M-2A1 Bradley engine, including a manual transmission and conventional driving controls. The engine develops 525 horsepower. The suspension was made a variant of the Bradley's suspension, capable of carrying the increased load and incidentally giving the AAVR7A1 a smoother ride while increasing spare parts commonality with the Bradley. This version was originally to be called the AAVR7A2, but came out with the official designation of AARV7A1 RAM. A concurrent program, the AAV SUP (Survivability Enhancement Program) gave the AAVR7A1 enhanced side armor and an enhanced bottom armor plate, as well as improved Kevlar-sheet anti-spalling liners, NBC Overpressure with a vehicular NBC backup and integrated blast-resistant seats. Another improvement initiative, the SAIC, gives the AAV7-series a new automatic transmission, further improved armor including MEXAS armor modules, an upgraded suspension, new, more powerful water jets, an upgraded driver's position, and a BMS with GPS as well as thermal imaging for the commander and a machinegun which may be aimed and fired from under armor. Both of these initiatives were initially to be applied to only a fraction of the total number of AAV7-series vehicles, but with the EFV many years behind schedule and threatened by budget cuts several times per year, more AAV7-series vehicles have both the RAM and SUP upgrades. Vehicles with the SUP initiative do not a different designation, and are identified solely by looks. SAIC was applied to much more AAV7-series vehicles from the beginning. Some 64% of the AAV7-series fleet will eventually receive all three upgrades, as well as a number of minor upgrades; only 7 of these, so far, the full set of upgrades have been done on AAVR7A1s..

There are clusters of five smoke grenade launchers on either side of the glacis plate. The AAVR7A1 can wear the appliqué of the AAVP7A1, except for the turret appliqué (as it has no turret). Crew includes three mechanics (and the vehicle crew are also mechanics), a driver, and a commander, who has a manually-operated cupola and a pintle-mounted machinegun.

Delays in the EFV means that the AAV7-series will be in service at least until 2030.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AAVR7A1	$249,957	D, G, AvG, A	8 tons	23.64 tons	5	15	Passive IR (D)	Shielded
AAVR7A1 w/Appliqué	$243,248	D, G, AvG, A	8 tons	25.64 tons	5	15	Passive IR (D)	Shielded
AAVR7A1 RAM	$244,071	D, A	7.77 tons	24.95 tons	5	13	Passive IR (D)	Shielded
AAVR7A1 SUP	$244,714	D, A	7.28 tons	26.92 tons	5	15	Passive IR (D)	Shielded
AAVR7A1 SAIC	$1,017,237	D, A	7.13 tons	27.52 tons	5	24	Passive IR (D), Thermal Imaging (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AAVR7A1	101/71/28	20/20/5 (4)	647	111	Stnd	T3	HF10 HS7 HR5
AAVR7A1 w/Appliqué	108/75/19	30/21/5 (3)	647	111	Stnd	T3	HF10 HS10Sp HR5
AAVR7A1	148/104/27	41/29/7 (5)	647	194	Stnd	T3	HF12Sp HS12Sp HR6

RAM							
AAVR7A1 SUP	139/98/25	39/27/7 (5)	647	194	Stnd	T3	HF12Sp HS15Sp HR6*
AAVR7A1 SAIC	137/96/25	38/27/7 (5)	647	194	Stnd	T3	HF16Cp HF18Cp HF8**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AAVR7A1 (Applique, RAM)	None	None	M-60D (C)	850x7.62mm
AAVR7A1 SUP	None	None	M-60D (C)	1700x7.62mm
AAVR7A1 SAIC	+2	Fair	M-60E2 (C)	1700x7.62mm

*Floor Armor is 5Sp. Roof Armor is 4.
** Floor Armor is 7Sp. Roof Armor is 5.

BAE M-1 ABV Assault Breacher

Notes: Though cancelled in the US Army, the US Marines saw great promise in the M-993 Grizzly CEV with its plethora of obstacle clearing tools. Though the Army decided to cancel it, the Marines decided to develop their own, similar version, the Assault Breacher. The Marines have nicknamed this the Shredder. It's first large-scale use was as a part of ISAF. In addition to clearing obstacles, it can create obstacles and dig fighting positions; one of its primarily roles in Afghanistan was to dig up and detonate mines and IEDs with its specially hardened buckets and mine plow. The Marines have a total of 52, on the way to a projected total of 189. The success of the ABV has led the US Army to take a second look at the Grizzly; 189 were ordered by the US Army in favor of the Grizzly in 2012. In fact, five are on loan to the US Army for use on the Korean DMV. The ABVs are essentially the Marines' equivalent of the Grizzly, but do not have a Grizzly's capabilities and general utility, being optimized for minefield breaching.

The turret is replaced with a special superstructure; it looks like a turret, but is not. The superstructure is, however, basically a locked-down turret that has been enlarged and modified for its new role. The chassis is an M-1A2 SEP hull, with some turret internal accouterments in the superstructure. The superstructure sides and rear are festooned with armored lockers, as is the back. In normal use, the superstructure is covered on the front and sides with ERA blocks.

The ABV uses a more powerful 20kW APU, which is under armor to reduce its thermal signature. The engine used is the 1500-horsepower Honeywell AGT-1500 gas turbine engine, coupled to an automatic transmission. In fact, as much as possible, the chassis and turret have been retained, though of course the top of the hull and the now nonrotating turret have been heavily modified.

The ABV has a smoke grenade cluster on either side of the front of the superstructure. The normal crew is two men, with the commander/tool operator on the front superstructure with a machinegun able to be aimed fired, and reloaded from within the vehicle, hatches closed. The driver is in his normal place inside the front center. Some ABVs have been further modified with an RWS-type station armed with an M-2HB and a Mk 19, both of which can be aimed, fired, and reloaded from under armor. The RWS mount can of course, rotate 360 degrees. The ABV has air conditioning, heating, and an NBC Overpressure system; it also has BMS and a GPS setup. The ABV carries a large amount of explosives and gear, used also for blowing IEDs in place and clearing or creating obstacles manually.

The plow is 4.5 meters wide and hinges to a V-shape or a straight plow. The plow may also be angled one way or the other. The plow's bottom edge has dozens of high-strength steel teeth for ripping and uncovering IEDs and mines well underground – and the blade may be angled as necessary in relation to the ground. Reaching over the dozer blade, and able to angle to almost 270 degrees, are arms able to dig up large IEDs. Their most important function, however, is as mine detectors and electronic fuze disruptors – They are 80% likely to disable fuzes within 30 meters of the ABV, and detect mines and IEDs. They are able to take an IED or mine blast to various degrees. The Shredder carries two MICLIC launchers on the rear deck.

A negative side of the ABV is that it requires a large amount of maintenance for both its chassis and turret, but also for the plow and subsystems.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ABV	$2,462,321	D, G, AvG, A	400 kg	65.32 tons	2	39	Image Intensification (D, C), Thermal Imager (C)	Shielded
ABV w/RWS	$2,629,037	D, G, AvG, A	400 kg	65.47 tons	2	41	Image Intensification (D, C), Thermal Imager (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
ABV	159/111	44/31	1920	558	Stnd	T6	HF262Cp HS34Sp HR27Sp
ABV w/RWS	159/111	44/31	1920	558	Stnd	T6	TF 8Sp TS6Sp TS6Sp HF262Cp HS34Sp HR27Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition

ABV	+1	None	M-2HB (C)	1500x.50, 2000 kg C4, 4 Engineer Demo Chests
ABV w/RWS	+2	Fair	M-2HB, Mk 19 (G)	2000x.50, 200x40mm, 2000 kg C4, 4 Engineer Demo Chests

*The ABV has ERA lugs on the front and side of the superstructure, as well as on the track skirts. The front and sides of the superstructure are normally equipped with ERA. The version with an RWS can also take turret RAM on all sides. The floor armor of the ABV is 20Sp. The dozer blade can protect against frontal hits, and it has an AV of 16Sp.

BAE M-2A2 ODS-E E-BFV

Notes: What that giant acronym means is that this vehicle is the engineer squad vehicle version of the M-2A2, with Operation Desert Storm modifications. Some are also M-2A3 E-BFVs, allowing them to interoperate with Bradley BCTs that are based on the M-2A3; the object is commonality of spare parts. The E-BFV is designed to interoperate with Bradley BCTs and to keep up with the line of march (or move ahead of them in some cases), and maintain the momentum of assaulting forces.

The E-BFV can be equipped with the following devices: a mine roller, a mine plow, or mine flail. It also has an automatic lane marker system (which may also be manually operated), and electronics which allow it to use a small robot to check and if necessary, detonate mines and IEDs. The lane marker assembly consists of two boxes of lane markers on the rear sides of the vehicle, and two on the back of the vehicle on either side of the ramp. The mine plow is a sectional blade which may be configured into a straight blade to clear obstacles, create obstacles, push into buildings, reduce fortifications, and dig fighting positions. As a V-shaped blade (it is hinged in the middle), it functions to push mines and IEDs aside and occasionally detonate them. As an angled blade, it operates as cross between the other two types of blades. The lane markers each have 48 marker flags, and serve to designated safe corridors for the vehicles that follow the E-BFV; they are fired into the ground far enough for them to remain upright and may be placed on automatic deployment at a given interval or deployed manually in groups of one or more on each side of the E-BFV. Other tools carried include a chainsaw, rotary cutter, and various pioneer tools and construction tools. The E-BFV normally tows a trailer that carries extra equipment and supplies, a MICLIC system, or a minelayer mechanism.

The biggest difference between the E-BFV and the standard M-2A2 ODS or M-2A3 is the lack of a TOW missile launcher in the box on the left side of the turret. Instead, the E-BFV carries additional observation equipment such as LLTVs (at the front and back of the box, a FLIR, and a 2nd Gen Image Intensifier. The rear LLTV is accessible to the driver, and the rest to the gunner and the sapper squad leader via a downlink to a small LCD screen. The E-BFV has a non-lethal (but not eye-safe) laser designed to deactivate mines and IEDs on the surface of up to 250 centimeters below the surface. Note that the latter generally requires having the fuze or center of the mine marked and is therefore not often done. The laser can also disperse crowds or enemy squads by temporarily blinding them. For disposal of obstacles, IEDs or mines, and to blow holes in buildings, the sappers may elect to dismount and blow them manually, using the 30 kilograms of C4 and the equivalent of three engineer demolitions chest. The 25mm Bushmaster autocannon is also retained, in addition to the coaxial machinegun and an a CROWS for the commander. Raised above the turret and driver is a wire cutter to keep them from injuring exposed crewmembers.

The E-BFV is, on paper anyway, designed to carry an engineer squad of six. Experience and testing show that with all the equipment carried, a squad of four is more like it. The crew has a small computer with engineer manuals and tips as well as specs on their vehicle. It has NBC Overpressure along with a vehicle air flushing system. On each side of the turret are two clusters of four smoke grenade launchers. The vehicles have a 15kW APU to run the sensors and tools when the engine is off.

Being a variant of the M-2A2, the following features are common to the two. Lugs for reactive armor blocks are found on the upper sides of the M-2A2 as well as on the glacis. These lugs can also mount bolt-on appliqué armor, bolt-on spaced armor, or the new slat armor if desired. The weight of the M-2A2 increased so much that it is no longer amphibious, and the trim vane and flotation screen have been removed. However, to cope with the increased weight, the VTA-903T was replaced with an upgraded version of the same engine, developing 600 horsepower. The ODS (Operation Desert Storm) upgrades, with such modified vehicles informally called M-2A2ODSs, included an improved, eye-safe laser rangefinder, the addition of a GPS system, an IFF system, thermal imaging for the driver, and a system to jam radio-guided and IR-guided missiles (regarded as only partially effective, but better than nothing). The missile jamming system consists of sensors to detect incoming missiles and automatically put out low-grade radio-jamming signals, launch flares and IR-defeating smoke grenades.

M-2A3 E-BFVs have the upgrades of the M-2A2 ODS. In addition, they have a BMS with GPS and Link-16. The commander has a full flat-panel display/touchscreen and computer control; the gunner and driver have touchscreens of their own that display information appropriate to their roles. In the passenger compartment, mounted on a bracket that is against the turret basket but not actually attached to it (i.e., it does not rotate with the turret), is another large display to provide the dismount squad with information on the battlefield situation and allow them to plan, receive and provide updated information. Along with this capability, GPS and an INU (Inertial Navigation Unit) have been added. The M-2A3 has a computer (which has been steadily upgraded over time) to allow it to quickly receive, integrate, display, and send real-time battlefield information; commanders therefore (usually) know where their units are and their status; the Bradley is therefore a true counterpart to the Abrams on the digital battlefield.

Other improvements a CIS (Commander's Independent Viewer), similar to the CITS of the M-1A2 Abrams III. The commander also retained the ability to see through the gunner's sight. In addition, the commander's thermal imagers were replaced with long-range FLIR systems more akin to those found on aircraft and helicopters. The M-2A3 has an automatic dual target tracking ability, and as the gunner's sighted target is destroyed, the turret can be set to rotate automatically and the gun trained automatically on the

commander's sighted target. Fire control s also improved (the system called the IBAS – Improved Bradley Acquisition System), and boresighting is essentially automatic instead of requiring a stop and extensive adjustments. The gunner's sight (the TAS – Target Acquisition System) has received particular attention in the fire control department. The main gun and coaxial machinegun is better stabilized and the ballistic computer improved (able to tap into, to a small amount, the primary computer of the Bradley). The TAS uses a 2nd-generation FLIR and a day TV/image intensification device, with a digital zoom from 4x to 48x, and twice the field of view of the zoom sights of earlier Bradleys. The day TV/image intensifier sees in near-infrared as well visible light, making it usable even in heavy smoke, IR-obscuring smoke, and conditions of low thermal contrast where FLIR imaging would be of little use.

The turret roof of the M-2A3 has a thin layer of added titanium alloy armor, as Desert Storm operations revealed the turret roof to be the weakest surface of the vehicle. As an adjunct to the electronic IFF system, the Bradley accommodates special panels on the sides of the vehicle made of the special aluminum alloy. These panels, when viewed through thermal imagers or FLIRs of the proper wavelength, gives off a heat signature that provides a further deterrent to fratricide. The M-2A3 includes a special cooling system for the vehicle's electronics, but experience in Iraq has led to low-power air conditioning to be fitted to the M-2A3 (and some M-2A2s still in service) to relieve the stifling heat that builds up inside the Bradley.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-2A2 ODS E-BFV	$6,351,906	D, A	900 kg	27 tons	3+4	21	2nd Gen Image Intensification (C), Image Intensification (G), LLTV w/Image Intensification (SQL), Thermal Imaging (D, G), FLIR (C)	Shielded
M-2A3 E-BFV	$1,4912,497	D, A	900 kg	28 tons	3+4	25	Thermal Imaging (D), FLIR (C), 2nd Gen FLIR (G), 2nd Gen Image Intensification (G), LLTV w/Image Intensification (SQL)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
M-2A2 ODS E-BFV	134/94	37/26	662	191	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp
M-2A3 E-BFV	151/106	42/29	662	222	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-2A2 ODS E-BFV	+3	Fair	M-242 Bushmaster Autocannon, M-240C, 6xM-231 PFW	900x25mm, 2200x7.62mm, 3070x5.56mm, 20 kg C4, 4 Engineer Demo Chests
M-2A3 E-BFV	+3	Good	M-242 Bushmaster Autocannon, M-240C, 6xM-231 PFW	900x25mm, 2200x7.62mm, 3070x5.56mm, 20 kg C4, 4 Engineer Demo Chests

*Floor Armor is 7. For the M-2A3 E-BFV, the Roof armor is 7. The E-BFV may take ERA, Bar/Slat armor, and appliqué armor, including MEXAS. The sides and front of the vehicle are, in fact, normally equipped with ERA. The E-BFV can also be equipped with the BUSK kit.

FMC CESV AEV

Notes: Also known as the MTVE, this vehicle is similar to the Canadian M-113 ESEV, but based on the larger MTVL chassis. The CESV's ramp may be used as a working platform, and may hold 1.1 tons. It has the same hydraulic auger that may dig in earth, asphalt, and frozen ground to a depth of 3.048 meters and 203mm wide; hydraulic power tools (a chainsaw, jack hammer, impact wrench, jaws of life, round saw), a welding set, and an engineer demo chest. In addition, several lengths of rope and wire cable are carried, along with snatch blocks and hooks. The CESV is also equipped with a light turret; its weapons and the rotation of the turret may be taken over by the commander and the weapon aimed and fired by him. As of 2012, only seven CESV vehicles have been built. The vehicle has a compact APU developing 7 kW, located on the right rear roof.

Like a standard MTVL, the vehicle has a 6V-53TIA Detroit Diesel Electronic Control (DDEC IV) turbocharged intercooled and aftercooled engine developing 400 horsepower. Transmission, and like the MTVL and M-113A3, is has a steering wheel instead of tillers. Like the MTVL, it has stryofoam blocks on the sides to support it while swimming; these are enclosed in light aluminum. The fuel tanks are on either side of the door with an AV of 4; under the floor are special rupture-resistant fuel tanks. The glacis and sides are equipped with lightweight titanium-alloy panels, giving it more armor protection without too much of a weight penalty. The glacis also carries appliqué armor blocks and the floor is made from spaced laminate steel. A Kevlar anti-spall liner has also been installed.

The CESV has ballistic protection a greater standard, to a similar level as the M-2A1 Bradley's hull. This allows the CESV, along

with its mobility, to keep up with and destroy obstacles. It also has additional protection against mines, more based on the survivability of the crew and not the vehicle. The gunner sits under a Rafael OHWS containing two machineguns (but an alternate installation on some CESVs replaces the M-2HB with a Mk 19 GMG), with a special rangefinder with ballistic computer, and night vision devices. This is on the top of the vehicle, on the front right side. The commander sits to the left of the gunner in a cupola, though he has a ring of vision blocks on the roof and a night vision device. The driver is in the usual place for the MTVL, on the front left side behind the glacis plate; he also has a night vision channel. The rest of the crew is also in the hull, though the commander sits on the center front slightly to the left; the rest of the engineers site on the right side. There is a hatch in the ramp, and a large hatch on the roof. A domed adjustable ventilator is behind the roof hatch. Though there is room for the commander and up to seven engineers, generally only five are carried. The CESV has a vehicular NBC system; the crew's protective masks can be connected to this by long hoses (though not long enough to allow them to leave the vehicle), 40 kilograms of C4 and an engineer demolitions chest are also carried, though the engineer demolitions kit components are generally broken up and stored in a manner that makes them more accessible. On each side and to the rear are firing ports, and the vehicle is equipped with air condition, a BMS, and a GPS set. The vehicle has a bank of four smoke grenade launchers on either side, which may be fired individually or in salvos by the commander. On the bumpers are four more smoke grenade launchers each; these act as normal smoke and also have a 50% chance of blocking laser designation or rangefinding beams.

Twilight 2000 Notes: This vehicle was taken into service by the US Army in late 1996 as the M-113A4 Sapper Vehicle.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,324,483	D, A	4.2 tons	18.14 tons	3+7	17	Image Intensification (D, G), Thermal Imaging (G, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
130/91	36/25/4	757	120	CiH	T3	TF3Sp TS3Sp TR3 HF10 HS5Sp HR4*

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	M-2HB or Mk 19, MAG	1000x.50 or 320x40mm, 1500x7.62mm, 40 kg C4, Engineer Demo Chest.

*Belly armor is 4Sp.

United Defense M-9 Armored Combat Earthmover (ACE)

Notes: The ACE is basically a military version of a bulldozer, with an armored body. It entered the US Army inventory in 1977, and is perhaps one of the most common engineer vehicles in the world. Most of these vehicles were upgraded starting in 1985 to extend their operational life, and included an appliqué armor package pioneered by the Israelis. Later production included nearly 200 vehicles for South Korea. The US Marines also use the ACE, but did not get any until 1995.

The ACE is a fast vehicle designed to keep up with Infantry Fighting Vehicles and Main Battle Tanks, in order to clear obstacles, create breaches in fortifications, and fill craters and ditches for those vehicles. The ACE is also used to prepare positions and dig fortifications. A secondary role for the ACE is the smoothing and creation of makeshift roads and airfields in rough terrain areas, or the destruction and scarring of road surfaces and runways. It is not suitable as an antimine vehicle, due to the absence of a curved blade and the depth of its bucket.

The ACEs primary feature is its large front-mounted scraper and dozer blade/bucket. The scraper has a capacity of 6.7 cubic meters, and the dozer blade/bucket can move 8 tons at a time. The position of the bucket is adjusted by adjusting the vehicle's hydropneumatic suspension. (When traveling at high speed, this suspension gives the vehicle a smoother ride than might be expected from such a vehicle.) The ACE's digging efficiency can be increased by using the scraper to fill the apron behind the bucket with ballast; this can be ejected at any time, and is also used to fill trenches or build up berms. The ACE also has a winch with a capacity of 15.9 tons, and has a 60-meter cable. The ACE is equipped with a bilge pump for amphibious operations -- it is amphibious with preparation -- but most countries using the ACE have removed the requirement from doctrine that requires the ACE to be swim-capable. The commander has a manually-rotating cupola with all-around vision blocks; the dozer operator also has a hatch above him, with all-around vision blocks..

Power is provided by a Cummins V-903C developing 295 horsepower; transmission is semi-automatic and steering is by tillers. Armor is basic aluminum, but is nothing to write home about. The ACE has a tow pintle that also allows several vehicles to be connected to allow for a larger line pull.

SIP improvements began in 1996. The base armor is an aluminum-aramid-steel sandwich, and the appliqué adds armor similar to that of the Bradley, along with improvements to the belly armor and increased strength to the tracks. Other improvements consists of improvements to fix deficiencies in the suspension and treads, and the addition of new access panels to make maintenance easier. In addition, new filters and filtration methods maintain the complicated and critical hydraulic system of the ACE clean. The dozer blade has been changed in composition from aluminum to steel, as repair and replacement of the aluminum dozer was coming too often. The large dozer blade could be folded from inside the cab; folding the blade protects it from damage in cross-country travel, and

folding the old blade took a half an hour of outside work from both members of the crew, and is problematic when under fire and a quick withdrawal is necessary. The winch's capacity has been raised to 25 tons, and the new winch is two-speed.

A possible future SIP is an OHWS with an M-2HB, a Mk 19, or both, in addition to a third crewman to operate it. In addition, air conditioning, a BMS with GPS, and NBC Overpressure are on the idea list. This is listed below as "M-9A2," though this is a designation I am using for this possible future modification and not a real-world designation. A third SIP is being planned, which will increase the reliability of the mechanical and electrical systems, making them stronger and more flexible in their use. It also provides the ACE with a more powerful engine, a Cummins turbocharged diesel with an output of 400 horsepower. I have noted this below as "M-9A3" though this not an official demonstration.

The SIPs are being performed as vehicles come into 3rd echelon or depot-level maintenance. The Army and Marines are well aware of the vehicle's vulnerability to ground fire; extra armor has been provided as part of the SIPs and normally, the ACE is protected by a Bradley or LAV-25 when working or traveling.

Though capable of carrying more crew, the M-9 and M-9A1 normally operate with only one crewmember, and the M-9A2 and M-9A3 with two.

The ACE is air-portable in any aircraft at least the size of the C-130 Hercules. There is a cluster of four smoke grenade launchers on each front corner.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-9 ACE	$420,485	D, A	1.8 tons	16.28 tons	2	14	Headlights	Shielded
M-9A1 ACE	$577,609	D, A	1.54 tons	17.31 tons	2	15	Headlights	Shielded
M-9A2 ACE	$1,596,119	D, A	1.44 tons	17.82 tons	3	20	Thermal Imaging (G)	Shielded
M-9A3 ACW	$1,596,915	D, A	1.44 tons	17.87 tons	3	20	Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-9 ACE	144/101	40/28/4	507	109	Stnd	T3	HF3Sp HS3Sp HR2Sp*
M-9A1 ACE	138/96	38/27/4	507	109	Stnd	T4	HF9Sp HS6Sp HR4Sp**
M-9A2 ACE	124/87	35/24	507	109	CiH	T4	TF4 TS4 TR4 HF9Sp HS6Sp HR4Sp**
M-9A3 ACE	155/109	43/30	507	148	CiH	T4	TF4 TS4 TR4 HF9Sp HS6Sp HR4Sp**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-9A2/A3 ACE	+2	Fair	M-2HB, Mk 19	2000x.50, 500x.40mm

*The dozer blade has an AV of 6, and is 50% likely to be hit is the shot comes from the front, adding to the vehicle's AV. If the blade is folded, this chance is 25%, but the AV is then 12.

**The steel dozer blade has an AV of 8, and is 50% likely to be hit is the shot comes from the front, adding to the ACE's AV. If the blade is folded, this chance is 25%, but the AV is then 16. Floor AV is 6Sp.

FMC M-58 Wolf

Notes: This is the US Army's current standard smoke generation vehicle, along with the M-56 Coyote. It is also used by several of America's allies. It uses a tactical smoke generator of the 1994-2000 period type on the latest M-113A3 chassis, featuring large area multispectral obscurants. It has the RISE improvements that are normally fitted to the M-113A4. This allows for greater speed to keep up with Bradley and Abrams formations. The Wolf uses smoke fuel and fog oil tanks twice as large as the standard tactical smoke generator. The Wolf has two large rotatable exhaust pipes for the smoke generator.

The commander and driver are in the same positions as on a standard M-113A3. The third crewmember is the smoke equipment operator, who sits at a panel of instruments and controls, on the center right side facing to the rear. He has a cupola above him. The driver has a hatch above him, with vision blocks to the left and front; the front one has a night channel, along with the center block of the commander. The rear ramp and door remain, but they act primarily as access doors to the generation equipment. There are also access panels on either side. The commander can aim and fire his machinegun with the hatch closed. The crew has vehicular NBC hookups for its crew. The third crewmember is inside the hull.

The engine is that of the M-113A4 – a 275 horsepower Detroit Diesel 6V53T turbocharged diesel, with an automatic transmission and conventional driving controls.

The SGS is currently able to, on one tank of obscurants, able to produce 90 minutes of visual obscuration and 30 minutes of IR/Thermal obscuration. (Future improvements in the obscurants include the blocking of MMW.) The Wolf may be charging at full speed, turning sharply or widely, and other such moves while laying down the screen. (The driver and commander have uncooled FLIR viewers to deal with the smoke.) The SGS operator can lay the screen as haze, blanket, or curtain (the thickest smoke). A raised area on the roof makes room for the SGS while also allowing access and replenishment of obscurants. The obscurants emerge

from a funnel-shaped pipe at the right rear of the deck. The SGS may use the appliqué armor of the M-113 series.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$727,808	D, A	300 kg	13 tons	3	13	FLIR (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
163/114	45/32/5	400	104	Stnd	T2	HF6 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	M-2HB (C)	2000x.50

GDLS M-60 AVLB

Notes: This is an armored vehicle-launched bridge most commonly found in US service (by the Army and Marines), and is also used by Germany, Israel, Pakistan, Singapore, Spain, and Taiwan. As the name suggests, most are based on the M-60A1 main battle tank, with a bridge that has a capacity of 54.43 tons; some are based on an M-48A3 or A5 chassis that has been brought up to M-60A1 standards, or the chassis from the retired M-60A2 (and all are identical for game purposes). Current plans call for a slow-rate replacement by the M-104 Wolverine, though Congress and the President have killed the M-104 more than once (only to arise from the dead). Export operators include Egypt, Iran, Israel, Pakistan, Singapore, and Spain. It should be noted that the M-60 AVLB is not capable of keeping up with modern fighting vehicles on a swift march, and normally one or two fighting vehicles "guard" it (and other such vehicles that are needed but can't keep up).

The scissors-type bridge may cross a gap of 18.29 meters, and takes 3 minutes to deploy and 10 minutes to recover. It is made of high-strength aluminum. The bridge is a scissors-type bridge, and thus the bridge hinge is raised high into the air during its deployment. The trackway is 3.81 meters wide; each treadway is 1.75 meters. It is normally used for MLC 60 vehicles max, but a (very) limited amount of MLC 70 traffic may cross; each such vehicle that exceeds the MLC 60 limited have a 1% chance of permanently damaging the bridge so that it cannot be recovered. If the M-60 AVLB reduces the gap to be spanned to 15 meters, it can allow MLC 70 vehicles to cross without danger of damaging the bridge. Such heavy vehicles may cross only at one-quarter normal speed. As the bridge deploys, stabilizers also automatically deploy at the front of the vehicle. These stabilizers are raised off the ground so the AVLB can cross its own bridge, then the AVLB turns around, puts the stabilizers back on the ground, and the stabilizers automatically retracts and stow themselves as the bridge is recovered. By itself, the bridge weighs 13.38 tons.

The M-60 AVLB chassis is virtually identical to the M-60A1; the turret is. Of course, removed and replaced with the bridge and its deployment machinery. The automotive characteristics and most of the chassis is unchanged from the M-60A1 chassis, with a Continental AVDS-1790-2DR turbocharged diesel developing 750 horsepower, with an automatic transmission and suspension by torsion bars, and shock absorbers on the front and rear pairs of roadwheels. Army versions have clusters of four smoke grenade launchers on each fender; Marine M-60 AVLBs have clusters of five.

The M-60 AVLB has a crew of two – the driver and the commander, who doubles as the bridge operator. There is a tightly-cramped tunnel between the driver's and commander's position, and each has a small space beside them for personal items (though not nearly all will fit).The bridge may be deployed from the driver's or bridge operator's position. The crew does not have to leave the vehicle or open the hatches to deploy or recover the bridge, though it is preferred that the TC get out of the vehicle and acts as a ground guide. The crew compartments have NBC Overpressure and a heater; later improvements (after the 1991 Gulf War) added an air conditioner and improved the reliability of the vehicle mechanically and electrically in general. Even later improvements (early 2000s) added a BMS and GPS. These did not have special designations, though for game purposes I have labeled then Upgrade 1 and 2.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-60 AVLB	$605,148	D, A	200 kg	55.21 tons	2	23	Passive IR (D)	Shielded
M-60 AVLB (Upgrade 1)	$605,483	D, A	200 kg	55.23 tons	2	23	Passive IR (D)	Shielded
M-60 AVLB (Upgrade 2)	$1,130,489	D, A	200 kg	55.78 tons	2	26	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-60 AVLB	118/83	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8*
M-60 AVLB (Upgrade	118/82	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8*

1) M-60 AVLB (Upgrade 2)	117/82	33/23	1457	276	CiH*	T6	TF4	TS4	TR4	HF56	HS15	HR8*

*The CiH configuration refers to the AVLB with the bridge mounted. If the bridge is deployed, Config is Stnd.

GDLS M-60 AVLM

Notes: The M-60 AVLM (Armored Vehicle Launched MICLIC) began as a field modification of a standard M-60 AVLB during Desert Storm. The bridge is removed from the vehicle, the bridge deployment machinery retracted, and up to two line charge machinery of a standard M-58A3 MICLIC (Mine-Clearing Line Charge) trailer is mounted on top of the hull at the rear. This allows a mine-clearing solution much more mobile than a trailer while carrying the ability for follow-up shots, as well as allowing the engineers to be better protected than in a truck, HMMWV, or even APC towing a trailer. It is also less vulnerable than a trailer-mounted solution. For the time being, these modified vehicles are still in service, though some have been converted back to AVLBs. Operation Desert Storm showed that the M-60 AVLM has some problems keeping up with a maneuver force consisting of Abrams and Bradleys. Like many such specialist vehicles that cannot keep up with the pace of march, the AVLMs are often escorted by tanks or APCs and IFVs. The AVLM normally operated in an engineer platoon with vehicles with mine plows, combat engineer squads in special vehicles, and vehicles with other specialist gear, along with the protective elements.

The MICLIC launcher carries two line charges; a further four are carried on the vehicle for follow-up shots, but the crew must leave armor protection to load these charges. The line charge is fired from the AVLM, and starting 20 meters from the AVLM, a 107-meter long line of C4 charges are laid straight ahead. Each meter of the charge contains 7.44 kg of C4, for a burst radius of 40 and a concussion value of 11. Any mines in this radius may be set off, causing their own explosions if they do. Once all sympathetic detonations have occurred, the AVLM, other vehicles, and personnel may proceed through the cleared area (hoping all the mines have been set off). In practice, the AVLM is usually followed by a tank or engineer vehicle equipped with a mine plow, roller, or flail, as the MICLIC typically fails to clear up to 50% of the mines in a lane. Normally, two AVLMs set on either side of the line of march, fire their MICLICs, then the mine dozers or flail tanks go in. A sapper squad checks the area quickly, then the line of march goes in. After that, sappers place markers for subsequent lines of march. Minefields are a real pain.

The MICLIC launchers and line charges are carried beneath armored sponsons, which raise along with the line charges and deployment rockets to approximately a 45-degree angle. Reloading a sponson requires 10 minutes and requires four personnel to stand atop the vehicle and reload (two for one sponson).

The AVLM was a field modification first used during the 1991 Gulf War, and there were never any purpose-built AVLMs, though it was a common modification, and kits were built to allow the modification. No AVLM M-60 mods were used in Iraq and Afghanistan, and they did not receive the Upgrades that the AVLB version received. The AVLM modification may be accomplished by 4 personnel with appropriate skills and equipment; normally, at least one person on the team must have the Mechanic or Combat Engineer skill, and must pass an Average test. The modification can be done in 2 hours by those four persons if they have a MICLIC trailer, basic tools, and a crane, whether ground or vehicle-mounted. At any time, the AVLM may be converted back to an AVLB by removing the MICLIC units and re-mounting the bridge. The operator is normally a Combat Engineer, but the controls are ad hoc and simple and the bridge crew can launch the MICLICs after a short lesson.

Being a subtype of the M-60 AVLB, is has the same automotive characteristics and most of the chassis is unchanged from the M-60A1 chassis, with a Continental AVDS-1790-2DR turbocharged diesel developing 750 horsepower, with an automatic transmission and suspension by torsion bars, and shock absorbers on the front and rear pairs of roadwheels. They have clusters of four smoke grenade launchers on each fender. The AVLM is normally crewed by sappers. (One criticism before the Desert Shield and Desert Storm was that the sappers did not receive enough training on what was essentially a new weapons system to them.) Like the AVLB, the AVLM's driver position is slightly back from that of the M-60 tank, and in the center of the vehicle is the commander/MICLIC operator. Internally, the crew positions are identical to the AVLB, except for the control box at the commander's position.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,025,096	D, A	400 kg	51.33 tons	2	23	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
112/78	31/22	1457	271	CiH	T6	TF5 TS5 TR5 HF56 HS15 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	2xMICLIC Launchers	8xLine Charge

BMY M-88 Hercules

Notes: This is the longtime standard armored recovery vehicle of the US Army, and to a far more limited extent, the Marines. It is also used by 19 other countries worldwide. It was in the process of being replaced by the M-88A2 and M-5 in US service and by the M-88A2 in some other countries, but the M-5 was killed in the budget and the M-88A2 suffered a dramatic slowing of the purse strings. The original M-88 was introduced in 1961 and replaced (largely by upgrading) by the M-88A1 in 1977, and the M-88A2 (mostly new-build vehicles) in 1997. Most Marine M-88s are M-88A1s; they are slowly and steadily building up a stock of M-88A2s, but nowhere

near the rate of the Army. The M-88 is a veteran of the Vietnam and Gulf Wars; the M-88A1 and A2 were used in Operation Iraqi Freedom and Operation Enduring Freedom. The M-88 in its various forms, are used by 23 countries (and almost all of them use the M-88 in its A1 form, though the new Iraqi Army and Kuwait use the M-88A2). The Egyptians license-produce the M-88A1 and M-88A2. In the US military, some 141 M-88A1s have been replaced by the M-88A2 (out of the 1059 M-81s in the Army), while the Marines lag behind, having put only four M-88A2s into service. At this time, 850 M-88A2s are scheduled to be produced, but this could change at any time.

The M-88 is described as a vehicle with something for every mechanic, from the wide selection of tools to an A-frame crane, and a very good heater, room for a recovered tank's crew, and even racks for things like an M-60 machinegun and four M-136 or six M-72 rockets; as well as the personal weapons of the crew. The M-88 carries basic, wheeled vehicle, tracked vehicle, small arms, and heavy ordinance tools, an air compressor, a welding and cutting set, and tow bars, ropes, chains, and cables. The crane may lift 22.7 tons when braced by the dozer blade, or 18.16 tons without using the blade. The main winch has a capacity of 40.8 tons, or double that with block and tackle. The auxiliary winch has a capacity of 1.9 tons. On the M-88 and the M-88 and M-88A1 are normally used by commander and fourth crewmember.

The M-88 is powered by a gasoline engine developing 750 horsepower; The M-88A1 is powered by a 908-horsepower diesel engine. The M-88A2 has a 1050-horsepower turbocharged diesel. The M-88 and M-88A1 have manual transmissions, while the M-88A2 has an automatic transmission.

The biggest difference between the base M-88 and the M-88A1 is that the M-88A1 is equipped with an 8.1 kW APU. The M-88A1 also has a fuel pump that allows the vehicle to pump fuel from an external source. Finally, the M-88A1 has a 19mm hydraulic impact wrench to assist in track maintenance of tracked vehicles. It is also powered by a diesel engine. The APU is also powered by diesel (and later, JP8). The M-88 series can refuel other vehicles from its own fuel tanks, but there is a 10% chance per refueling operation of clogging the M-88s fuel filters, since an operation draws the fuel from the bottom of the tanks and contains the sediment that collects on the bottom. It has the battery and engine power to slave start even an M-1; the APU can also be used to jump-start vehicles. The APU can also be used to jump start engines. The dozer of the M-88 series can also be used to dig larger fighting positions or conduct general earthmoving. The M-88 has a 10kW gasoline-powered APU; the M-88A1 and A2 use a diesel-powered unit of the same output. The M-88 series is not amphibious, but can ford bodies of water up to 2.6 meters deep with preparation.

The M-88A2 is a progressive development of the M-88A1. The general layout is similar to the M-88A1, but the M-88A2 adds armored side skirts, appliqué armor, stronger suspension, an upgraded engine, improved brakes, and more powerful winches. The M-88A2 is able to recover and tow a 70-ton vehicle at one-third speed, or a 30-ton vehicle at full speed. The M-88A2's crane can lift 35 tons, or 8.4 tons when not braced by the dozer blade. The main winch is capable of pulling 63.6 tons. Directly above the main winch is a lead winch (used to assist in deploying the main winch), which is itself able to pull 3 tons. The fuel pump is able to pump 95 liters per minute. This vehicle is outclassed by the XM-5 but is much cheaper, and crews familiar with the M-88A1 can use it with ease (and the M-88A2 has not been killed in the budget process). The M-88A2 is at its limits when towing an M-1 Abrams; the M-88A1 is really straining to do this and more normally, two M-88A1s are used to tow an Abrams. The M-88 is not capable of this feat. The crane of the M-88A2 is longer and can be moved from side to side in a limited amount. The armor has been increased, and the belly armor is likewise dramatically increased. The crew has been reduced to three, with room for a fourth crewmember if necessary for operations. The four seats for a recovered tank crew are retained. The commander normally operates the tools, with help from the gunner.

The driver is on the top left; the driver of the M-88 uses a tiller setup, while the M-88A1 and A2 use conventional driving controls. All three have a power takeoff for the engine, controlled by the driver. The gunner is in a manually-rotating cupola with all-around vision and a heavy weapons mount. On the center of the rear deck is a hatch for the crane operator and for general overseeing of operations; this is normally used by the commander, and has vision blocks one to the front, two to the left side, and one to the rear. The M-882 has air conditioning and a heater, as well as an Vehicular NBC system; M-88A1 were retroactively fitted with an air conditioner in the late 1990s. The M-88A2 was fitted with a BMS and GPS. The crew of the M-88A2 has a small computer that has the tech manuals and bulletins for most Army (or Marine) vehicles. The M-88 series has a cluster of six smoke grenade launchers on the upper glacis on either side; Marine M-88A2 use five-grenade clusters. M-88-series vehicle have two spotlights, one in the rear and one in the front.

The M-88A2 has suffered from some unresolved problems, such as winch failure when the cable is incorrectly wound around the drum, and problems towing the Abrams in wet, muddy conditions. Crews complain about the lack of armor protection.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-88	$903,224	G, A	3 tons	50.4 tons	4+4	39	Passive IR (D), 2xWL/IR Spotlight (C)	Enclosed
M-88A1	$1,538,581	D, A	3 tons	50.8 tons	4+4	37	Passive IR (D), 2xWL/IR Spotlight (C)	Enclosed
M-88A2	$1,450,471	D, A	3 tons	63.05 tons	3+5	45	Passive IR (D), 2xWL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-88	126/88	35/24	1514	417	Stnd	T6	HF7 HS5 HR4
M-88A1	130/91	36/25	1514	337	Stnd	T6	HF7 HS5 HR4
M-88A2	136/95	38/26	1628	390	Stnd	T6	HF12Sp HS9Sp HS5*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(All)	None	None	M-2HB (C)	1500x.50

*Belly Armor for the M-88A2 is 6Sp. The dozer blade may help protect the vehicle from the front, depending upon where it is positioned; it has an AV of 4Sp.

GDLS M-104 Wolverine

Notes: This is a limited production mechanized bridging vehicle based on the chassis of the M-1A2 SEP main battle tank, also known as the HAB (Heavy Assault Bridge). The shortcomings of the M-60 AVLB are becoming more and more painfully obvious every day, from inadequate speed to an inadequate bridge for heavy vehicles. The US Army has received 44 Wolverines to date, and the Marines are scheduled to receive some in the future. Production is a bit slow right now, due to budgetary restrictions. Currently, the Army does not intend to purchase any more Wolverines, but has the right to order a restart at any time.

The Wolverine uses the chassis of the M-1A2 SEP tank with the turret removed and replaced with bridge-laying equipment. Unlike the illustration in the *US Army Vehicle Handbook*, the bridge is not a three-part scissors-type affair. It uses a bridge similar to that on the German Biber, but able to hold 70 tons with a length of 26 meters, and allowing a gap of 24 meters to be crossed. This bridge takes 5 minutes to deploy and 10 minutes to recover, and the crew does not need to exit the vehicle or even open the hatches to do this. The bridge weighs 10.9 tons, using lighter but stronger construction. (The bridge is in fact designed by Leguan in Germany, the same builders of the Biber's bridge.) The bridge can withstand 5000 full-speed MLC 70 crossings before needing to be replaced. The M-104 has a 15kW APU to power the bridgelaying mechanism so the engine does not have to be running while the deployment is taking place; this is a 12kW generator. This includes the lowering of a dozer blade in front of the vehicle for stabilization. The commander, on the right side of the front hull, operates the bridge controls with simple push buttons, which in part operate a computer assist for the controls. Deployment can be reversed at any time and the bridge can be recovered from either side of the bridge. The buttons can also be used to make small adjustments in the deployment of the bridge. If a trestle is available, two bridges may be laid end to end, with the ends overlapping at the trestle, and a 48-meter gap crossed in this way.

The driver is in the same place, in the center of the front hull. The Wolverine is equipped with BMS system and GPS. The commander is to the driver's left. Both the driver and commander have bridge controls, but the commander usually operates the bridge. The driver and commander have (on opposite sides) a small space for personal gear, able to store something the size of a duffel bag or large rucksack.

Being an M-1A2 SEP chassis, it has the same Honeywell AGT-1500 gas turbine developing 1500 horsepower. With an automatic X1100 transmission. It carries the same fuel and electrical systems, as well as fire suppression and detection systems. It has NBC Overpressure. It has the same armor for the chassis as the M-1A2 SEP's chassis. The vehicle also has a small computer in the commander's compartment with engineering solutions related to bridge use.

The Wolverine was cancelled in 2000, but reinstated in 2004 for low-rate, limited-period production.

Twilight 2000 Notes: This vehicle was approved for production in 1996.

Merc 2000 Notes: This vehicle was cancelled, reapproved, cancelled, and finally reapproved in 2007.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,103,928	D, G, AvG, A	200 kg	70 tons	2	49	Image Intensification (D), 2xWL Spotlights (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
162/114	45/32	1920	556	CiH	T6	TF6 TS6 TR6 HF276Cp HS38Sp HR28*

*The Config of CiH is when the bridge is mounted. When the bridge is deployed, the vehicle's Config is Stnd.

BMY M-578 Light Recovery Vehicle

Notes: This vehicle is common in US units that still use the M-113 series as a primary vehicle; it's original purpose, however, was to provide a vehicle able to make rapid barrel replacements on the M-107 and M-110 SP howitzers, whose barrels wore out quickly. After Desert Storm, VTRs were gradually replaced by M-88-series vehicles. Some 12 countries use or used the VTR. The VTR is known for its speed and maneuverability and may also be air transported in any aircraft at least as big as a C-130; due to its high speed (at the time), it was often used as an *ad hoc* cargo transporter. The VTR was used by some 13 countries, but in most of those, they are out of service.

More commonly known to troops as a VTR (Vehicle, Tracked, Recovery), the M-578 is a US-built recovery vehicle with a chassis as the M-107 and M-110 howitzers. The turret, however, is based on the M-109 SP howitzer. The rear-mounted turret has a crane capable of lifting 13.6 tons; I've personally seen one lift an M-113A2 completely off the ground and mechanics inspect underneath it. The turret can rotate the crane (slowly) while under load, but this is not recommended under a heavy load. The VTR has an integral 10kW generator, a front mounted winch with 70m of cable capable of pulling 27.24 tons (or twice that with block and tackle), and a dozer blade. The dozer is primarily used to stabilize the vehicle while the crane or winch are operating, but it can also be used to smooth dirt surfaces, or dig large fighting positions. The M-578 can tow up to 35 tons, but is slowed to one-quarter movement at that weight. The VTR carries sort of a standard tool set for a recovery vehicle: basic, wheeled, and tracked vehicle tools, electrical tools, an air compressor, and things like bolt cutters, excavation tools, and a welding set, along with scads of spare parts. It does not,

however, have an area where is could carry a powerpack or engine, and normally carries these in a trailer. The suspension can be locked, and a dozer blade at the rear stabilizes the VTR during heavy lifts or winching.

The VTR is not amphibious, the VTR can ford up to a depth of 1.07 meters.

The VTR has a driver's hatch on the front deck, rigger's and crane operator's hatches (the rigger mans the machinegun and also functions as the TC) on the turret deck, as well as doors on the turret sides and a double door on the rear of the turret. Both the rigger and the crane operator have manually-operated cupolas with all-around vision blocks. Power is provided by a Detroit Diesel 8V71T 425-horsepower turbocharged diesel, and a manual Allison XTG-411-2A crossdrive transmission. The VTR is not known for its armor protection. It has a vehicular NBC system that the crew can plug into, but nothing like Overpressure. It went out of service too early to have enhancements like a BMS or GPS mapping.

Just a note: When I was at 24th ID in 1988, our VTRs were replaced with M-88A1s when we got our Bradleys.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$886,101	D, A	2 tons	24.3 tons	3	19	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
128/90	36/25	984	157	Trtd	T4	TF3 HS3 TR3 HF6 HS4 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C) (L-7A2 (C) on British vehicles)	500x.50 (750x7.62mm on British vehicles)

GDLS M-728 CEV

Notes: This vehicle was designed soon after the M-60A1 main battle tank was taken into US service. It was not widely exported, and the only other countries to currently use it are Singapore and Saudi Arabia, though four other countries used it in the past. Few are still used in the US Army; 29 are used by selected engineer units. 262 are in boneyards, USAR service, National Guard, and certain FBI and ATF uses. In the US, the M-728 was no longer used by active duty units after 2000; Desert Storm taught the military that the M-728 could not keep up with Abrams and Bradley formations, and many were simply used for the initial breach in the berm separating Kuwait from Saudi Arabia and then left behind, The CEVs were retired without a replacement. Despite their retirement by the US, the M-728 is still in use by National Guard and a few Reserve units and by Oman, Portugal, Morocco, Saudi Arabia, and Singapore. A controversial use of the M-728 is by the FBI in the Waco Siege, where is was used to fire CS and CN grenades into the compound. Combat use includes Vietnam, where it was used for close assaults, and Desert Storm, where it was used for bunker-busting.

The M-728 retains the base M-60A1 chassis (some were made using the hulls of retired M-60A2s hulls), but a new turret armed with a 165mm M-135 demolitions gun is mounted instead of the 105mm gun turret. This is a very stubby-barreled and short-range weapon based on that used by the British Army's FV-4003 AVRE, and its best use is to destroy fortifications and tank traps, and to a certain extent minefields, instead of as an antivehicle weapon. It more spits a HESH round off instead of "firing" the shell. Mounted on the turret is an A-frame crane with a capacity of 15.88 tons. The crane doubles as a winch, and has 61 meters of cable; it can pull 12.5 tons, and is used mostly to pull items and debris down or out of the way. At the front of the hull is a large dozer blade; this can be removed and replaced with a V-shaped mine plow or mine rake, or even a mine flail system. The standard plow has an AV of 5, the mine plow has an AV of 5 on the top half and 8Sp at the bottom. The mine rake has an AV of 12; the mine flail has an AV of 14Sp, though mines generally do not harm a mine flail. The dozer blade stabilizes the CEV when it lifts with the crane (items can range from empennage to explosive devices); it can also be used to drop explosives into enclosed areas (such as was done in the Waco Siege). An alternate V-shaped plow may be mounted for use as a mine plow, or the standard plow may be used to dig fighting positions and smooth dirt roads. The plows can be raised to a vertical position, allowing a load of whatever to dump off when the blade is lowered.

The normal M-60A1 commander's manually-rotating cupola is on top of this turret; though of course all crewmembers are combat engineers. He mans the machinegun. Beside him is the crane operator; he has a standard loader's hatch for an M-60A1.and also acts as the loader for the main gun. The driver is in his normal slot in the center front of the hull. The winch operator doubles as a gunner. The crew has 20 kilograms of C4 to work with, along with an engineer's demolitions kit, along with a liberal supply of fragmentation, concussion, and thermite grenades.

The M-728 is not amphibious, but can ford up to 2.4 meters.

Power is provided by a Continental ADVS-1790-2 developing 750 horsepower, and coupled to a manual transmission. The chassis is essentially identical to the M-60A1. There were several proposals to re-engine the M-728 to regain its mobility; the 1050-horsepower option in particular would have been good for this. However, re-engining even a large portion of the M-728s on the rolls was not considered budgetworthy.

Twilight 2000 Notes: Just prior to the Twilight War, the M-728 was being phased out of US service, thought to be overkill in a combat engineer role; however, a need for these vehicles was soon found again and they were drawn back out of the boneyards.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$601,570	D, A	700 kg	53.2 tons	4	31	Passive IR, WL/IR Searchlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
120/84	33/23	1420	273	Trtd	T6	TF45 TS17 TR13 HF56 HS12 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	165mm M-135 Demolitions Gun, MAG, M-2HB (C)	30x165mm, 3600x7.62mm, 728x.50, 20 kg C4, Engineer Demo Chest

FMC M-1059A3 Lynx

Notes: This was the US Army's standard smoke generation vehicle until adoption of the M-58 Wolf in the mid-1990s; however, it is still being used in Force Package 2 and Force Package 3 units. Many of these vehicles were sold to US allies and other countries using the M-113A2 base vehicle. The vehicle carrier remained the M-113A2, but was sort of a hybrid vehicle as it had most of the RISE powerpack upgrades, but, for example, steering remains by tillers. The SGS used is an upgrade of an earlier SGS. Some were put into heavy modification, to allow them to be re-issued to Force Package 1 (Active-Duty first-line) units. These modifications are being modified by use of a kit, with some 342 eventually to be modified.

The M-157A2 is an upgrade of the earlier M-167 SGS. It produces visual-blocking smoke screens by using duel pulse jets, and can run on diesel, gasoline, JP4, and JP-8); to a lesser extent, is can block IR, image intensification, and thermal imaging (though results will vary with the viewer -- little degradation is experienced by thermal imagers.) It uses 151 liters in one hour; and the obscurant tank is 450 liters. The Lynx can run off one smoke generator, but the resulting smoke screen is half as thick. The Lynx uses a tactical smoke generator of the 1986-1993 period type, with tanks twice as big as that of the standard tactical smoke generator. The generator and its tanks take up most of the room in the M-113 base vehicle that would normally be used for passengers, so no passengers may be carried. The pulse jet engines and the smoke generation equipment are on two tall boxes on either side of the rear of the vehicle; because of this, the radio antennae have been moved to the front of the roof, 1-3 behind the driver, atop the radios.

The driver occupies the standard left front position as on the M-113A2; the commander has a standard M-113A2 cupola with a pintle-mounted machinegun. The third crewmember is the smoke generator specialist; he sits on the right side facing rear where a control panel is. Controls of the SGS is primarily by push-buttons. He has a hatchway above him. The rear hatch remains, but primarily provides access to the obscurant tanks, and a small amount of personal or other gear. These are normally retrieved through the door in the ramp; there is no room to slip past the obscurant tanks, and SGS mechanisms. Around the obscurant operator is an empty space where ammunition and personal gear kept; it is not usually strapped outside of the vehicle since it will get obscurant embedded in it. The commander and driver have special FLIR devices to see through their own smoke, though it blocks enemy FLIR and night vision and lasers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$896,717	D, A	300 kg	12.2 tons	3	7	FLIR (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
168/118	47/33/5	360	102	Stnd	T2	HF6 HS4 HR4

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

United Defense AAVR7A1

Notes: Originally designated the LVTR7A1, this vehicle is the recovery version of the AAVP7A1 amphibious APC used by the US Marines and other countries. (The US Marines, Argentina, Brazil, Italy, South Korea, Spain, Thailand, and Venezuela use the AAVP7A1 and the AAVR7A1.) The cupola of the AAVP7A1 is not present on this vehicle; instead, the AAVR7A1 has a mount on the commander's position for an M-60D machinegun. On the right side of the hull is a crane with a telescoping arm that reaches 6.55 meters and can lift 6 tons. The winch is at the rear and has a capacity of 13.61 tons. Also installed in the vehicle is an air compressor, 5 kW generator, workbenches, welding gear, and a complete range of tools. A tent comes with the vehicle that can be erected at the rear to extend the workspace. A range of commonly-used spare parts is also carried, including often a powerpack on top if necessary.

The engine and transmission are removable as a unit, like on the AAVP7A1. The lifting capacity of the crane is approximately that of an AAVP7A1's power pack. The driver is on the front left behind the glacis plate and has a single hatch that opens to the rear. He has vision blocks to the front and left side; one of the front vision blocks may be swapped out for night vision block. The commander is to the rear of the driver and has a cupola with all-around vision blocks. The commander's cupola is high enough that he can fire over the open hatch cover of the driver. The crane operator is opposite the commander on the right side, and also has a raised cupola with all-around vision blocks. The entire crew are mechanics and recovery specialists. At the rear is a power-operated ramp. Over the top of the repair is a large hatch, but normal means of exit and entry are via the ramp with its door set in it.

Applique armor is commonly used today, and consists of corrugated aluminum sheets on the sides and front. The extra weight means that a bow plane has to be used when swimming, and one was added for this purpose, which is operated by the driver from inside his position.

The AAVR7A1 is fully amphibious, powered in the water via water jets. The jets have deflectors enabling the AAVR7A1 to turn in the water. If a slower, more controlled transit is desired, the water jets can be shut off and the vehicle propelled in water via its tracks,

which is the second swimming speed listed below. Engine is a Cummins VT-400 developing 400 horsepower. The transmission is manual, but with a power assist.

Newer versions under the AAV RAM/RS Program version use an M-2A1 Bradley engine, including a manual transmission and conventional driving controls. The engine develops 525 horsepower. The suspension was made a variant of the Bradley's suspension, capable of carrying the increased load and incidentally giving the AAVR7A1 a smoother ride while increasing spare parts commonality with the Bradley. This version was originally to be called the AAVR7A2, but came out with the official designation of AARV7A1 RAM. A concurrent program, the AAV SUP (Survivability Enhancement Program) gave the AAVR7A1 enhanced side armor and an enhanced bottom armor plate, as well as improved Kevlar-sheet anti-spalling liners, NBC Overpressure with a vehicular NBC backup and integrated blast-resistant seats. Another improvement initiative, the SAIC, gives the AAV7-series a new automatic transmission, further improved armor including MEXAS armor modules, an upgraded suspension, new, more powerful water jets, an upgraded driver's position, and a BMS with GPS as well as thermal imaging for the commander and a machinegun which may be aimed and fired from under armor. Both of these initiatives were initially to be applied to only a fraction of the total number of AAV7-series vehicles, but with the EFV many years behind schedule and threatened by budget cuts several times per year, more AAV7-series vehicles have both the RAM and SUP upgrades. Vehicles with the SUP initiative do not a different designation, and are identified solely by looks. SAIC was applied to much more AAV7-series vehicles from the beginning. Some 64% of the AAV7-series fleet will eventually receive all three upgrades, as well as a number of minor upgrades; only 7 of these, so far, the full set of upgrades have been done on AAVR7A1s..

There are clusters of five smoke grenade launchers on either side of the glacis plate. The AAVR7A1 can wear the appliqué of the AAVP7A1, except for the turret appliqué (as it has no turret). Crew includes three mechanics (and the vehicle crew are also mechanics), a driver, and a commander, who has a manually-operated cupola and a pintle-mounted machinegun.

Delays in the EFV means that the AAV7-series will be in service at least until 2030.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AAVR7A1	$249,957	D, G, AvG, A	8 tons	23.64 tons	5	15	Passive IR (D)	Shielded
AAVR7A1 w/Appliqué	$243,248	D, G, AvG, A	8 tons	25.64 tons	5	15	Passive IR (D)	Shielded
AAVR7A1 RAM	$244,071	D, A	7.77 tons	24.95 tons	5	13	Passive IR (D)	Shielded
AAVR7A1 SUP	$244,714	D, A	7.28 tons	26.92 tons	5	15	Passive IR (D)	Shielded
AAVR7A1 SAIC	$1,017,237	D, A	7.13 tons	27.52 tons	5	24	Passive IR (D), Thermal Imaging (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AAVR7A1	101/71/28	20/20/5 (4)	647	111	Stnd	T3	HF10 HS7 HR5
AAVR7A1 w/Appliqué	108/75/19	30/21/5 (3)	647	111	Stnd	T3	HF10 HS10Sp HR5
AAVR7A1 RAM	148/104/27	41/29/7 (5)	647	194	Stnd	T3	HF12Sp HS12Sp HR6
AAVR7A1 SUP	139/98/25	39/27/7 (5)	647	194	Stnd	T3	HF12Sp HS15Sp HR6*
AAVR7A1 SAIC	137/96/25	38/27/7 (5)	647	194	Stnd	T3	HF16Cp HF18Cp HF8**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AAVR7A1 (Applique, RAM)	None	None	M-60D (C)	850x7.62mm
AAVR7A1 SUP	None	None	M-60D (C)	1700x7.62mm
AAVR7A1 SAIC	+2	Fair	M-60E2 (C)	1700x7.62mm

*Floor Armor is 5Sp. Roof Armor is 4.

** Floor Armor is 7Sp. Roof Armor is 5.

BAE M-1 ABV Assault Breacher

Notes: Though cancelled in the US Army, the US Marines saw great promise in the M-993 Grizzly CEV with its plethora of obstacle clearing tools. Though the Army decided to cancel it, the Marines decided to develop their own, similar version, the Assault Breacher. The Marines have nicknamed this the Shredder. It's first large-scale use was as a part of ISAF. In addition to clearing obstacles, it can create obstacles and dig fighting positions; one of its primarily roles in Afghanistan was to dig up and detonate mines and IEDs with its specially hardened buckets and mine plow. The Marines have a total of 52, on the way to a projected total of 189. The success of the ABV has led the US Army to take a second look at the Grizzly; 189 were ordered by the US Army in favor of the Grizzly

in 2012. In fact, five are on loan to the US Army for use on the Korean DMV. The ABVs are essentially the Marines' equivalent of the Grizzly, but do not have a Grizzly's capabilities and general utility, being optimized for minefield breaching.

The turret is replaced with a special superstructure; it looks like a turret, but is not. The superstructure is, however, basically a locked-down turret that has been enlarged and modified for its new role. The chassis is an M-1A2 SEP hull, with some turret internal accouterments in the superstructure. The superstructure sides and rear are festooned with armored lockers, as is the back. In normal use, the superstructure is covered on the front and sides with ERA blocks.

The ABV uses a more powerful 20kW APU, which is under armor to reduce its thermal signature. The engine used is the 1500-horsepower Honeywell AGT-1500 gas turbine engine, coupled to an automatic transmission. In fact, as much as possible, the chassis and turret have been retained, though of course the top of the hull and the now nonrotating turret have been heavily modified.

The ABV has a smoke grenade cluster on either side of the front of the superstructure. The normal crew is two men, with the commander/tool operator on the front superstructure with a machinegun able to be aimed fired, and reloaded from within the vehicle, hatches closed. The driver is in his normal place inside the front center. Some ABVs have been further modified with an RWS-type station armed with an M-2HB and a Mk 19, both of which can be aimed, fired, and reloaded from under armor. The RWS mount can of course, rotate 360 degrees. The ABV has air conditioning, heating, and an NBC Overpressure system; it also has BMS and a GPS setup. The ABV carries a large amount of explosives and gear, used also for blowing IEDs in place and clearing or creating obstacles manually.

The plow is 4.5 meters wide and hinges to a V-shape or a straight plow. The plow may also be angled one way or the other. The plow's bottom edge has dozens of high-strength steel teeth for ripping and uncovering IEDs and mines well underground – and the blade may be angled as necessary in relation to the ground. Reaching over the dozer blade, and able to angle to almost 270 degrees, are arms able to dig up large IEDs. Their most important function, however, is as mine detectors and electronic fuze disruptors – They are 80% likely to disable fuzes within 30 meters of the ABV, and detect mines and IEDs. They are able to take an IED or mine blast to various degrees. The Shredder carries two MICLIC launchers on the rear deck.

A negative side of the ABV is that it requires a large amount of maintenance for both its chassis and turret, but also for the plow and subsystems.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ABV	$2,462,321	D, G, AvG, A	400 kg	65.32 tons	2	39	Image Intensification (D, C), Thermal Imager (C)	Shielded
ABV w/RWS	$2,629,037	D, G, AvG, A	400 kg	65.47 tons	2	41	Image Intensification (D, C), Thermal Imager (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
ABV	159/111	44/31	1920	558	Stnd	T6	HF262Cp HS34Sp HR27Sp
ABV w/RWS	159/111	44/31	1920	558	Stnd	T6	TF 8Sp TS6Sp TS6Sp HF262Cp HS34Sp HR27Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
ABV	+1	None	M-2HB (C)	1500x.50, 2000 kg C4, 4 Engineer Demo Chests
ABV w/RWS	+2	Fair	M-2HB, Mk 19 (G)	2000x.50, 200x40mm, 2000 kg C4, 4 Engineer Demo Chests

*The ABV has ERA lugs on the front and side of the superstructure, as well as on the track skirts. The front and sides of the superstructure are normally equipped with ERA. The version with an RWS can also take turret RAM on all sides. The floor armor of the ABV is 20Sp. The dozer blade can protect against frontal hits, and it has an AV of 16Sp.

BAE M-2A2 ODS-E E-BFV

Notes: What that giant acronym means is that this vehicle is the engineer squad vehicle version of the M-2A2, with Operation Desert Storm modifications. Some are also M-2A3 E-BFVs, allowing them to interoperate with Bradley BCTs that are based on the M-2A3; the object is commonality of spare parts. The E-BFV is designed to interoperate with Bradley BCTs and to keep up with the line of march (or move ahead of them in some cases), and maintain the momentum of assaulting forces.

The E-BFV can be equipped with the following devices: a mine roller, a mine plow, or mine flail. It also has an automatic lane marker system (which may also be manually operated), and electronics which allow it to use a small robot to check and if necessary, detonate mines and IEDs. The lane marker assembly consists of two boxes of lane markers on the rear sides of the vehicle, and two on the back of the vehicle on either side of the ramp. The mine plow is a sectional blade which may be configured into a straight blade to clear obstacles, create obstacles, push into buildings, reduce fortifications, and dig fighting positions. As a V-shaped blade (it is hinged in the middle), it functions to push mines and IEDs aside and occasionally detonate them. As an angled blade, it operates as cross between the other two types of blades. The lane markers each have 48 marker flags, and serve to designated safe corridors for

the vehicles that follow the E-BFV; they are fired into the ground far enough for them to remain upright and may be placed on automatic deployment at a given interval or deployed manually in groups of one or more on each side of the E-BFV. Other tools carried include a chainsaw, rotary cutter, and various pioneer tools and construction tools. The E-BFV normally tows a trailer that carries extra equipment and supplies, a MICLIC system, or a minelayer mechanism.

The biggest difference between the E-BFV and the standard M-2A2 ODS or M-2A3 is the lack of a TOW missile launcher in the box on the left side of the turret. Instead, the E-BFV carries additional observation equipment such as LLTVs (at the front and back of the box, a FLIR, and a 2nd Gen Image Intensifier. The rear LLTV is accessible to the driver, and the rest to the gunner and the sapper squad leader via a downlink to a small LCD screen. The E-BFV has a non-lethal (but not eye-safe) laser designed to deactivate mines and IEDs on the surface of up to 250 centimeters below the surface. Note that the latter generally requires having the fuze or center of the mine marked and is therefore not often done. The laser can also disperse crowds or enemy squads by temporarily blinding them. For disposal of obstacles, IEDs or mines, and to blow holes in buildings, the sappers may elect to dismount and blow them manually, using the 30 kilograms of C4 and the equivalent of three engineer demolitions chest. The 25mm Bushmaster autocannon is also retained, in addition to the coaxial machinegun and an a CROWS for the commander. Raised above the turret and driver is a wire cutter to keep them from injuring exposed crewmembers.

The E-BFV is, on paper anyway, designed to carry an engineer squad of six. Experience and testing show that with all the equipment carried, a squad of four is more like it. The crew has a small computer with engineer manuals and tips as well as specs on their vehicle. It has NBC Overpressure along with a vehicle air flushing system. On each side of the turret are two clusters of four smoke grenade launchers. The vehicles have a 15kW APU to run the sensors and tools when the engine is off.

Being a variant of the M-2A2, the following features are common to the two. Lugs for reactive armor blocks are found on the upper sides of the M-2A2 as well as on the glacis. These lugs can also mount bolt-on appliqué armor, bolt-on spaced armor, or the new slat armor if desired. The weight of the M-2A2 increased so much that it is no longer amphibious, and the trim vane and flotation screen have been removed. However, to cope with the increased weight, the VTA-903T was replaced with an upgraded version of the same engine, developing 600 horsepower. The ODS (Operation Desert Storm) upgrades, with such modified vehicles informally called M-2A2ODSs, included an improved, eye-safe laser rangefinder, the addition of a GPS system, an IFF system, thermal imaging for the driver, and a system to jam radio-guided and IR-guided missiles (regarded as only partially effective, but better than nothing). The missile jamming system consists of sensors to detect incoming missiles and automatically put out low-grade radio-jamming signals, launch flares and IR-defeating smoke grenades.

M-2A3 E-BFVs have the upgrades of the M-2A2 ODS. In addition, they have a BMS with GPS and Link-16. The commander has a full flat-panel display/touchscreen and computer control; the gunner and driver have touchscreens of their own that display information appropriate to their roles. In the passenger compartment, mounted on a bracket that is against the turret basket but not actually attached to it (i.e., it does not rotate with the turret), is another large display to provide the dismount squad with information on the battlefield situation and allow them to plan, receive and provide updated information. Along with this capability, GPS and an INU (Inertial Navigation Unit) have been added. The M-2A3 has a computer (which has been steadily upgraded over time) to allow it to quickly receive, integrate, display, and send real-time battlefield information; commanders therefore (usually) know where their units are and their status; the Bradley is therefore a true counterpart to the Abrams on the digital battlefield.

Other improvements a CIS (Commander's Independent Viewer), similar to the CITS of the M-1A2 Abrams III. The commander also retained the ability to see through the gunner's sight. In addition, the commander's thermal imagers were replaced with long-range FLIR systems more akin to those found on aircraft and helicopters. The M-2A3 has an automatic dual target tracking ability, and as the gunner's sighted target is destroyed, the turret can be set to rotate automatically and the gun trained automatically on the commander's sighted target. Fire control s also improved (the system called the IBAS – Improved Bradley Acquisition System), and boresighting is essentially automatic instead of requiring a stop and extensive adjustments. The gunner's sight (the TAS – Target Acquisition System) has received particular attention in the fire control department. The main gun and coaxial machinegun is better stabilized and the ballistic computer improved (able to tap into, to a small amount, the primary computer of the Bradley). The TAS uses a 2nd-generation FLIR and a day TV/image intensification device, with a digital zoom from 4x to 48x, and twice the field of view of the zoom sights of earlier Bradleys. The day TV/image intensifier sees in near-infrared as well visible light, making it usable even in heavy smoke, IR-obscuring smoke, and conditions of low thermal contrast where FLIR imaging would be of little use.

The turret roof of the M-2A3 has a thin layer of added titanium alloy armor, as Desert Storm operations revealed the turret roof to be the weakest surface of the vehicle. As an adjunct to the electronic IFF system, the Bradley accommodates special panels on the sides of the vehicle made of the special aluminum alloy. These panels, when viewed through thermal imagers or FLIRs of the proper wavelength, gives off a heat signature that provides a further deterrent to fratricide. The M-2A3 includes a special cooling system for the vehicle's electronics, but experience in Iraq has led to low-power air conditioning to be fitted to the M-2A3 (and some M-2A2s still in service) to relieve the stifling heat that builds up inside the Bradley.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-2A2 ODS E-BFV	$6,351,906	D, A	900 kg	27 tons	3+4	21	2nd Gen Image Intensification (C), Image Intensification (G), LLTV w/Image Intensification (SQL), Thermal Imaging (D, G), FLIR (C)	Shielded
M-2A3	$1,4912,497	D, A	900 kg	28 tons	3+4	25	Thermal Imaging (D), FLIR (C), nd nd	Shielded

E-BFV							2 Gen FLIR (G), 2 Gen Image Intensification (G), LLTV w/Image Intensification (SQL)

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
M-2A2 ODS E-BFV	134/94	37/26	662	191	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp
M-2A3 E-BFV	151/106	42/29	662	222	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-2A2 ODS E-BFV	+3	Fair	M-242 Bushmaster Autocannon, M-240C, 6xM-231 PFW	900x25mm, 2200x7.62mm, 3070x5.56mm, 20 kg C4, 4 Engineer Demo Chests
M-2A3 E-BFV	+3	Good	M-242 Bushmaster Autocannon, M-240C, 6xM-231 PFW	900x25mm, 2200x7.62mm, 3070x5.56mm, 20 kg C4, 4 Engineer Demo Chests

*Floor Armor is 7. For the M-2A3 E-BFV, the Roof armor is 7. The E-BFV may take ERA, Bar/Slat armor, and appliqué armor, including MEXAS. The sides and front of the vehicle are, in fact, normally equipped with ERA. The E-BFV can also be equipped with the BUSK kit.

FMC CESV AEV

Notes: Also known as the MTVE, this vehicle is similar to the Canadian M-113 ESEV, but based on the larger MTVL chassis. The CESV's ramp may be used as a working platform, and may hold 1.1 tons. It has the same hydraulic auger that may dig in earth, asphalt, and frozen ground to a depth of 3.048 meters and 203mm wide; hydraulic power tools (a chainsaw, jack hammer, impact wrench, jaws of life, round saw), a welding set, and an engineer demo chest. In addition, several lengths of rope and wire cable are carried, along with snatch blocks and hooks. The CESV is also equipped with a light turret; its weapons and the rotation of the turret may be taken over by the commander and the weapon aimed and fired by him. As of 2012, only seven CESV vehicles have been built. The vehicle has a compact APU developing 7 kW, located on the right rear roof.

Like a standard MTVL, the vehicle has a 6V-53TIA Detroit Diesel Electronic Control (DDEC IV) turbocharged intercooled and aftercooled engine developing 400 horsepower. Transmission, and like the MTVL and M-113A3, is has a steering wheel instead of tillers. Like the MTVL, it has stryofoam blocks on the sides to support it while swimming; these are enclosed in light aluminum. The fuel tanks are on either side of the door with an AV of 4; under the floor are special rupture-resistant fuel tanks. The glacis and sides are equipped with lightweight titanium-alloy panels, giving it more armor protection without too much of a weight penalty. The glacis also carries appliqué armor blocks and the floor is made from spaced laminate steel. A Kevlar anti-spall liner has also been installed.

The CESV has ballistic protection a greater standard, to a similar level as the M-2A1 Bradley's hull. This allows the CESV, along with its mobility, to keep up with and destroy obstacles. It also has additional protection against mines, more based on the survivability of the crew and not the vehicle. The gunner sits under a Rafael OHWS containing two machineguns (but an alternate installation on some CESVs replaces the M-2HB with a Mk 19 GMG), with a special rangefinder with ballistic computer, and night vision devices. This is on the top of the vehicle, on the front right side. The commander sits to the left of the gunner in a cupola, though he has a ring of vision blocks on the roof and a night vision device. The driver is in the usual place for the MTVL, on the front left side behind the glacis plate; he also has a night vision channel. The rest of the crew is also in the hull, though the commander sits on the center front slightly to the left; the rest of the engineers site on the right side. There is a hatch in the ramp, and a large hatch on the roof. A domed adjustable ventilator is behind the roof hatch. Though there is room for the commander and up to seven engineers, generally only five are carried. The CESV has a vehicular NBC system; the crew's protective masks can be connected to this by long hoses (though not long enough to allow them to leave the vehicle), 40 kilograms of C4 and an engineer demolitions chest are also carried, though the engineer demolitions kit components are generally broken up and stored in a manner that makes them more accessible. On each side and to the rear are firing ports, and the vehicle is equipped with air condition, a BMS, and a GPS set. The vehicle has a bank of four smoke grenade launchers on either side, which may be fired individually or in salvos by the commander. On the bumpers are four more smoke grenade launchers each; these act as normal smoke and also have a 50% chance of blocking laser designation or rangefinding beams.

Twilight 2000 Notes: This vehicle was taken into service by the US Army in late 1996 as the M-113A4 Sapper Vehicle.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,324,483	D, A	4.2 tons	18.14 tons	3+7	17	Image Intensification (D, G), Thermal	Shielded

Imaging (G, C)

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
130/91	36/25/4	757	120	CiH	T3	TF3Sp TS3Sp TR3 HF10 HS5Sp HR4*

Fire Control	Stabilization	Armament	Ammunition
+2	Fair	M-2HB or Mk 19, MAG	1000x.50 or 320x40mm, 1500x7.62mm, 40 kg C4, Engineer Demo Chest.

*Belly armor is 4Sp.

United Defense M-9 Armored Combat Earthmover (ACE)

Notes: The ACE is basically a military version of a bulldozer, with an armored body. It entered the US Army inventory in 1977, and is perhaps one of the most common engineer vehicles in the world. Most of these vehicles were upgraded starting in 1985 to extend their operational life, and included an appliqué armor package pioneered by the Israelis. Later production included nearly 200 vehicles for South Korea. The US Marines also use the ACE, but did not get any until 1995.

The ACE is a fast vehicle designed to keep up with Infantry Fighting Vehicles and Main Battle Tanks, in order to clear obstacles, create breaches in fortifications, and fill craters and ditches for those vehicles. The ACE is also used to prepare positions and dig fortifications. A secondary role for the ACE is the smoothing and creation of makeshift roads and airfields in rough terrain areas, or the destruction and scarring of road surfaces and runways. It is not suitable as an antimine vehicle, due to the absence of a curved blade and the depth of its bucket.

The ACEs primary feature is its large front-mounted scraper and dozer blade/bucket. The scraper has a capacity of 6.7 cubic meters, and the dozer blade/bucket can move 8 tons at a time. The position of the bucket is adjusted by adjusting the vehicle's hydropneumatic suspension. (When traveling at high speed, this suspension gives the vehicle a smoother ride than might be expected from such a vehicle.) The ACE's digging efficiency can be increased by using the scraper to fill the apron behind the bucket with ballast; this can be ejected at any time, and is also used to fill trenches or build up berms. The ACE also has a winch with a capacity of 15.9 tons, and has a 60-meter cable. The ACE is equipped with a bilge pump for amphibious operations -- it is amphibious with preparation -- but most countries using the ACE have removed the requirement from doctrine that requires the ACE to be swim-capable. The commander has a manually-rotating cupola with all-around vision blocks; the dozer operator also has a hatch above him, with all-around vision blocks..

Power is provided by a Cummins V-903C developing 295 horsepower; transmission is semi-automatic and steering is by tillers. Armor is basic aluminum, but is nothing to write home about. The ACE has a tow pintle that also allows several vehicles to be connected to allow for a larger line pull.

SIP improvements began in 1996. The base armor is an aluminum-aramid-steel sandwich, and the appliqué adds armor similar to that of the Bradley, along with improvements to the belly armor and increased strength to the tracks. Other improvements consists of improvements to fix deficiencies in the suspension and treads, and the addition of new access panels to make maintenance easier. In addition, new filters and filtration methods maintain the complicated and critical hydraulic system of the ACE clean. The dozer blade has been changed in composition from aluminum to steel, as repair and replacement of the aluminum dozer was coming too often. The large dozer blade could be folded from inside the cab; folding the blade protects it from damage in cross-country travel, and folding the old blade took a half an hour of outside work from both members of the crew, and is problematic when under fire and a quick withdrawal is necessary. The winch's capacity has been raised to 25 tons, and the new winch is two-speed.

A possible future SIP is an OHWS with an M-2HB, a Mk 19, or both, in addition to a third crewman to operate it. In addition, air conditioning, a BMS with GPS, and NBC Overpressure are on the idea list. This is listed below as "M-9A2," though this is a designation I am using for this possible future modification and not a real-world designation. A third SIP is being planned, which will increase the reliability of the mechanical and electrical systems, making them stronger and more flexible in their use. It also provides the ACE with a more powerful engine, a Cummins turbocharged diesel with an output of 400 horsepower. I have noted this below as "M-9A3" though this not an official demonstration.

The SIPs are being performed as vehicles come into 3rd echelon or depot-level maintenance. The Army and Marines are well aware of the vehicle's vulnerability to ground fire; extra armor has been provided as part of the SIPs and normally, the ACE is protected by a Bradley or LAV-25 when working or traveling.

Though capable of carrying more crew, the M-9 and M-9A1 normally operate with only one crewmember, and the M-9A2 and M-9A3 with two.

The ACE is air-portable in any aircraft at least the size of the C-130 Hercules. There is a cluster of four smoke grenade launchers on each front corner.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-9 ACE	$420,485	D, A	1.8 tons	16.28 tons	2	14	Headlights	Shielded
M-9A1 ACE	$577,609	D, A	1.54 tons	17.31 tons	2	15	Headlights	Shielded

M-9A2 ACE	$1,596,119	D, A	1.44 tons	17.82 tons	3	20	Thermal Imaging (G)	Shielded
M-9A3 ACW	$1,596,915	D, A	1.44 tons	17.87 tons	3	20	Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-9 ACE	144/101	40/28/4	507	109	Stnd	T3	HF3Sp HS3Sp HR2Sp*
M-9A1 ACE	138/96	38/27/4	507	109	Stnd	T4	HF9Sp HS6Sp HR4Sp**
M-9A2 ACE	124/87	35/24	507	109	CiH	T4	TF4 TS4 TR4 HF9Sp HS6Sp HR4Sp**
M-9A3 ACE	155/109	43/30	507	148	CiH	T4	TF4 TS4 TR4 HF9Sp HS6Sp HR4Sp**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-9A2/A3 ACE	+2	Fair	M-2HB, Mk 19	2000x.50, 500x.40mm

*The dozer blade has an AV of 6, and is 50% likely to be hit is the shot comes from the front, adding to the vehicle's AV. If the blade is folded, this chance is 25%, but the AV is then 12.

**The steel dozer blade has an AV of 8, and is 50% likely to be hit is the shot comes from the front, adding to the ACE's AV. If the blade is folded, this chance is 25%, but the AV is then 16. Floor AV is 6Sp.

FMC M-58 Wolf

Notes: This is the US Army's current standard smoke generation vehicle, along with the M-56 Coyote. It is also used by several of America's allies. It uses a tactical smoke generator of the 1994-2000 period type on the latest M-113A3 chassis, featuring large area multispectral obscurants. It has the RISE improvements that are normally fitted to the M-113A4. This allows for greater speed to keep up with Bradley and Abrams formations. The Wolf uses smoke fuel and fog oil tanks twice as large as the standard tactical smoke generator. The Wolf has two large rotatable exhaust pipes for the smoke generator.

The commander and driver are in the same positions as on a standard M-113A3. The third crewmember is the smoke equipment operator, who sits at a panel of instruments and controls, on the center right side facing to the rear. He has a cupola above him. The driver has a hatch above him, with vision blocks to the left and front; the front one has a night channel, along with the center block of the commander. The rear ramp and door remain, but they act primarily as access doors to the generation equipment. There are also access panels on either side. The commander can aim and fire his machinegun with the hatch closed. The crew has vehicular NBC hookups for its crew. The third crewmember is inside the hull.

The engine is that of the M-113A4 – a 275 horsepower Detroit Diesel 6V53T turbocharged diesel, with an automatic transmission and conventional driving controls.

The SGS is currently able to, on one tank of obscurants, able to produce 90 minutes of visual obscuration and 30 minutes of IR/Thermal obscuration. (Future improvements in the obscurants include the blocking of MMW.) The Wolf may be charging at full speed, turning sharply or widely, and other such moves while laying down the screen. (The driver and commander have uncooled FLIR viewers to deal with the smoke.) The SGS operator can lay the screen as haze, blanket, or curtain (the thickest smoke). A raised area on the roof makes room for the SGS while also allowing access and replenishment of obscurants. The obscurants emerge from a funnel-shaped pipe at the right rear of the deck. The SGS may use the appliqué armor of the M-113 series.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$727,808	D, A	300 kg	13 tons	3	13	FLIR (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
163/114	45/32/5	400	104	Stnd	T2	HF6 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	M-2HB (C)	2000x.50

GDLS M-60 AVLB

Notes: This is an armored vehicle-launched bridge most commonly found in US service (by the Army and Marines), and is also used by Germany, Israel, Pakistan, Singapore, Spain, and Taiwan. As the name suggests, most are based on the M-60A1 main battle tank, with a bridge that has a capacity of 54.43 tons; some are based on an M-48A3 or A5 chassis that has been brought up to M-60A1 standards, or the chassis from the retired M-60A2 (and all are identical for game purposes). Current plans call for a slow-rate replacement by the M-104 Wolverine, though Congress and the President have killed the M-104 more than once (only to arise from the dead). Export operators include Egypt, Iran, Israel, Pakistan, Singapore, and Spain. It should be noted that the M-60 AVLB is not capable of keeping up with modern fighting vehicles on a swift march, and normally one or two fighting vehicles “guard” it (and other

such vehicles that are needed but can't keep up).

The scissors-type bridge may cross a gap of 18.29 meters, and takes 3 minutes to deploy and 10 minutes to recover. It is made of high-strength aluminum. The bridge is a scissors-type bridge, and thus the bridge hinge is raised high into the air during its deployment. The trackway is 3.81 meters wide; each treadway is 1.75 meters. It is normally used for MLC 60 vehicles max, but a (very) limited amount of MLC 70 traffic may cross; each such vehicle that exceeds the MLC 60 limited have a 1% chance of permanently damaging the bridge so that it cannot be recovered. If the M-60 AVLB reduces the gap to be spanned to 15 meters, it can allow MLC 70 vehicles to cross without danger of damaging the bridge. Such heavy vehicles may cross only at one-quarter normal speed. As the bridge deploys, stabilizers also automatically deploy at the front of the vehicle. These stabilizers are raised off the ground so the AVLB can cross its own bridge, then the AVLB turns around, puts the stabilizers back on the ground, and the stabilizers automatically retracts and stow themselves as the bridge is recovered. By itself, the bridge weighs 13.38 tons.

The M-60 AVLB chassis is virtually identical to the M-60A1; the turret is. Of course, removed and replaced with the bridge and its deployment machinery. The automotive characteristics and most of the chassis is unchanged from the M-60A1 chassis, with a Continental AVDS-1790-2DR turbocharged diesel developing 750 horsepower, with an automatic transmission and suspension by torsion bars, and shock absorbers on the front and rear pairs of roadwheels. Army versions have clusters of four smoke grenade launchers on each fender; Marine M-60 AVLBs have clusters of five.

The M-60 AVLB has a crew of two – the driver and the commander, who doubles as the bridge operator. There is a tightly-cramped tunnel between the driver's and commander's position, and each has a small space beside them for personal items (though not nearly all will fit).The bridge may be deployed from the driver's or bridge operator's position. The crew does not have to leave the vehicle or open the hatches to deploy or recover the bridge, though it is preferred that the TC get out of the vehicle and acts as a ground guide. The crew compartments have NBC Overpressure and a heater; later improvements (after the 1991 Gulf War) added an air conditioner and improved the reliability of the vehicle mechanically and electrically in general. Even later improvements (early 2000s) added a BMS and GPS. These did not have special designations, though for game purposes I have labeled then Upgrade 1 and 2.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-60 AVLB	$605,148	D, A	200 kg	55.21 tons	2	23	Passive IR (D)	Shielded
M-60 AVLB (Upgrade 1)	$605,483	D, A	200 kg	55.23 tons	2	23	Passive IR (D)	Shielded
M-60 AVLB (Upgrade 2)	$1,130,489	D, A	200 kg	55.78 tons	2	26	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-60 AVLB	118/83	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8*
M-60 AVLB (Upgrade 1)	118/82	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8*
M-60 AVLB (Upgrade 2)	117/82	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8*

*The CiH configuration refers to the AVLB with the bridge mounted. If the bridge is deployed, Config is Stnd.

GDLS M-60 AVLM

Notes: The M-60 AVLM (Armored Vehicle Launched MICLIC) began as a field modification of a standard M-60 AVLB during Desert Storm. The bridge is removed from the vehicle, the bridge deployment machinery retracted, and up to two line charge machinery of a standard M-58A3 MICLIC (Mine-Clearing Line Charge) trailer is mounted on top of the hull at the rear. This allows a mine-clearing solution much more mobile than a trailer while carrying the ability for follow-up shots, as well as allowing the engineers to be better protected than in a truck, HMMWV, or even APC towing a trailer. It is also less vulnerable than a trailer-mounted solution. For the time being, these modified vehicles are still in service, though some have been converted back to AVLBs. Operation Desert Storm showed that the M-60 AVLM has some problems keeping up with a maneuver force consisting of Abrams and Bradleys. Like many such specialist vehicles that cannot keep up with the pace of march, the AVLMs are often escorted by tanks or APCs and IFVs. The AVLM normally operated in an engineer platoon with vehicles with mine plows, combat engineer squads in special vehicles, and vehicles with other specialist gear, along with the protective elements.

The MICLIC launcher carries two line charges; a further four are carried on the vehicle for follow-up shots, but the crew must leave

armor protection to load these charges. The line charge is fired from the AVLM, and starting 20 meters from the AVLM, a 107-meter long line of C4 charges are laid straight ahead. Each meter of the charge contains 7.44 kg of C4, for a burst radius of 40 and a concussion value of 11. Any mines in this radius may be set off, causing their own explosions if they do. Once all sympathetic detonations have occurred, the AVLM, other vehicles, and personnel may proceed through the cleared area (hoping all the mines have been set off). In practice, the AVLM is usually followed by a tank or engineer vehicle equipped with a mine plow, roller, or flail, as the MICLIC typically fails to clear up to 50% of the mines in a lane. Normally, two AVLMs set on either side of the line of march, fire their MICLICs, then the mine dozers or flail tanks go in. A sapper squad checks the area quickly, then the line of march goes in. After that, sappers place markers for subsequent lines of march. Minefields are a real pain.

The MICLIC launchers and line charges are carried beneath armored sponsons, which raise along with the line charges and deployment rockets to approximately a 45-degree angle. Reloading a sponson requires 10 minutes and requires four personnel to stand atop the vehicle and reload (two for one sponson).

The AVLM was a field modification first used during the 1991 Gulf War, and there were never any purpose-built AVLMs, though it was a common modification, and kits were built to allow the modification. No AVLM M-60 mods were used in Iraq and Afghanistan, and they did not receive the Upgrades that the AVLB version received. The AVLM modification may be accomplished by 4 personnel with appropriate skills and equipment; normally, at least one person on the team must have the Mechanic or Combat Engineer skill, and must pass an Average test. The modification can be done in 2 hours by those four persons if they have a MICLIC trailer, basic tools, and a crane, whether ground or vehicle-mounted. At any time, the AVLM may be converted back to an AVLB by removing the MICLIC units and re-mounting the bridge. The operator is normally a Combat Engineer, but the controls are ad hoc and simple and the bridge crew can launch the MICLICs after a short lesson.

Being a subtype of the M-60 AVLB, is has the same automotive characteristics and most of the chassis is unchanged from the M-60A1 chassis, with a Continental AVDS-1790-2DR turbocharged diesel developing 750 horsepower, with an automatic transmission and suspension by torsion bars, and shock absorbers on the front and rear pairs of roadwheels. They have clusters of four smoke grenade launchers on each fender. The AVLM is normally crewed by sappers. (One criticism before the Desert Shield and Desert Storm was that the sappers did not receive enough training on what was essentially a new weapons system to them.) Like the AVLB, the AVLM's driver position is slightly back from that of the M-60 tank, and in the center of the vehicle is the commander/MICLIC operator. Internally, the crew positions are identical to the AVLB, except for the control box at the commander's position.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$1,025,096	D, A	400 kg	51.33 tons	2	23	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
112/78	31/22	1457	271	CiH	T6	TF5 TS5 TR5 HF56 HS15 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	2xMICLIC Launchers	8xLine Charge

BMY M-88 Hercules

Notes: This is the longtime standard armored recovery vehicle of the US Army, and to a far more limited extent, the Marines. It is also used by 19 other countries worldwide. It was in the process of being replaced by the M-88A2 and M-5 in US service and by the M-88A2 in some other countries, but the M-5 was killed in the budget and the M-88A2 suffered a dramatic slowing of the purse strings. The original M-88 was introduced in 1961 and replaced (largely by upgrading) by the M-88A1 in 1977, and the M-88A2 (mostly new-build vehicles) in 1997. Most Marine M-88s are M-88A1s; they are slowly and steadily building up a stock of M-88A2s, but nowhere near the rate of the Army. The M-88 is a veteran of the Vietnam and Gulf Wars; the M-88A1 and A2 were used in Operation Iraqi Freedom and Operation Enduring Freedom. The M-88 in its various forms, are used by 23 countries (and almost all of them use the M-88 in its A1 form, though the new Iraqi Army and Kuwait use the M-88A2). The Egyptians license-produce the M-88A1 and M-88A2. In the US military, some 141 M-88A1s have been replaced by the M-88A2 (out of the 1059 M-81s in the Army), while the Marines lag behind, having put only four M-88A2s into service. At this time, 850 M-88A2s are scheduled to be produced, but this could change at any time.

The M-88 is described as a vehicle with something for every mechanic, from the wide selection of tools to an A-frame crane, and a very good heater, room for a recovered tank's crew, and even racks for things like an M-60 machinegun and four M-136 or six M-72 rockets; as well as the personal weapons of the crew. The M-88 carries basic, wheeled vehicle, tracked vehicle, small arms, and heavy ordinance tools, an air compressor, a welding and cutting set, and tow bars, ropes, chains, and cables. The crane may lift 22.7 tons when braced by the dozer blade, or 18.16 tons without using the blade. The main winch has a capacity of 40.8 tons, or double that with block and tackle. The auxiliary winch has a capacity of 1.9 tons. On the M-88 and the M-88 and M-88A1 are normally used by commander and fourth crewmember.

The M-88 is powered by a gasoline engine developing 750 horsepower; The M-88A1 is powered by a 908-horsepower diesel engine. The M-88A2 has a 1050-horsepower turbocharged diesel. The M-88 and M-88A1 have manual transmissions, while the M-88A2 has an automatic transmission.

The biggest difference between the base M-88 and the M-88A1 is that the M-88A1 is equipped with an 8.1 kW APU. The M-88A1 also has a fuel pump that allows the vehicle to pump fuel from an external source. Finally, the M-88A1 has a 19mm hydraulic impact

wrench to assist in track maintenance of tracked vehicles. It is also powered by a diesel engine. The APU is also powered by diesel (and later, JP8). The M-88 series can refuel other vehicles from its own fuel tanks, but there is a 10% chance per refueling operation of clogging the M-88s fuel filters, since an operation draws the fuel from the bottom of the tanks and contains the sediment that collects on the bottom. It has the battery and engine power to slave start even an M-1; the APU can also be used to jump-start vehicles. The APU can also be used to jump start engines. The dozer of the M-88 series can also be used to dig larger fighting positions or conduct general earthmoving. The M-88 has a 10kW gasoline-powered APU; the M-88A1 and A2 use a diesel-powered unit of the same output. The M-88 series is not amphibious, but can ford bodies of water up to 2.6 meters deep with preparation.

The M-88A2 is a progressive development of the M-88A1. The general layout is similar to the M-88A1, but the M-88A2 adds armored side skirts, appliqué armor, stronger suspension, an upgraded engine, improved brakes, and more powerful winches. The M-88A2 is able to recover and tow a 70-ton vehicle at one-third speed, or a 30-ton vehicle at full speed. The M-88A2's crane can lift 35 tons, or 8.4 tons when not braced by the dozer blade. The main winch is capable of pulling 63.6 tons. Directly above the main winch is a lead winch (used to assist in deploying the main winch), which is itself able to pull 3 tons. The fuel pump is able to pump 95 liters per minute. This vehicle is outclassed by the XM-5 but is much cheaper, and crews familiar with the M-88A1 can use it with ease (and the M-88A2 has not been killed in the budget process). The M-88A2 is at its limits when towing an M-1 Abrams; the M-88A1 is really straining to do this and more normally, two M-88A1s are used to tow an Abrams. The M-88 is not capable of this feat. The crane of the M-88A2 is longer and can be moved from side to side in a limited amount. The armor has been increased, and the belly armor is likewise dramatically increased. The crew has been reduced to three, with room for a fourth crewmember if necessary for operations. The four seats for a recovered tank crew are retained. The commander normally operates the tools, with help from the gunner.

The driver is on the top left; the driver of the M-88 uses a tiller setup, while the M-88A1 and A2 use conventional driving controls. All three have a power takeoff for the engine, controlled by the driver. The gunner is in a manually-rotating cupola with all-around vision and a heavy weapons mount. On the center of the rear deck is a hatch for the crane operator and for general overseeing of operations; this is normally used by the commander, and has vision blocks one to the front, two to the left side, and one to the rear. The M-882 has air conditioning and a heater, as well as an Vehicular NBC system; M-88A1 were retroactively fitted with an air conditioner in the late 1990s. The M-88A2 was fitted with a BMS and GPS. The crew of the M-88A2 has a small computer that has the tech manuals and bulletins for most Army (or Marine) vehicles. The M-88 series has a cluster of six smoke grenade launchers on the upper glacis on either side; Marine M-88A2 use five-grenade clusters. M-88-series vehicle have two spotlights, one in the rear and one in the front.

The M-88A2 has suffered from some unresolved problems, such as winch failure when the cable is incorrectly wound around the drum, and problems towing the Abrams in wet, muddy conditions. Crews complain about the lack of armor protection.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-88	$903,224	G, A	3 tons	50.4 tons	4+4	39	Passive IR (D), 2xWL/IR Spotlight (C)	Enclosed
M-88A1	$1,538,581	D, A	3 tons	50.8 tons	4+4	37	Passive IR (D), 2xWL/IR Spotlight (C)	Enclosed
M-88A2	$1,450,471	D, A	3 tons	63.05 tons	3+5	45	Passive IR (D), 2xWL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-88	126/88	35/24	1514	417	Stnd	T6	HF7 HS5 HR4
M-88A1	130/91	36/25	1514	337	Stnd	T6	HF7 HS5 HR4
M-88A2	136/95	38/26	1628	390	Stnd	T6	HF12Sp HS9Sp HS5*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(All)	None	None	M-2HB (C)	1500x.50

*Belly Armor for the M-88A2 is 6Sp. The dozer blade may help protect the vehicle from the front, depending upon where it is positioned; it has an AV of 4Sp.

GDLS M-104 Wolverine

Notes: This is a limited production mechanized bridging vehicle based on the chassis of the M-1A2 SEP main battle tank, also known as the HAB (Heavy Assault Bridge). The shortcomings of the M-60 AVLB are becoming more and more painfully obvious every day, from inadequate speed to an inadequate bridge for heavy vehicles. The US Army has received 44 Wolverines to date, and the Marines are scheduled to receive some in the future. Production is a bit slow right now, due to budgetary restrictions. Currently, the Army does not intend to purchase any more Wolverines, but has the right to order a restart at any time.

The Wolverine uses the chassis of the M-1A2 SEP tank with the turret removed and replaced with bridge-laying equipment. Unlike the illustration in the *US Army Vehicle Handbook*, the bridge is not a three-part scissors-type affair. It uses a bridge similar to that on the German Biber, but able to hold 70 tons with a length of 26 meters, and allowing a gap of 24 meters to be crossed. This bridge takes 5 minutes to deploy and 10 minutes to recover, and the crew does not need to exit the vehicle or even open the hatches to do this. The bridge weighs 10.9 tons, using lighter but stronger construction. (The bridge is in fact designed by Leguan in Germany, the same builders of the Biber's bridge.) The bridge can withstand 5000 full-speed MLC 70 crossings before needing to be replaced. The

M-104 has a 15kW APU to power the bridgelaying mechanism so the engine does not have to be running while the deployment is taking place; this is a 12kW generator. This includes the lowering of a dozer blade in front of the vehicle for stabilization. The commander, on the right side of the front hull, operates the bridge controls with simple push buttons, which in part operate a computer assist for the controls. Deployment can be reversed at any time and the bridge can be recovered from either side of the bridge. The buttons can also be used to make small adjustments in the deployment of the bridge. If a trestle is available, two bridges may be laid end to end, with the ends overlapping at the trestle, and a 48-meter gap crossed in this way.

The driver is in the same place, in the center of the front hull. The Wolverine is equipped with BMS system and GPS. The commander is to the driver's left. Both the driver and commander have bridge controls, but the commander usually operates the bridge. The driver and commander have (on opposite sides) a small space for personal gear, able to store something the size of a duffel bag or large rucksack.

Being an M-1A2 SEP chassis, it has the same Honeywell AGT-1500 gas turbine developing 1500 horsepower. With an automatic X1100 transmission. It carries the same fuel and electrical systems, as well as fire suppression and detection systems. It has NBC Overpressure. It has the same armor for the chassis as the M-1A2 SEP's chassis. The vehicle also has a small computer in the commander's compartment with engineering solutions related to bridge use.

The Wolverine was cancelled in 2000, but reinstated in 2004 for low-rate, limited-period production.

Twilight 2000 Notes: This vehicle was approved for production in 1996.

Merc 2000 Notes: This vehicle was cancelled, reapproved, cancelled, and finally reapproved in 2007.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$2,103,928	D, G, AvG, A	200 kg	70 tons	2	49	Image Intensification (D), 2xWL Spotlights (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
162/114	45/32	1920	556	CiH	T6	TF6 TS6 TR6 HF276Cp HS38Sp HR28*

*The Config of CiH is when the bridge is mounted. When the bridge is deployed, the vehicle's Config is Stnd.

BMY M-578 Light Recovery Vehicle

Notes: This vehicle is common in US units that still use the M-113 series as a primary vehicle; it's original purpose, however, was to provide a vehicle able to make rapid barrel replacements on the M-107 and M-110 SP howitzers, whose barrels wore out quickly. After Desert Storm, VTRs were gradually replaced by M-88-series vehicles. Some 12 countries use or used the VTR. The VTR is known for its speed and maneuverability and may also be air transported in any aircraft at least as big as a C-130; due to its high speed (at the time), it was often used as an *ad hoc* cargo transporter. The VTR was used by some 13 countries, but in most of those, they are out of service.

More commonly known to troops as a VTR (Vehicle, Tracked, Recovery), the M-578 is a US-built recovery vehicle with a chassis as the M-107 and M-110 howitzers. The turret, however, is based on the M-109 SP howitzer. The rear-mounted turret has a crane capable of lifting 13.6 tons; I've personally seen one lift an M-113A2 completely off the ground and mechanics inspect underneath it. The turret can rotate the crane (slowly) while under load, but this is not recommended under a heavy load. The VTR has an integral 10kW generator, a front mounted winch with 70m of cable capable of pulling 27.24 tons (or twice that with block and tackle), and a dozer blade. The dozer is primarily used to stabilize the vehicle while the crane or winch are operating, but it can also be used to smooth dirt surfaces, or dig large fighting positions. The M-578 can tow up to 35 tons, but is slowed to one-quarter movement at that weight. The VTR carries sort of a standard tool set for a recovery vehicle: basic, wheeled, and tracked vehicle tools, electrical tools, an air compressor, and things like bolt cutters, excavation tools, and a welding set, along with scads of spare parts. It does not, however, have an area where is could carry a powerpack or engine, and normally carries these in a trailer. The suspension can be locked, and a dozer blade at the rear stabilizes the VTR during heavy lifts or winching.

The VTR is not amphibious, the VTR can ford up to a depth of 1.07 meters.

The VTR has a driver's hatch on the front deck, rigger's and crane operator's hatches (the rigger mans the machinegun and also functions as the TC) on the turret deck, as well as doors on the turret sides and a double door on the rear of the turret. Both the rigger and the crane operator have manually-operated cupolas with all-around vision blocks. Power is provided by a Detroit Diesel 8V71T 425-horsepower turbocharged diesel, and a manual Allison XTG-411-2A crossdrive transmission. The VTR is not known for its armor protection. It has a vehicular NBC system that the crew can plug into, but nothing like Overpressure. It went out of service too early to have enhancements like a BMS or GPS mapping.

Just a note: When I was at 24th ID in 1988, our VTRs were replaced with M-88A1s when we got our Bradleys.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$886,101	D, A	2 tons	24.3 tons	3	19	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
128/90	36/25	984	157	Trtd	T4	TF3 HS3 TR3 HF6 HS4 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C) (L-7A2 (C) on British vehicles)	500x.50 (750x7.62mm on British vehicles)

GDLS M-728 CEV

Notes: This vehicle was designed soon after the M-60A1 main battle tank was taken into US service. It was not widely exported, and the only other countries to currently use it are Singapore and Saudi Arabia, though four other countries used it in the past. Few are still used in the US Army; 29 are used by selected engineer units. 262 are in boneyards, USAR service, National Guard, and certain FBI and ATF uses. In the US, the M-728 was no longer used by active duty units after 2000; Desert Storm taught the military that the M-728 could not keep up with Abrams and Bradley formations, and many were simply used for the initial breach in the berm separating Kuwait from Saudi Arabia and then left behind, The CEVs were retired without a replacement. Despite their retirement by the US, the M-728 is still in use by National Guard and a few Reserve units and by Oman, Portugal, Morocco, Saudi Arabia, and Singapore. A controversial use of the M-728 is by the FBI in the Waco Siege, where is was used to fire CS and CN grenades into the compound. Combat use includes Vietnam, where it was used for close assaults, and Desert Storm, where it was used for bunker-busting.

The M-728 retains the base M-60A1 chassis (some were made using the hulls of retired M-60A2s hulls), but a new turret armed with a 165mm M-135 demolitions gun is mounted instead of the 105mm gun turret. This is a very stubby-barreled and short-range weapon based on that used by the British Army's FV-4003 AVRE, and its best use is to destroy fortifications and tank traps, and to a certain extent minefields, instead of as an antivehicle weapon. It more spits a HESH round off instead of "firing" the shell. Mounted on the turret is an A-frame crane with a capacity of 15.88 tons. The crane doubles as a winch, and has 61 meters of cable; it can pull 12.5 tons, and is used mostly to pull items and debris down or out of the way. At the front of the hull is a large dozer blade; this can be removed and replaced with a V-shaped mine plow or mine rake, or even a mine flail system. The standard plow has an AV of 5, the mine plow has an AV of 5 on the top half and 8Sp at the bottom. The mine rake has an AV of 12; the mine flail has an AV of 14Sp, though mines generally do not harm a mine flail. The dozer blade stabilizes the CEV when it lifts with the crane (items can range from empennage to explosive devices); it can also be used to drop explosives into enclosed areas (such as was done in the Waco Siege). An alternate V-shaped plow may be mounted for use as a mine plow, or the standard plow may be used to dig fighting positions and smooth dirt roads. The plows can be raised to a vertical position, allowing a load of whatever to dump off when the blade is lowered.

The normal M-60A1 commander's manually-rotating cupola is on top of this turret; though of course all crewmembers are combat engineers. He mans the machinegun. Beside him is the crane operator; he has a standard loader's hatch for an M-60A1.and also acts as the loader for the main gun. The driver is in his normal slot in the center front of the hull. The winch operator doubles as a gunner. The crew has 20 kilograms of C4 to work with, along with an engineer's demolitions kit, along with a liberal supply of fragmentation, concussion, and thermite grenades.

The M-728 is not amphibious, but can ford up to 2.4 meters.

Power is provided by a Continental ADVS-1790-2 developing 750 horsepower, and coupled to a manual transmission. The chassis is essentially identical to the M-60A1. There were several proposals to re-engine the M-728 to regain its mobility; the 1050-horsepower option in particular would have been good for this. However, re-engining even a large portion of the M-728s on the rolls was not considered budgetworthy.

Twilight 2000 Notes: Just prior to the Twilight War, the M-728 was being phased out of US service, thought to be overkill in a combat engineer role; however, a need for these vehicles was soon found again and they were drawn back out of the boneyards.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$601,570	D, A	700 kg	53.2 tons	4	31	Passive IR, WL/IR Searchlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
120/84	33/23	1420	273	Trtd	T6	TF45 TS17 TR13 HF56 HS12 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	165mm M-135 Demolitions Gun, MAG, M-2HB (C)	30x165mm, 3600x7.62mm, 728x.50, 20 kg C4, Engineer Demo Chest

FMC M-1059A3 Lynx

Notes: This was the US Army's standard smoke generation vehicle until adoption of the M-58 Wolf in the mid-1990s; however, it is still being used in Force Package 2 and Force Package 3 units. Many of these vehicles were sold to US allies and other countries using the M-113A2 base vehicle. The vehicle carrier remained the M-113A2, but was sort of a hybrid vehicle as it had most of the RISE powerpack upgrades, but, for example, steering remains by tillers. The SGS used is an upgrade of an earlier SGS. Some were put into heavy modification, to allow them to be re-issued to Force Package 1 (Active-Duty first-line) units. These modifications are being modified by use of a kit, with some 342 eventually to be modified.

The M-157A2 is an upgrade of the earlier M-167 SGS. It produces visual-blocking smoke screens by using duel pulse jets, and can run on diesel, gasoline, JP4, and JP-8; to a lesser extent, it can block IR, image intensification, and thermal imaging (though results will vary with the viewer -- little degradation is experienced by thermal imagers.) It uses 151 liters in one hour; and the obscurant tank is 450 liters. The Lynx can run off one smoke generator, but the resulting smoke screen is half as thick. The Lynx uses

a tactical smoke generator of the 1986-1993 period type, with tanks twice as big as that of the standard tactical smoke generator. The generator and its tanks take up most of the room in the M-113 base vehicle that would normally be used for passengers, so no passengers may be carried. The pulse jet engines and the smoke generation equipment are on two tall boxes on either side of the rear of the vehicle; because of this, the radio antennae have been moved to the front of the roof, 1-3 behind the driver, atop the radios.

The driver occupies the standard left front position as on the M-113A2; the commander has a standard M-113A2 cupola with a pintle-mounted machinegun. The third crewmember is the smoke generator specialist; he sits on the right side facing rear where a control panel is. Controls of the SGS is primarily by push-buttons. He has a hatchway above him. The rear hatch remains, but primarily provides access to the obscurant tanks, and a small amount of personal or other gear. These are normally retrieved through the door in the ramp; there is no room to slip past the obscurant tanks, and SGS mechanisms. Around the obscurant operator is an empty space where ammunition and personal gear kept; it is not usually strapped outside of the vehicle since it will get obscurant embedded in it. The commander and driver have special FLIR devices to see through their own smoke, though it blocks enemy FLIR and night vision and lasers.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$896,717	D, A	300 kg	12.2 tons	3	7	FLIR (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
168/118	47/33/5	360	102	Stnd	T2	HF6 HS4 HR4

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