



TRACKED ENGINEER VEHICLES

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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; block and tackle is carried which can increase the pull strength to 16 tons. 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. The AVE also normally carries a case of C4 plastic explosive and a smaller case of primercord to blast or reduce obstacles that cannot be removed by more conventional means, along with an Engineer Demo Chest. 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. Two tow bars are normally carries, one on each side

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 321.8 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
\$115,638	D, A	1.36 tons	19 tons	4	17	Headlights, WL Spotlight (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
125/88	35/24	500	120	Std	T3	HF9 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C)	1050x.50, 25 kg C4, 125 m Primercord

*The front dozer blade has an AV of 9. Depending on what the blade is raised to (or not raised), the blade gives the Pionier 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 8 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, or 40 tons with block and tackle. 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 321.8-horsepower turbocharged diesel engine, the same as that on the Pionier 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
\$117,452	D, A	2.98 tons	19.8 tons	4	17	Headlights, WL Spotlight (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
121/85	34/24	500	120	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 Greif a bonus frontal AV of 6Sp.

M113A1-B-Rec

Notes: This armored recovery vehicle is based on an M113A1 chassis updated to M113A2 standards. It is used by Brazil, Australia, Bahrain, Belgium, Egypt, Israel, Lebanon, Netherlands, and Sudan. The M113A1 B-Rec has a main winch with a capacity of 9.07 tons, and has 91.4 meters of cable. This winch is located in the center of the rear compartment. 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 at the rear during heavy winching operations and when using the crane. If the soil is especially soft a third spade can be lowered in the front. The crane is mounted on the left side of the roof, has a reach of 3 meters, and can lift 1.36 tons. M113A1 B-Recs are modified so that, with the hatches closed, the vehicle has NBC Overpressure protection. The M113A1 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.)

The original M113 ARVs were designed in the US, and during their testing were designated XM806; despite much testing with satisfactory results, the US Army ultimately decided to pass on them for its uses.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$169,209	D, A	2.42 tons	13.94 tons	3	13	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
141/99	39/27/4	360	102	Stnd	T2	HF6 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M2HB (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 M4 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
\$49,851	D, A	2.1 tons	19 tons	4	19	WL Spotlight	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
131/92	36/25	320	111	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
\$394,101	D, A	250 kg	14.7 tons	3	10	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor*
149/104	41/29	320	104	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 FV4003 Centurion AVRE

Notes: This is a CEV similar in concept to the US M728, and also a variant of a main battle tank, in this case, the Churchill Mk VII. (In fact, the M728 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 L9A1 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 L8A2 coaxial machinegun, and an L7A2 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 Fiberglass 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 an A-frame 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 1/2/2.2/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	582 kg	51.81 tons	4	36	Passive IR (D, G)	Shielded
Centurion AVRE w/Apliqué	\$1,119,153	D, A	566 kg	54.3 tons	4	36	Passive IR (D, G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Centurion AVRE	101/70	28/20	1037	361	Trtd	T6	TF40 TS17 TR11 HF60 HS13 HR8
Centurion AVRE w/Apliqué	97/68	27/19	1037	361	Trtd	T6	TF45Sp TS17Sp TR16 HF70Sp HS13Sp HR13*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Centurion AVRE	+1	Basic	165mm Demolition Gun,	30x165mm,

L8A2, L7A2 (C)

3000x7.62mm, 50 kg C4
or TNT, Engineer Demo
Chest

*Floor AV is 6Sp.

AEC FV4018 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 L7A2 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 L85s 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
FV4018	\$175,465	D, A	1.9 tons	50 tons	4	36	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV4018	115/81	32/22	386	241	Std	T6	HF22 HS10 HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV4018	None	None	L7A2 (C) or Bren	1600x7.62mm (belted) or 1500x7.62mm (in 50x30- round Bren magazines)

Alvis/BAE FV434

Notes: The ARV part of the FV432 family, the FV434 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 FV434 RMV is the primary subtype of the FV434. It has a crane with a capacity of 3 tons and a flat area at the rear of the deck for powerpacks -- however, an FV430 series powerpack is about the largest one it can handle. The FV434 is equipped with a selection of tools and parts appropriate to its job of repair work. Parts are primarily for FV430 vehicles, though the FV434 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 vehicle, leaving a space for the crane.

The FV434 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 M113's). The FV434 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
FV434	\$72,476	D, G, A	3.26 tons	17.5 tons	4	17	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
FV434	115/80	32/22/5	454	98	Std	T6	HF6 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV434	None	None	L7A2 (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 FV180 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 FV180, 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 FV180: 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 33 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 to 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 Spotlight	Shielded

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	L7A2 (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	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	L7A2	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 current CR ARRIV, 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 if filled with soil). 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. It can also tow a special trailer that carries a Python rocket-propelled MICLIC. (With this trailer, it can clear a route through mines and/or IEDs in a 230-meter long, and 8-meter wide path. The Python trailer carries up to four of these MICLICs. (The blast throw dirt, dust, and smoke in a cloud about 200 meters wide and high. (When it was tested on a British proving ground, households and businesses within a 20-kilometer radius were robo-called to warn them that such a blast would be happening a short time later.) The MICLICs are contained in an elongated barrel when on the trailer. The Python system also has some antipersonnel use if fired at infantry in the open.

The crew consists of a driver on the front left, a commander's hatch at the right front, 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 L8A2 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.) GPS, a mapping module, a vehicle state computer, and a BMS equip the Trojan. The Trojan is equipped with an air conditioner with NBC filters.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Trojan	\$1,089,752	D, A	700 kg	62.5 tons	3	42	Thermal Imaging (D, G, RWS), Image Intensification (RWS), WL/IR	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Trojan	138/97	38/27	1592+600	616	CIH	T6	TF8 TF8 TR8 HF140Cp HS24Sp HR16

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Trojan	+2	Fair	L8A2 (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 CR ARRAV (Challenger Armored Repair and Recovery Vehicle) Rhino

Notes: This is an engineer vehicle based upon the Challenger 1, with a Challenger 2's updated power train. The adoption of the Challenger 1 tank and its 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 50 tons (98 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, or 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 uses GPS navigation and has a BMS.

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, normally casualties from a knocked-out vehicle. The Rhino is equipped with night vision devices and has an L37A2 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.), but it does not have an APU. 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
\$661,129	D, A	5.82 tons	61.2 tons	3+4	38	Thermal Imaging (C, CO), Image Intensification (D, C, CO), WL/IR Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
140/98	39/27	1592	446	Std	T6	HF149 HS21Sp HR16

Fire Control	Stabilization	Armament	Ammunition
+1	Basic	L37A2	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.

FV4002 Chieftain AVRE

There was to be a standardized Chieftain AVRE, with the designation of FV4203, 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. Its secondary role is to recover vehicles, though the most it can do in this activity is to winch out stuck vehicles or tow them back to a rear area for repair. 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, though the commander's position has a steerable spotlight. The vehicle has a small computer which is primarily loaded with field manuals and tech manuals that concern the AVRE's duties. Other electronics include inertial navigation and a mapping computer, loaded originally with maps of the Cold War BAOR AOR and somewhat beyond, and could be loaded with more maps sections as needed. Later, this mapping computer was replaced with one covering most of Europe, part of Russia, and much of the Middle East. The inertial navigation system and the mapping computer were originally borrowed from the Germans, but later replaced with British-made systems.

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. In game terms, this feature means that the Chieftain AVLB may immediately accelerate from Com Mov 0 to Com Mov 8 in the same phase.

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.

FV4006 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 AVRE, 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 L7A2, but M2HBs and Minimis have also been seen of CHAVREs (and in one picture I've seen, an odd-looking L86A1 on a pintle mount).. 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 stats below include four rolls of fascines the same as those of the AVRE above.) 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 able to dig a 50-centimeter-wide hole, a pile driver able to hammer with a force of 890 newtons, or small bucket with a size of 2.5 x 2.5 meters and a capacity of 13.2 tons. (For those in the US and/or not familiar with the newton unit of force, the pile driver can hammer with a force of 200 foot-pounds.)

Along with clearing obstacles, the Chieftain CHAVRE was often tasked with digging fighting positions, using its dozer blade and bucket. 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. In game terms, this feature means that the CHAVRE may immediately accelerate from Com Mov 0 to Com Mov 8 in the same phase, instead of having to start moving at COM Mov 0. Other electronics include inertial navigation and a mapping computer, The interior has an NBC Overpressure system.

The CHAVRE has a secondary role of conducting route reconnaissance. To this end, it has more long-range radios which are data capable.

The British keep some of the AVREs 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 AVRE, CHAVREs are still used by Australia, India, Israel, Netherlands, Sweden, and Switzerland.

FV4205 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. In game terms, this feature means that the Chieftain AVLB may immediately accelerate from Com Mov 0 to Com Mov 8 in the same phase.

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

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Chieftain AVRE	\$664,923	G, AvG, D, A	3.83 tons	52 tons	5	18	Passive IR (D), WL/IR Spotlight (C)	Shielded
Chieftain CHAVRE	\$559,684	G, AvG, D, A	5.4 tons	48.35 tons	4		Passive IR (D), WL/IR Spotlight (C)	Shielded
Chieftain AVLB (No 8 Bridge)	\$437,466	G, AvG, D, A	328 kg	53.3 tons	3	41	Passive IR (D, BO), WL/IR Spotlight (BO)	Shielded
Chieftain AVLB (No 9 Bridge)	\$419,418	G, AvG, D, A	338 kg	50.24 tons	3	41	Passive IR (D, BO), WL/IR Spotlight (BO)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Chieftain AVRE	109/76	30/21	955	277	CIH*	T6	TF8 TS8 TR8 HF84 HS18 HR10**
Chieftain CHAVRE	115/80	32/20	1014	271	CIH*	T6	TF8 TS8 TR8 HF84 HS18 HR10**
Chieftain AVLB (No 8 Bridge)	119/83	33/23	1037	270	CiH	T6	TF10 TS10 TR10 HF48 HS16 HR10***
Chieftain AVLB (No 9 Bridge)	124/87	34/24	1037	270	CiH	T6	TF9 TS9 TR9 HF48 HS16 HR10***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Chieftain AVRE	None	None	L7A2 (C)	1800x7.62mm
Chieftain CHAVRE	None	None	M2HB (C) or L7A2 (C) or Minimi (C)	1100x.50 or 1800x7.62 or 2460x5.56mm
Chieftain AVLB	None	None	L7A2 (C)	4500x7.62mm

*The "turret" is actually the fascine rolls. If they have already been deployed, the configuration of the Chieftain AVRE or CHAVRE changes to "Std." If they are still deployed, personnel casualties resulting from a "turret" hit are considered misses; and electronics hits are considered damage to the fascine rolls or deploying machinery. The

**The Vehicle decks and floors of both vehicles are AV 6. The "turret" AV is per each fascine mounted, rather than as a single "block" of fascines.

***The "turret" is actually the bridge; it does not actually have anyone in it and all personnel hits are considered misses. Electronics hits are actually hits to the bridge deployment machinery.

Alvis FV106 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 FV430 series. Design work began in the early 1970s, with production starting in 1978. Users include Britain, Belgium, Brunei, Philippines, Oman, and Thailand, though they have been out of service with the British Army for several years.

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 equipped with hand tools of most types and a welding set.

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. Later 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 L7A2. 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)	\$77,193	G, A	980 kg	8.74 tons	4	11	Passive IR (D)	Shielded
Samson (Diesel Engine)	\$77,472	D, A	984 kg	8.76 tons	4	11	Passive IR (D)	Shielded
Samson (Perkins Engine)	\$84,749	D, A	987 kg	8.77 tons	4	11	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Samson (Gas Engine)	142/106	42/30/4	405	109	Std	T3	HF6 HS3 HR3
Samson (Diesel Engine)	158/110	44/21/4	405	74	Std	T3	HF6 HS3 HR3
Samson (Perkins Engine)	180/126	50/35/5	405	87	Std	T3	HF6 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Samson	None	None	L7A2 (C)	900x7.62mm

BAE FV180 RO Defence Combat Engineer Tractor (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 Terrier.

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 FV180 are double walled; this 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 FV180 prefer a grenade launcher. The FV180 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 1.72m³, and the maximum lift height is 1.829 meters. (The FV180 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 FV180 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 smooths 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, or 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 FV180 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 torque. Without preparation, the FV180 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 styrofoam, 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 lifting 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 FV180 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 FV180 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 FV180s were deployed to Iraq. (They were not so equipped for Desert Storm.) The weapon mounts are optional; British and Indian FV180s have them, but most of Singapore's FV180s 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 FV180.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$159,350	D, A	763 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	Std	T4	HF6Sp HS4Sp HR4Sp

Fire Control	Stabilization	Armament	Ammunition
None	None	M2HB or Mk 19 AGL (C), L7A2	1000x.50 or 320x40mm; 1000x7.62mm

*The front bucket is 50% likely to be hit by frontal shots. This bucket adds 6Sp to the FV180'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 FV434 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 mostly replaced by the Challenger Repair and Recovery Vehicle, especially in tank units, and the FV512/13 in armored units. The FV434 normally operates as part of a team of FV430-based repair and recovery vehicles; the FV434 is primarily a repair vehicle, and has only a limited recovery capability.

The FV434 is based on the FV432 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 FV432, 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. The FV434 does not have a winch, and it has not the means to conduct a conventional recovery (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 FV434 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.

The FV434 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 FV434 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 FV434 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
\$100,023	D, G, A	2.46 tons	17.75 tons	4	17	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
113/79	32/22/5	454	98	Std	T2	HF6 HS3 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	L7A2 (C) or Bren L2A4 (C)	1600x7.62mm

Alvis FV512 MCRV/FV513 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 FV510 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 FV512 does not have a winch, while the FV513 does. The FV512 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 FV510, with a maximum reach of 4.52 meters. The FV513 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 FV513 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, and a small computer with tech manuals and bulletins to help in the repair.

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
FV512	\$155,955	D, A	1.46 tons	30 tons	5	17	Passive IR (D)	Shielded
FV513	\$165,451	D, A	1.45 tons	30.2 tons	5	18	Passive IR (D)	Shielded
FV513 (w/Side Applique)	\$389,957	D, A	933 kg	32.63 tons	5	21	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV512/513	132/93	37/26	770	202	CIH	T4	TF4 TS4 TR4 HF20 HS6 HR6
FV513 (w/Side Applique)	120/84	33/23	770	202	CIH	T4	TF4 TS4 TR4 HF20 HS12Sp HR6

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

Vickers ARR

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

The Vickers ARR 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, though it

cannot lift any but the smallest of turrets). 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 ARRВ 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 MBТ power pack.

Power is provided by a Detroit Diesel 12V-712T 720-horsepower turbocharged diesel. Vickers will instead equip the Vickers ARRВ with a Perkins CV12 800E turbocharged diesel developing 800 horsepower. (No actual orders for a Vickers ARRВ with this engine have been made, but the stats have been worked out anyway.) The Vickers ARRВ is known for its exceptional suspension. Three of Kenya's Vickers ARRВs 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. (These are labelled below as "Kenyan ARV.") 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 ARRВs 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 ARRВ	\$279,148	D, A	3.05 tons	36.8 tons	4	25	Passive IR (D, C), WL Spotlight (C)	Shielded
Vickers ARRВ w/800hp	\$283,414	D, A	3.13 tons	36.8 tons	4	25	Passive IR (D, C), WL Spotlight (C)	Shielded
Kenyan ARV	\$289,029	D, A	3.19 tons	36.6 tons	4	25	Passive IR (D, C), WL Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Vickers ARRВ	140/98	39/27	1000	267	Std	T6	HF76 HS10 HR8
Vickers ARRВ w/800hp	152/107	42/30	1000	297	Std	T6	HF76 HS10 HR8
Kenyan ARV	141/98	39/27	1000	267	Std	T6	HF76 HS10 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Vickers ARRВ	None	None	L7A2 (C)	2600x7.62mm

BETA PLC MTP-1 CEV

Notes: This combat engineer vehicle is a variant of the MTLBu used by Bulgaria. It can be used to recover and repair vehicles of a similar size and weight., though it is primarily meant to clear debris from routes friendly vehicles will take, and map accessible routes and report them through data-capable radios to higher headquarters and other vehicles with data-capable radios. 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 has 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 crane may be tipped by a bucket able to dig out soil or small rocks.

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 large cargoes. In its role to clear routes, it is equipped with a 5kW APU which is used to power tools, ranging from chainsaws to circular saws to jaws-of-life debris separators. To aid in route reconnaissance, the MTP-1 is equipped with inertial navigation and a mapping module.

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 a few spare parts, but also change the side armor from "no slope" to moderate slope. It also carries a torch to burn away fuselage and a variety of pioneer tools, an engineer demo chest, and an amount of C-4 or RDX to blow stubborn obstacles, as well as primercord to sever tree trunks. 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.

Though the standard crew of the MTP-1 is only two, quite often 1-3 additional combat engineers or mechanics are carried.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTP-1 w/PK & PKT in Turret	\$139,179	D, A	2.62 tons	15 tons	2+3	15	WL/IR Spotlight	Shielded
MTP-1 w/12.7mm & PKT in Turret	\$137,736	D, A	2.58 tons	15 tons	2+3	15	WL/IR Spotlight	Shielded
MTP-1 w/PKT & 12.7mm in Turret	\$137,736	D, A	2.58 tons	15 tons	2+3	15	WL/IR Spotlight	Shielded
MTP w/12.7mm & 12.7mm in Turret	\$141,765	D, A	2.54 tons	15.1 tons	2+3	15	WL/IR Spotlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
MTP-1 w/PK & PKT in Turret	155/108	43/30/4	450	111	Std	T3	HF4 HS3 HR2
MTP-1 w/12.7mm & PKT in Turret	155/108	43/30/4	450	111	Std	T3	HF4 HS3 HR2
MTP-1 w/PKT &	155/108	43/30/4	450	111	Std	T3	HF4 HS3 HR2

12.7mm in Turret MTP w/12.7mm & 12.7mm in Turret	154/108	43/30/4	450	111	Std	T3	HF4 HS3 HR2
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Vehicle	Fire Control	Stabilization	Armament	Ammunition
MTP-1 w/PKT & PKT in Turret	None	None	PKT (C), PKT (Turret)	2500x7.62mm, 50 kg C-4 or RDX, 200mm Primercord
MTP-1 w/12.7mm & PKT in Turret	None	None	DShK or NSVT (C), PKT (Turret)	2500x7.62mm, 1200x12.7mm, 50kg C-4 or RDX, 200m Primercord
MTP-1 w/PKT & 12.7mm in Turret	None	None	PKT (C), DShK or NSVT (Turret)	2500x7.62mm, 1200x12.7mm, 50kg C-4 or RDX, 200m Primercord
MTP w/12.7mm & 12.7mm in Turret	None	None	DShK or NSVT (C), DShK or NSVT (Turret)	1200x12.7mm, 50 kg C-4 or RDX, 200mm Primercord

*The rear blade has AV 4; depending on the position of the blade, this AV may be applied against hits from the lower rear hull or upper rear hull. (When firing at the rear hull, apply a 50-50 chance, unless the firer is aiming; then apply a 75-25% chance.)

Kharkiv Sova NBC/EW Reconnaissance Vehicle

Notes: This is a vehicle based on the BRM-23 IFV, but heavily-modified for it's role. It looks more like the standard MTLBu chassis, with a flat roof, the same layout as the standard MTLBu, including a small turret on right front armed with a PKT machinegun. Externally, it looks almost identical to the MTLBu. Where it is vastly different, however is in the interior and some boxes and ports on the exterior at the front of the roof. These boxes contain an optical chemical sniffer, a biological agent detector, a laser rangefinder/designator, and a radiac meter. The commander has an actual rotating cupola, and the top of the cupola ring is an artillery/rocket aiming circle, which allows the Sova to direct artillery and rocket artillery fire if the need arises. (The secondary role of the Sova is as a general reconnaissance vehicle.) Unlike most MTLBus, the Sova has a night vision suite for the commander, gunner, and driver as well as telescopic sights for the commander, these can be downlinked to the crew manning the sensors inside the vehicle. The Sova-1 has a long-range radio and a medium-range radio. The Sova-1's transmission range for its radios is extended to double range by use of an AZI frame antenna, and it may be extended to triple range by use of a telescoping mast. The long-range radio is data-capable. The Sova-2 is essentially the same, but uses a longer-range radio with 150% range and is also data capable.

The current Sova-3 is equipped with a PNSR-5K Block 87 (NATO reporting name Tall Mike). The dish unfolds out of a box on the rear deck and is anchored to the center deck of the vehicle. The Sova-3 has additional computers to monitor and fix targets, and hand them off to the computers for transmission via long-range radio. The radios have the same general range and capabilities, but are more modern versions of the Sova-2's radios. The Sova-3 has more of a general reconnaissance role than the other Sova variants, and also has two CCD day/night cameras (one on top of the turret to allow it to rotate).

The Sova-1 and Sova-2 are equipped with inertial navigation and a mapping computer. The Sova-3 is equipped with GLONASS with an inertial navigation backup (GLONASS was later replaced with a GPS receiver after Bulgaria's entry into NATO). The commander and driver have MFDs that display the mapping computer's data as well as two MFDs for the crew inside, that display the information from the sensors (or the radar on the Sova-3). If the radar is extended on the Sova-3, the Sova-3 cannot conduct amphibious operations. There is no sampling equipment on the Sova and variants other than the basic sensors. All Sova Variants have ELINT 1 suites, including RDFs and limited MIJI capability. (Radio Jamming 2.) All Sovas have an NBC Overpressure system.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Sova-1	\$794,531	D, A	896 kg	13.6 tons	2+3	17	Image Intensification (D, G, C), Thermal Imaging (C), 2xDay/Night CCD TV (Front, Rear)	Shielded
Sova-2	\$795,161	D, A	989 kg	14.3 tons	2+3	17	Image Intensification (D, G, C), Thermal Imaging (C), 2xDay/Night CCD TV (Front, Rear)	Shielded

Bulgarian Tracked Engineering Vehicles

Sova-3	\$1,123,178	D, A	508 kg	15.1 tons	2+3	18	Image Intensification (D, G, C), Thermal Imaging (C), 2xDay/Night CCD TV (Front, Rear), Radar (60 km)	Shielded
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Sova-1	166/116	46/32/5	450	111	Std	T3	HF4 HS3 HR2
Sova-2	154/108	43/30/4	450	111	Std	T3	HF4 HS3 HR2
Sova-3	148/103	41/29/4	450	111	Std	T3	HF4 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Sova	None	None	PKT (G)	2500x7.62mm

United Defense M113 Engineering Specially Equipped Vehicle (ESEV)

Notes: The ESEV is an M113A2 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); welding gear; and a modified ramp that can be used as a working platform (and may hold up 500kg). Only the Canadian Army uses the M113 ESEV. The ESEV may use the same add-on armor as the standard M113, though Canadian Forces has its own package.

The US tested Canadian ESEVs during Iraqi Freedom. They had three main criticisms of the ESEV: Inadequate armor, inferior mobility, and inferior survivability. The resulting vehicle will be found in US Tracked Engineer Vehicles (upcoming; it is not there now).

DEW (a company in Canada) greatly augmented the M113 ESEV, all the areas required for the American improvements, as well as miniaturization of components, resulting in more interior space. An engine and electrical component upgrade was equivalent to the RISE. These vehicles were based on the M113A3 and MTV-L (M113A4); the increase in space for the M113A3 ESEV was done by better arrangement of the interior, and links to hold supplies on the exterior. As with the MTVL, the MTVL ESEV has its gun position surrounded by AV2 gun shields, and the fuel tanks are in the floor (go to US APCs to find out why). Both have a small computer to offer suggestions for solutions to particular problems encountered by the sappers and some of the calculations required in their work.

These crews often carried one underbarrel or stand-alone grenade launcher for local defense and minor target destruction, though this is not a part of its standard loadout.

For more details of the APCs on which these vehicles are based, go to US Tracked APCs.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M113A2 ESEV	\$609,569	D, A	2 tons	11.65 tons	2+6	8	Passive IR (D)	Shielded
M113A2 ESEV (Appliqué Armor)	\$618,312	D, A	1.96 tons	11.84 tons	2+6	8	Passive IR (D)	Shielded
M113A3 ESEV	\$597,180	D, A	1.34 tons	12.95 tons	2+6	8	Thermal Imaging (D)	Shielded
MTVL ESEV	\$1,105,948	D, A	1.9 tons	18.85 tons				

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
M113A2 ESEV	137/96	34/24/3	360	73	Std	T2	HF6 HS4 HR4
M113A2 ESEV (Appliqué Armor)	135/94	34/24	360	74	Std	T2	HF9Sp HS6Sp HR4
M113A3 ESEV	161/113	40/28	360	102	Std	T2	HF9Sp HS6Sp HR4**
MTVL ESEV	145/102	36/26	492	143	S		HF12Sp HS9Sp HS6Sp***

Vehicle	Fire Control	Armament	Ammunition
M113A2 ESEV	None	M2HB (C)	2000x.50, Engineer Demo Chest, 2xEngineer's Demo Kit
M113A3 ESEV	None	M2HB (C)	2250x.50, 2 Engineer Demo Chests, 5xEngineer Demo Kit
MTVL ESEV	None	M2HB (C)	2500x.50

*The addition of spaced armor over the front of the vehicle requires the removal of the trim vane, making amphibious operations impossible.

**The roof AV for this variant is 3.

***The Roof AV is 3; the floor AV is 4Sp.

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 59A chassis (with some improvements), 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, being operated by manual cranks and wheels. 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
\$759,839	D, A	1.08 tons	31 tons	4	21	Passive IR (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
124/87	35/24	790	154	CiH	T6	TF3 TS3 TR3 HF60 HS10 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	Type 59 (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.

NORINCO GCZ-110

Notes: The PLA describes the GCZ-110 as a "multipurpose armored engineer and recovery vehicle." It is partially based on the Russian IMR series of AEV; however, while it does have many of the same or similar features as the IMR series, it also markedly differs from the IMR. These differences are what allows the GCZ-110 to function in a dual role. The chassis is based on the Type 96 tank, but the turret is heavily-modified to provide a pivot point for the GCZ-110's crane.

The GCZ-110 carries engineer-specific equipment, including an engineer demo chest, 5 engineer demo kits, and 40 kilograms of C4. It also carries equipment which can be used in both roles, such as power tools, a circular saw, a "jaws of life" (actually called a Hurst rescue tool), and a chainsaw, as well as two sets of pioneer tools and basic and heavy tool kits. It carries tools for recovery, including a tow bar, 3 lengths of 30-meter steel wire rope, and the tool kits necessary for working on tracked and wheeled vehicle. There is no area on the rear deck where a powerpack may be carried; normally is one is needed, it will be carried by another vehicle or on a trailer.

The crane can rotate 360 degrees and has a maximum reach of 3.5 meters. At this distance, the crane may lift 3 tons. The crane is normally traversed to the rear when travelling, allowing the plow to be raised straight up for easier travel carriage. The GCZ-110 has a main winch which can be led out of the front or back of the vehicle and has a pull strength of 50 tons, or 100 tons with block and tackle, and has 70 meters of 30-millimeter cable. A lead/auxiliary winch has a capability of 300 kilograms and has 100 meters of 10-millimeter cable.

The GCZ-110 has a large frontally-mounted plow which can be configured in a V-shape for use as a mine/debris plow, or spread out to a flat shape 5 meters wide (wider than the GCZ-110). The plow can also dig fighting positions for vehicles or large generators, and can move 250 cubic meters of soil at once. Other uses the plow include road clearing, grading, and filling ditches or preparing banks for use by an AVLB.

The GCZ-110 has a 118Kw APU to power the vehicle's systems when the engine is off.

The GCZ-110 is lengthened from its Type 96 tank base, though the lengthening is minimal and there are no roadwheels added. Armor of the GCZ-110 carries over from its Type 96 base, though the electrical system has been heavily modified and upgraded. The engine is a 1000-horsepower turbocharged diesel; this engine also has high torque, used when towing or when additional power is required in winch operation.

The GCZ-110 has a BMS, a GPS receiver with an inertial navigation backup, a mapping computer, and a vehicle state computer. The commander, driver, and crane operator have LCD screens at their position which display applicable information – the driver has mainly vehicle state and navigation information, the crane operator has mainly vehicle state and tool states, and the commander has two LCD screen with access to all information. The driver is at the front left, and the commander on the front right; the engine is at the rear. The interior of the GCZ-110 has a small computer with tech manuals for the crew to consult, and two long-range data-capable radios and a short-range radio for communication with the vehicle being recovered or vehicles in the immediate vicinity. The GCZ-110 has no defensive armament other than the small arms of the crew, a box of fragmentation grenades, and an RPG-7 rocket launcher. The GCZ-110 is equipped with air conditioner with NBC filters.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,761,091	D, A	3.74 tons	37.5 tons	3	42	Image Intensification (D, CO, C), FLIR (C), WL/IR Spotlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
180/126	50/35	1000	373	Trtd	T6	TF152Cp TS45Sp TR22 HF190Cp HS32Sp HR20

Fire Control	Stabilization	Armament	Ammunition
None	None	None	50 kg C4 or RDX, Engineer Demo Chest.

*If the plow is in the forward position, it provides an AV of 15Sp to the front of the vehicle. If the plow is raised, the mechanism provides an AV of 7 to the front, though of course this may damage the mechanism.

NORINCO GCZ-112

Notes: Unlike the GCZ-110 above, the GCZ-112 does not do double duty; it is a full AEV and not designed to recover vehicles. However, it is also based on the Type 96 tank chassis. The GCZ-112's primary job is to aid the mobility of armored vehicles and other units, and is heavily armored and has a powerful engine to operate with these vehicles at the FEBA. It looks vaguely like the Russian IMR-2, but has a number of features the IMR-2 doesn't have and doesn't have some features the IMR-2 does have. The GCZ-112 has the Type 96's turret replaced with a raised superstructure and the excavator arm on the right of the vehicle. The GCZ-112 is generally used in operations to fill ditches and move rock obstacles to bashing open pillboxes and filling ditches on top of defenders,

The GCZ-112 has a 52kW APU, used to power the excavator arm and winch when the engine is off (though the APU power and the engine power can be used together to add a little oomph to the winch operation), and can operate the powered tools, excavator arm,, and both winches at the same time. Tools range from basic power tools to hand tools of every type to items like two sizes of chainsaw, three sizes of circular saw, and a Hurst rescue tool. An air compressor is also available.

Instead of a crane, the GCZ-112 has a large excavating arm which can be rotated through 285 degrees and is capable of lifting up to 25 tons of rock, soil, or other debris, and moving it around. The arm can also be used to position a fascine roll, which may be carried on the rear deck. It can also be used as a giant club, to push aside trees, rocks, or in some instances where the fortifications are thin and light, bash down fortifications. It can also do considerable damage to unarmored vehicles which are not moving, causing the equivalent of 20 points of damage to such vehicles per swipe. (The excavator arm is actually able to cause some slicing damage to such vehicles.)

The GCZ-112 has a pulling power of 50 tons, but is able to pull with double or triple strength with proper block and tackle. The main winch has 150 meters of cable. An auxiliary/lead winch has a capacity of 500 kilograms and has 300 meters of cable. The main winch cable is 30 millimeters wide, while that of the aux winch is 10 millimeters thick. The winches can be lead out of the front, rear, or the front sides.

The dozer blade may be put into a V-shape for route or mine clearing, or in a straight configuration for digging or bracing the vehicle. The blade can dig 250 cubic meters per hour, and the blade can also shoulder aside obstacles (especially in its V configuration) or push down certain fortifications.

The engine of the GCZ-112 is the same as that on the Type 96 tank and related vehicles – a 1000-horsepower turbocharged diesel, modified for supplying high torque.

The GCZ-112 has a BMS, a GPS receiver with an inertial navigation backup, a mapping computer, and a vehicle state computer. The commander, driver, and crane operator have LCD screens at their position which display applicable information – the driver has mainly vehicle state and navigation information, the crane operator has mainly vehicle state and tool states, and the commander has two LCD screen with access to all information. The driver is at the front left, and the commander on the front right; the engine is at the rear. The interior of the GCZ-112 has a small computer with tech manuals for the crew to consult, and two long-range data-capable

radios and a short-range radio for communication with the vehicle being recovered or vehicles in the immediate vicinity. The GCZ-112 has no defensive armament other than the small arms of the crew, a box of fragmentation grenades, and an RPG-7 rocket launcher. (This normally uses HESH warheads, to blast obstacles.) The GCZ-112 is equipped with an air conditioner with NBC filters.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,814,846	D, A	3.44 tons	40 tons	3	53	Image Intensification (D, CO, C), FLIR (C), WL/IR Spotlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
170/119	47/33	1000	373	Std	T6	HF190Cp HS32Sp HR20

Fire Control	Stabilization	Armament	Ammunition
None	None	None	50 kg C4 or RDX, Engineer Demo Chest.

*If the plow is in the forward position, it provides an AV of 12Sp to the front of the vehicle. If the plow is raised, the mechanism provides an AV of 6 to the front, though of course this may damage the mechanism.

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. The Type 84 AVLB has a vehicular NBC Pack, and extra radios. The Type 84 has a small computer with tech manuals and solutions of various problems in bridging.

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
\$1,806,837	D, A	484 kg	38.5 tons	3	29	Image Intensification (D, CO, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
109/76	30/21	935+380	200	CiH	T6	TF4 TS4 TR4 HF65 HS12 HR8**

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

*The Type 84 has a Config of CiH is the bridge is mounted. Otherwise the Config is Std. If the bridge is mounted and there is a "turret" hit, no personnel hits are possible; these are regarded as misses. Other CiH hits are on the bridge itself or the deployment machinery.

^*The Type 84 has a floor AV of 5.

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 carrying 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 dynamometer. It also has a circular saw and power tools. It normally carries a wide selection of spare parts.

The Type 85 Repair Vehicle is a Type 85 armored personnel carrier with a hydraulic crane that has a capacity of 1 ton. It has a light winch with a capacity of 25 tons (50 with block & tackle). 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. (The RV essentially carries the same tool set as the ARV.) 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.

Both versions have two long-range secure data-cable radios. As well as a secure short-range radio. They have inertial navigation with a mapping computer. There is a vehicular NBC Pack into which the crewmembers plug their protective masks; the hoses reach to the rear workbench.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ARV	\$143,464	D, A	1.31 tons	15 tons	5	15	Active/Passive IR, WL/IR Spotlight	Enclosed
RV	\$139,730	D, A	1.31 tons	15.11 tons	5	17	Active/Passive IR, WL/IR Spotlight	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
ARV	150/105	42/39/4	450	119	CiH	T4	TF2 TS2 TR2 HF6 HS3 HR2
RV	149/105	42/29/4	450	119	CiH	T4	TF2 TS2 TR2 HF6 HS3 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(Both)	None	None	Type 59 (G)	1120x12.7mm

*The CiH Config rating refers primarily to the armored gun shields around gunner's nest, but also refers to the various equipment, including the generator, carried on top of the vehicles. It can also refer to the crane of the Type 85 RV.

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. As the Type 90-II tank, the Type 90-II ARV has a 1200-horsepower turbocharged 6TD diesel. The vehicle may ford 1.4 meters, or 5 meters with preparation (though it cannot actually swim).

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 or 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 Type 90-II ARV has a BMS, GPS, mapping computer, and vehicle state computer. There are three MFDs, one for the driver, one for the commander, and one in the rear for the crew.

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
\$1,440,828	D, A	7.5 tons	48 tons	5	34	Image Intensification (D, C, G), WL Spotlight	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
171/120	47/33	1000+400	446	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 84/84A

Notes: The Type 84 (also known as the Type 653 or WZ-84A) series is an armored recovery vehicle based on the chassis of the Type 69-II tank. The primary mission of the Type 84 is vehicle recovery, and movement to rear areas for repair; however, it does have a limited ability to repair vehicles and a tertiary mission of preparing fighting positions.

The Type 84 series is in use by China, Bangladesh, Iraq, Pakistan, and Thailand. A small amount have also been supplied to Kuwait along with their new PLZ-45 SP howitzers.

The Type 84A is basically a Type 84 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 84, this has a capacity of 10 tons, while on the Type 84A, 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. Both the cranes can lift a Type 69 powerpack or equivalent or smaller items; the Type 84A's crane allows it to work with larger vehicles or powerpacks.

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 84 series also has a hydraulic winch with a capacity of 70 tons with 130 meters of cable (160 meters on the Type 84A). The Type 84 also has an auxiliary winch with a capacity of 10 tons. The winches, power tools, and crane are powered by the engine, but the Type 84 has two transmissions; when the winches are in use, or the crane and a winch, the two transmissions allow the engine to be used to operate two pieces of equipment at once. The vehicle carries 100 kg of random vehicle parts, with the accent on tracked vehicle parts. The Type 84 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 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 84	\$200,769	D, A	3.25 tons	38 tons	5	28	Passive IR (D, C), WL/IR Spotlight	Enclosed
Type 84A	\$211,269	D, A	3.25 tons	41.4 tons	5	29	Passive IR (D, C), WL/IR Spotlight	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Type 84	128/89	35/25	861+380	215	Std	T6	HF40 HS10 HR8
Type 84A	121/84	34/23	1041+380	215	Std	T6	HF40 HS10 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(Both)	None	None	Type 59 (C)	500x12.7mm

NORINCO VME-102-40

Notes: Though the GCZ-110 was designed partially with repairing and recovering the Type 96 tank series in mind, the GCV-110 is really more of an AEV with some ARV capabilities. The VME-102-40 (increasingly referred to in the PLA as the Type 96 ARV) is designed specifically for recovery and if possible, repair in the field.

The VME-102-40 is based on a Type 96's hull, and is essentially the same hull, modified for use with a crane and other recovery crews, and lengthened, with a total of seven roadwheels instead of the six of the Type 96 tank. The turret is removed and replaced with a raised superstructure, and a large crane with its base on the front right side. The front of the VME-102-40 resembles that of the BREM-80U, though the VME-102-40 has heavier frontal armor (and side and rear armor as well). The VME-102-40 appears to be a

long-flat vehicle, often towing a trailer with spare parts or a powerpack. The superstructure is cut out on the right side to allow for stowage of the crane in traveling order. The heavy armor allows the VME-102-40 to operate in the front lines under direct fire from enemy forces; though it does not have the composite armor of the Type 96 tank..

The large crane can operate at a maximum reach of six meters and can turn through 360 degrees. It can lift 16 tons at this maximum reach or 18 tons at half that reach, and can lift a complete Type 96 tank powerpack or turret. In the front glacis there is a winch that has a pull power of 35 tons, though this may be doubled or tripled with use of blocks and tackle. A lead/auxiliary winch has a pulling power of 400 kilograms.

The tool set is similar to that of the GCZ-110, though the number of most tools is doubled and there are much more spare parts. The electronics are also similar. The APU is a 52 kW model.

Unlike the GCZ-110, the VME-102-40 has a heavy machinegun on the turret roof attached to a cupola. This machinegun may be operated, aimed, and reloaded from inside the armor envelope of the vehicle. Clusters of four smoke grenade launchers are found at each corner of the vehicle.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,781,759	D, A	7.44 tons	45 tons	3	45	Image Intensification (D, CO, C), FLIR (C), WL/IR Spotlight, Backup Camera (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**	
155/108	43/30	1000	371	CiH	T6	TF140Sp HS30Sp	TS40Sp TR22 HF150Sp HR20

Fire Control	Stabilization	Armament	Ammunition
None	None	W-85 (C)	1200x12.7mm

*Most of the small turret contains tools and the controls for the crane and winches, and any "electronics hits" will be on these tools, the intercom system, the turret portion of the BMS system, or the night vision system.

**The bracing blade can protect the front end and glacis: what it depends upon whether the blade is lowered (lower front protected), midway/traveling order (lower glacis protected), or fully upwards (upper glacis/hull protected). The blade gives a protection level of 4Sp.

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 Std.

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-l 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 Std.

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

Nowy Jicin VT-72M4 ARV

Notes: Based on a melding of the Russian VT-72 ARV and Czech T-72M4 tank, this ARV is called the VT-72B by the Slovaks. The VT-72M4 carries a large amount of equipment for the recovery of vehicles or repair of their components as necessary, including the ability to remove an engine, transmission, unitary powerpack, or turret assembly. A version of this vehicle is used by India, and it is up for sale on the international marketplace by both the Czech Republic and Slovakia. (The VT-72M4 and VT-72B are slightly different, but not enough to matter in game terms. As with most such vehicles, the VT-72M4 has a main winch, and an auxiliary winch. The main winch has a capacity of 67.4 tons, or 202 tons with block and tackle, and has 100 meters of cable. The auxiliary winch has a capacity of 2.25 tons, and has 400 meters of cable. The load platform on the rear deck of the vehicle can carry 4 tons, enough for a powerpack for a vehicle like a T-72, T-80, or T-90's engine. The crane is able to rotate through 330 degrees (from back to front) and can lift 19 tons, enough to lift most tank's complete powerpacks or turret assemblies.

Modifications to the chassis for its role include a strengthened undercarriage and drive assembly, the addition of a dozer blade (primarily used for bracing when using the winch) on the front capable of moving 126 cubic meters at a time, strengthened tow hooks and cables, and the addition of a 15kW APU for use when operating the power tools (it is not strong enough to let the winches run off it). Tools include a "jaws of life"-type force separator, six fire extinguishers, a welding set, an air compressor, a complete set of power tools and power machine tools, a complete set of manual tracked vehicle and wheeled vehicle tools, and two sets of pioneer tools

such as shovels, picks, axes, adzes, and prybars. The VT-72M4 has internal seats for the complete crew of most T-55, T-72, T-80, or T-90 crews (3-4 men and their basic equipment and personal weapons); alternatively, these seats may be used to bring extra mechanics or extra equipment not normally a part of the VT-72M4 equipment set. The VT-72M4 carries two slave cables for powering vehicles which may be able to aid in their own recovery; one of these is five meters long and the other eight meters. (These could not originally be used to power Western vehicles, but modular adapters devised after the Czechs joined NATO allows this.) The VT-72M4 typically carries up to ten spare roadwheels of various sorts, six tires of various sorts, and five sections of three tracks each, again of various sorts, along with three drive sprockets and three return rollers.

The VT-72M4 is powered by a Western engine and transmission – the engine being a Perkins 12-1000 turbocharged diesel developing 987 horsepower and the transmission an Allison XTG 411-6-N automatic. The VT-72M4 used a steering bar which is similar to that of many NATO tanks, and is power boosted. The brakes are also power brakes.

The VT-72M4 has a crew of two, a driver who is also at least a tracked vehicle mechanic and often a Wheeled vehicle mechanic also. The commander is usually a master mechanic. Both are usually thoroughly versed in the characteristics of their vehicle and equipment. The commander also usually knows the characteristics of most vehicle they may have to recover. (The vehicle crews of the vehicle being recovered are also expected to help in their vehicle's recovery.) The commander has a cupola with either an NSVT or M2HB mounted on it. The vehicle is NBC sealed, but most operations will require the crew to leaves the protection of the VT-72M4. Late in production (or from the start of production for the Indian VT-72C) an air conditioner was built in, with NBC filters. These were retrofitted to existing VT-72M4s and VT-72Bs in the early-to-mid 2000s. The VT-72M4 is equipped with GPS navigation and an inertial backup, and a mapping system, as well as a computer with the mechanical and recovery aspects of the various vehicles of Czech, Slovakian, and some NATO vehicles. In additional, the VT-72M4 has a partial vehicle state computer; it primarily monitors the winches, crane, suspension, and powerpack.

The Slovaks sold a copy of their VT-72B to India. India and Slovakia calls these the VT-72C. The first of these vehicles were built in Slovakia; these served as a template for Indian home production of the VT-72C. The VT-72C differs from the VT-72B primarily in the language used on the vehicle parts, gauges, and magazines, and the use of Indian electrical systems, hydraulics, and manufacture of most parts, which are slightly different due to indigenous Indian production methods.

The VT-72M4 has secondary roles of digging fighting positions and delivering large amounts or items of supplies. The Slovaks and Indians tend not to use their VT-72Bs and VT-72Cs in such a manner, preferring the use of other specialist vehicles.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,665,663	D, A	471 kg	51.5 tons	2	29	Passive IR (D), LLTV (Backup, R, Sides, Front)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
138/96	38/27	1000	366	Std	T6	HF129Sp HS17Sp HR12*

Fire Control	Stabilization	Armament	Ammunition
None	None	NSVT or M-2HB (C)	960x12.7mm or .50

*Belly armor for the VT-72M4 series is 7Sp.

Leopard 1 ARV

Notes: These are descendants of the German BPz-2 Bergepanzer, and are generally improvements or 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 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	Std	T6	HF46Sp HS15Sp HR8***
Leopard 1 Wisent	162/113	45/31	1410	371	Std	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 increased, 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 suppression 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.

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	Std	T3	HF6 HS4 HR4
Diesel Engine	131/91	36/25	410	83	Std	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. Its 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	Std	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	Std	T3	HF8 HS4 HR4
AMX-D (20mm)	76/53	21/15	410	139	Std	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	Std	T6	HF170Cp HS28Sp HR19
UAE EPG	171/119	47/33	1600	279	Std	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	Std	T6	HF170Sp HS28Sp HR19
UAE DNG	172/120	48/33	1600	554	Std	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

Notes: 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 French 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 "Std."

Krauss-Maffei/RUAG/Rheinmetall AEV-3 Kodiak

Notes: Development of the AEV-3 Kodiak (not to be confused with the LAV III Kodiak) began in 2002. At that time, the Switzerland and Sweden were unsatisfied with their PIPz-2s, and instead of going the Czech route of modifying their PIPz-2s, they petitioned Germany to solicit a new vehicle to replace their PIPz-2s altogether. Other names that the AEV-3 Pionierpanzer 3 (Germany), AEBV in the Netherlands (Armored Engineering and Breaching Vehicle), in Swiss the Panzer 87 Geniepanzer, and Ingenjörbandvagn 120 (Sweden). The AEV 3 is also used by Denmark, and Spain, and (much later) Singapore. (known locally as the L-2AEV, in 2013) In 2003, additional countries were sought to round out the consortium; initially, all the countries above would leave the consortium except Germany and Switzerland, though they were interested in the finished product. The first customers were Switzerland; shortly afterwards, the Danish and Dutch bought theirs. The Swedish and Dutch bought their in a joint purchase in 2011 (The Swedes had been doing this since 2001 to reduce costs by buying in greater lots.) Other countries using the Leopard 2 normally made theirs from knock-down kits from Germany, Those who didn't bought them whole from Germany and Switzerland. The Kodiak is generally made from surplus Leopard 2A4 hulls, but new-build Kodiaks are available upon request. Potential future buyers (or those who seem very interested) include Austria, Chile, Germany (despite having designed the vehicle, they have yet to adopt it). Greece, Indonesia, Poland, Portugal and Turkey. All of these potential buyers operate older Leopard 2s and have older AEVs or no AEVs.

AEV 3

Though the primary job of the Kodiak is it's engineer vehicle duties, it can double as a partial recovery vehicle, pulling out vehicles with its winch or towing them out, and towing them to a rear area. The primary use of the Kodiak, however, is to breach minefields, reducing ore erecting obstacles, covering or digging trenches and large fighting positions, and removing obstacles to friendly lines of march. Conversely, the Kodiak may be used to deny road access to general terrain to the enemy.

The AEV 3 is a heavy vehicle which falls into the MLC 70 class for traversing bridges or man-laid military bridges. The chassis is slightly longer than its Leopard 2 base chassis, having seven roadwheels instead of six. Track tensioning may be set at the idler wheel up front, like a Leopard 2, and can also be equipped tread extensions to allow functioning in deep snow, mud, or swamps. The armor is similar to that of a Leopard 2A4, but the turret is removed, replaced with a large pivot point for its jib arm. Inside the superstructure and interior of the vehicle, the space is split in two, with the right side containing the mechanism for the arm, and the right for the crew. The rear of the vehicle is also accessible to the crew, and normally contains the radios and Vehicle State computers.

The blade does not have any sort of stabilizing blade or legs; instead, the bucket and arm tools and winch is stabilized by two large ski-like bars, which may rotate 180 degrees to the front or sides, and are made of heavy high-strength steel. The bars themselves may be used for digging in sand, soil, or mud. The Kodiak also may have up to five sets of ripping teeth (if the vehicle is using a V-shaped plow. The bars, however, are primarily used as a lane-marking device. (The same plow assembly is used on the US Army's experimental M1150 ABV and the British Trojan AVRE.) The AEV may also mark routes by use of lane-marking flags which are deployed from either corner of the vehicle; these have 80 flags per magazine and are also equipped with LED lights on top for use at night. A Pearson mine plow is generally mounted; this is 4.2 meters across and 1.95 meters high, and requires considerable (2 hours) of time to retrofit. This plow may be kept in V-shape, or retracted to a straight plow.

The digging bucket of the AEV 3 is almost a small blade. It can dig up to 5.3 tons of soils per swipe, and can also be fitted with a ripping blade set. And it ca0n also be used as a hammer to drive 4 newtons per hammering action. The digging bucket can also be used to smash rocks and concrete of up to 10 AV, and dig medium and large fighting positions. The tool on the arm may also be replaced with a true earth pneumatic hammer, which can drive with a strength of 490 newtons per hammering action, and drives a hole 100 millimeters wide. The tool on the atm may also be equipped with a universal grabber, able to grab and lift 10 tons. A concrete cutter is sort of a large circular saw can cut a channel 500 millimeters wide and 800 millimeters deep, against a concrete strength of 15 AV. Rocks, large stones, and tank traps can also be similarly cut. A large hook with 30 meters of heavy-gauge chain can also be used to move items or as an ad hoc recovery device; is can lift 26 tons. The arm may also be fitted with a dedicated concrete and rock crusher, able to smash up to 25 AV of concrete or hard rock. Finally, the arm may be used to carry and emplace or remove a fascine roll or double concertina roll.

The AEV 3 is equipped with two capstan-type Rotzer winches which can pull 9 tons each, and can work together, to the point that they may be combined into one cable and used with block and tackle, together or separately. Each is 200 meters of 25-millimeter cable.

The front of the AEV 3 is equipped with an electronic explosive detection and disruption device The disruption ability extends 20 meters around the front of the vehicle, and stops enemy signals from cell phones, remote detonators, delay detonators, and mines, and even extends to the firing chain of RPG-type weapons and ATGM. The AEV 3 may tow a large trailer specifically designed for Leopard 2-series vehicles, and able to carry up to 5 tons, including a Leopard 2 powerpack. The AEV 3 itself uses an MTU MB 873 Ka501 turbocharged diesel. with enhanced torque. In addition, the AEV 3 has a 24 kW APU, which is fully contained under armor at the left rear corner, exposing only a small cooling grate and an exhaust pipe. This APU runs off the Kodiak's fuel.

The AEV 3 has a crew of three: commander, who also operates the RWS, the driver, and the arm operator. The driver operates the plow and its associated equipment. As said above, the interior of the superstructure is split in half; half contains the arm mechanism and base, and some of the smaller tools which may be swapped out. The left side has the arm operator, and most BMS, GPS, and mapping module. The crane operator operates the crane using four LLTV cameras on the corners of the superstructure. The commander often spots for the crane operator or the driver/plow operator, using the cameras on the RWS. There is also an LLTV in front at the top of the glacis, used by the driver to assist in using the plow and associated mechanisms, and a sixth camera on the center rear, used to supervise towing or trailer operations, or simply as a backup camera. . If necessary, blocks of C4, lengths of

primercord,, an engineer demo chest, and four smaller engineer demo kits are available for reducing or creating obstacles. The crew can perform all operations of the AEV 3 except those requiring the emplacement of explosives from inside the vehicle under NBC Overpressure protection. The AEV 3 also has an air conditioner with NBC filters. Through the normal crew is three, the AEV may also operate efficiently with a crew of two, with the commander operating as arm operator, The crew have 4-point seat belts and the chairs are shock-absorbing. The AEV 3 is armed with an RWS on the top right of the superstructure; this is normally armed with an M2HB, but a 40mm grenade launcher may be mounted instead. The RWS is normally operated manually, but can be set to automatically deal with threats. The interior of the AEV 3 is considered by most military experts as being rather spacious compared to most fighting vehicles.

Though the AEV 3 is primarily meant to be used in a combat role, it has been used in Europe for civilian relief operations in the recent flooding in 2020.

Swedish AEV 3(S)

Swedish AEV 3(S)s are built on a Strv 122 (Swedish Leopard 2A6) base and have somewhat better armor protection and an engine with more torque. They all have high-efficiency crew compartment heaters. Swedish AEV 3(S)s use clusters of five instead of four smoke grenade launchers. The AEV 3(S) has a reduced IR Signature (IR Suppression).

Dutch AEV 3

Dutch AEV 3s are 95% identical to Swedish AEV 3s; however, Dutch AEVs, however, are based on Leopard 2A5s and have slightly less hull armor protection, though they have increased overhead armor, clusters of only four smoke grenade launchers, and three sets of excavating tools. Interestingly, Dutch Kodiaks were until recently declared unlawful for driving on civil roads in the Netherlands, because in one case shortly after their adoption, a control cable snapped and the Kodiak damaged a highway bridge support.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AEV 3	\$2,050,792	D, G, A	2.1 tons	62 tons	3	39	Image Intensification (D, C, RWS), Thermal Imaging (D, C, RWS), 6xLLTV (D, CO, C)	Shielded
AEV 3 S	\$2,200,053	D, G, A	2.09 tons	63 tons	3	47	Image Intensification (D, C, RWS), Thermal Imaging (D, C, RWS), 6xLLTV (D, CO, C)	Shielded
AEV 3 (Dutch)	\$1,964,286	D, G, A	4.42 tons	62.5 tons	3	47	Image Intensification (D, C, RWS), Thermal Imaging (D, C, RWS), 6xLLTV (D, CO, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
AEV 3	166/116	46/32	1200	558	CiH	T6	TF20Sp TS10Sp TR10 HF160Sp HS25Sp HR15**
AEV 3 S	164/115	46/32	1200	558	CiH	T6	TF20Sp TS10Sp TR10 HF203Sp HS30Sp HR16**
AEV 3 (Dutch)	176/123	49/34	1200	558	CiH	T6	TF20 TS15 TR10 HF213Cp HS35Cp HR15***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AEV 3	Fair	+2	M2HB or HK GMG (RWS)	900x.50 or 900x40mm

*The plow of the Kodiak may give a frontal AV of 12Sp; what it protects depends on how high the blade is lifted.

**The Standard AEV 3 and the AEV 3(S) have a roof AV of 8Sp and a Floor AV of 12Sp.

***Dutch AEV 3s have a roof AV of 10Sp. Floor AV remains 12Sp.

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 built by Italy, where they were license-produced. Unusually, in NATO operations, spare

bridges for Danish Biber are to be carried and delivered by Dutch Army personnel on IVECO Magirus MP-260E37W heavy trucks.

The bridge can span a gap of 22 meters and has a capacity of 50 tons or 60 tons if the vehicles move across the bridge with care (one-quarter speed); 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 with bipod or tripod-mounted MG3s. In most cases, the weapons may not be taken above the hull while the bridge is mounted. (This weapon is not included in the stats below.) The crew has an NBC Overpressure system with a vehicular NBC system backup. 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 ad hoc machinegun position is normally in the commander's position.

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
\$1,430,517	D, A	409 kg	45.3 tons	2	33	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor**
133/93	37/26	995	307	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. It's normal carry position is on the lower front hull.

Rheinmetall BPz-3 Büffel

Notes: This is a newer armored recovery vehicle based on the Leopard 2 chassis. The Büffel 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 Büffel, as does India. 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. Some other components are used on other ARVs and AEVs. The Büffel, and some of its components, are available on the international market.

BPz-3 Büffel

The turret is removed, and from the front to the center of the vehicle is a raised superstructure, except on the left side.

The Büffel has a crane on the right side of the superstructure that can traverse through 270 degrees and can lift 30 tons completely or lift 70 tons up to 20 degrees to allow mechanics to work on the underside of a vehicle. 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 33-millimeter 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 tools and a power saw. There is, however, no APU. There is a cradle over the engine compartment to carry large assemblies such as powerpacks..

The Büffel has bilge pump for deep fording operations (though it is not amphibious). It can ford up to 4 meters, though all hatches must be closed. The hull mounts 16 smoke grenade launchers, eight on each side of the front fenders and glacis. The Büffel 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. There is a multi-compartment automatic fire detection and suppression system. The commander has a manually-operated cupola with all-around vision in the center top behind the driver's position; The Büffel has an air conditioner with NBC filters and the crew is protected by an NBC Overpressure system. The commander has a manual cupola with a light machinegun; however, the machinegun and can be aimed and fired from within the vehicle.

Slightly to the rear and the right is the crane operator has a hatch on the left rear deck in front of the engine. 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.

The Buffel is equip[ped] with a BMS, Vehicle State computer, a GPS with mapping system, and data-capable radios.

Power is provided by an MTU MB-837 Ka-501 developing 1500 horsepower, along with an automatic transmission. This is the same powerpack as on the Leopard 2, but also have a 15kW APU. Most characteristics of the hull are the same as on the Leopard 2, including the suspension and transmission.

Swedish BPz-3s

Swedish Bpz-3s are given increased protection though the front and side arcs, as well as on the roof and floor. They have other technical improvements, including a Kongsberg RWS. They are equipped with four GALIX launchers which can through smoke and flare shells. They have IRCM 1 for the vehicle, especially the engine compartment. They have electronics similar to those of the BPz-3, as well as tools. There is a rear camera, not for the driver's use (though he can use the camera, it more to monitor equipment on the trailer or a towed vehicle). They have an increased crane working range (295 degrees). The aux winch has a 1.5-ton capacity, and the Swedish version has an air conditioner with NBC filters, as well as a high-efficiency heater.

BPz-3A1

In 2011, four German BPz-3s were modified to the BPz-3A1 for operations in Afghanistan. They were designed to operate alongside the new Leopard 2A6M tanks used by the Canadian Army. Four Canadian BPz-3A1 were actually deployed first, in 2007, in Afghanistan; later, German BPz-3A1s were later deployed. The BPz-3A1 is now the production standard for new Buffels. India is currently looking to buy kits to upgrade their BPz-3s to BPz-3A1s.

Modifications included an increase in armor through MEXAS appliqué, a titanium plate of spaced armor on the floor, sides with armored skirts, and increased top protection., 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 is equipped with a V-shaped dozer blade (a shallow V, however) which, while it is not much bigger than the BPz-3's blade (3.8x1m), is stronger and can be used as a mine plow. Like the BPz-3, it can have ripping teeth attach to the bottom of the blade, with characteristics as above. The BPz-3A1 also has a secondary role of digging large fighting positions and filling ditches.

The tool set is largely the same as that of the BPz-3; however, the BPz-3A1 also carries a chainsaw, a "jaws of life," power tools, and a circular saw. The BPz-3A1 has a 24kW APU, enough to run the power tools, and the crane or the winch while the engine is off.

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.

The commander's position is ringed with AV2 gun shields. Available machinegun ammunition is increased dramatically. The driver is on the front left, with the commander to the rear and right of him. The commander's machinegun and gun shields are mounted on an electrically-rotating cupola. The commander doubles as a crane operator. A mechanic is present inside the vehicle; he does most of the mechanical work on disabled vehicles, though the driver is also a mechanic and the commander a master mechanic.

The BPz-3A1 uses the same engine and transmission, as well as power train, and suspension, as the Leopard 2A6M. The crew has the same amenities as the BPz-3, with the addition of a 50-liter drinking water tank and an air conditioner with NBC filters. There is a rear camera, not for the driver's use (though he can use the camera, but more to monitor equipment on the trailer or a towed vehicle) The BPz-3A1 is equip[ped] with a BMS, Vehicle State computer, a GPS with mapping system, and data-capable radios. In addition, a small computer is inside the computer which primarily has the tech manuals for all vehicles present in the German army or whatever army the BPz-3A1 is operating in.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BPz-3	\$1,061,685	D, G, A	4.73 tons	54.3 tons	3	46	Passive IR (D, C)	Shielded
BPz-3A1	\$1,886,063	D, G, A	4.8 tons	59 tons	3	52	Thermal Imaging (D, C), Image Intensification (CO), Rear LLTV Camera (D, CO, C)	Shielded
BPz-3 (Swedish)	\$1,964,286	D, G, A	4.42 tons	57.8 tons	3	47	Thermal Imaging (D, C), Image Intensification (CO, C), Rear LLTV Camera (D, CO, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BPz-3	186/130	52/36	1629	558	Std	T6	HF193 HS25 HR15
BPz-3A1	172/121	48/34	1629	558	CiH	T6	TF3 TS3 TR3 HF203Cp HS35Cp HR25Sp**
BPz-3 (Swedish)	176/123	49/34	1629	558	CiH	T6	TF20 TS15 TR10 HF213Cp HS35Cp HR15****

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BPz-3	None	None	MG3 (C)	2375x7.62mm
BPz-3A1	None	None	MG3 (C)	4750x7.62mm
BPz-3 (Swedish)	Fair	+2	M2HB (RWS), 4xGALIX Launchers	2850x.50BMG, 4x81mm Smoke or ILLUM Rounds

*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 for the BPz-3A1 and the Swedish BPz-3 are 14Sp. Roof armor is AV 12Sp. The bracing blade of the BPz-3 (including the Swedish variant) has an AV of 4Sp; area protected depends how high the blade is raised.

****Floor Armor of the BPz-3A1 is AV 16Sp. Roof Armor is 14Sp. On the sides, the BPz-3A1 presents a sort of "one-two" punch; when a round hits, the special effects of spaced armor are calculated, then the special effects of composite armor. The blade has an AV of 8Sp.

Krauss-Maffei Pionierpanzer PiPz

PIPz-1 Pionierpanzer

Notes: This is an armored engineer vehicle developed from the Bergepanzer. It is currently used by Germany (in ever-shrinking numbers), Belgium, Italy, and the Netherlands. The Canadians and the Germans used the vehicle in active service, but the Canadians found the PIPz-1 inadequate for their needs and replaced them. The Germans also originally used a good number of them, but are in the process of replacing them with more up-to-date vehicles. 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 at a rate of 1.5 meters per auguring action, a dozer blade, a 36-ton winch, and a digging bucket that can lift 2 tons. (about 5 cubic meters in soil) This arm can rotate 360 degrees; however, it is mounted on the front right side, and when turned from 271-360 degrees, the arm has to be raised at an angle of 50 degrees to reach over the hull. The crane has a ladder on it to assist in attaching tools. The arm may also be fitted with a large hook on a heavy-gauge chain (about like you might find on a naval frigate), and able to lift 20 tons, or partially lift up to 40 tons (to emplace explosives for blasting, for example).

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 PIPz-1 also has a standard winch able to pull 36 tons with a straight pull.

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, an engineer demo chest, and a variety of mines (up to 50).

The plow is straight, and is as wide as the vehicle (3.75 meters) and one-third as high (90 centimeters). The blade can dig, in soil, 300 cubic meters in an hour. The plow is also extended on telescoping arms that can push with a strength of 10 tons up to 3.5 meters. The plow can have a set of ripping teeth attached to it. The ripping teeth can rip up roads or pull up train tracks, or pull down electrical of communications poles; four such attachments may rip to 50mm, eight may rip to 400mm.

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 a ZF4HP250 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, but it is admittedly deficient as an ARV, primarily limited to pulling out stuck vehicles and towing them.

The crew is protected by an NBC Overpressure system and personal gas masks. There is no BMS, GPS, or Vehicle State computer (being in service before these were standardized), but it does have a transponder and inertial navigation. The driver is on the front left; the commander doubles as the crane operator and is on the front left and to the rear. Additional engineers are inside the hull, and exit and enter through a hatch on the roof at the center of the superstructure. The commander also may use the bow machinegun, which can be fired in an arc of 30 degrees right and 60 degrees left, and 20 degrees down and 45 degrees upwards. The main machinegun is used by one of the two mechanics in the hull, and is mounted on a skate mount around the center hatch.

Czech PIPz-1

The Czech version's primary difference from the standard PIPz-1 is the engine, another German-made engine, the MTU MB838 multifuel turbocharged engine with 919 horsepower available, and with considerable torque. It is coupled to a ZF4HP250 automatic transmission with four forward and two reverse rears. The auger is only 60 centimeters wide, and can dig to 1.9 meters of earth in one auguring action. The Czech version is equipped with two machineguns, one at the central hatch on a skate mount, and another at the commander's position, also on a skate mount. The bow machinegun is removed, and the space used to store the Engineer Demo Chest the vehicle carries.

Like the standard Pionierpanzer 1, the Czech version can be used in a pinch as an ARV, Other than listed above and in the stats below, the Czech version has the same tool set as the Pionierpanzer 1. However, the Czech version has a GPS mapping system installed, and has air conditioning.

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 (see above). 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 in the bow. 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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PiPz-1	\$276,775	D, G, AvG, A	2.4 tons	40.8 tons	4	23	Passive IR (D)	Shielded
PIPz-1 (Czech)	\$754,685	D, G, AvG, A	2.45 tons	40.8 tons	4	24	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	144/101	40/28	1410	308	Std	T6	HF38 HS10 HR6
PIPz-1 (Czech)	157/110	44/30	1410	341	Std	T6	HF38 HS10 HR6
PiPz-2 Dachs	139/97	39/27	1410	325	Std	T6	HF38 HS10 HR6
PiPz-2A2 Dachs	129/91	36/25	1410	340	Std	T6	HF46Cp HS12Cp HR6**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
PiPz-1/2	None	None	MG3 (Bow), MG3 (M) or MG3 (C)	4250x7.62mm, Engineer Demo Chest, 117 kg C4, 50m Primercord, 50 Assorted Mines
PIPz-1 (Czech)	None	None	NSVT (M), Vz.59N (C)	3000x12.7mm, 3000x7.62N, Engineer Demo Chest, 120 kg C4 or RDX, 50m primercord, 50 assorted mines
PiPz-2A2 Dachs	+1	Basic	C7A2 (M)	4250x7.62mm, Engineer Demo Chest, 20 kg C4, 50 Assorted Mines

*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.

***The blade on the PIPz-1 can be used as ad hoc armor, giving the vehicle an AV of 7Sp from the front (where it protects depends

on how high the blade is raised). The Dachs's blade is stronger and provides an AV of 10Sp.

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 M48-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.

BPz--2

The turret of the Leopard 1 is removed and replaced with a raised superstructure. The rest of the chassis is essentially the same as that of the Leopard 2A1 tank, though the electrical system has been upgraded to accommodate the tools and generator, The electrical system is also upgraded to account for the crane, winch, and bracing blade.

The Bergepanzer is equipped with a crane on the front right side that can mostly traverse 270° and lift 20 tons. It can however, swing a powerpack onto its flat platform.

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 aux 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, though this is a secondary role). The BPz-2 can carry an entire Leopard power pack on its rear deck or other large cargo.

The BPz-2 also has a fuel pump, so it can refuel vehicles from a containerized source fuel, a trailer, or a truck.

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. The commander has a machinegun on a skate mount; the cupola has all-around vision blocks, it does not rotate, Another hatch is provided in the center for the crane operator; the hatch is not raised; but the seat can superelevate almost to the opening of the hatch, and manually rotates, The control box for the crane is actually connected by a wiring harness and can be removed from its bracket, enough that the crane operator may step out of his hatch and stand on the vehicle. Passenger spaces are provided for an entire tank crew or additional repair personnel. The bow machinegunner is operated by the driver via solenoid, and which can be fired in an arc of 30 degrees right and 60 degrees left, and 20 degrees down and 45 degrees upwards.

BPz-2A2

The BPz-2A2 is an upgraded form of the BPz-2. It has a jack carried on the rear face able to lever up a vehicle weighing 70 tons to 20 degrees, allowing mechanics to get to the underside of the vehicle being recovered., The jack is also used to reduce the pressure on the dozer blade when working with the crane., a crane boom able to reach 7.68 meters, and can lift 32 tons, and it is strengthened. 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. Other details are largely as the BPz-2 though the BPz-2A2APU has an APU of 20kW. The BPz-2A2 were mostly equipped with BMSs, Vehicle State computer, and a GPS System with mapping computer later in life; any or all of this is offered on the international market as a kit for existing BPz-3A2s.

A small hatch in the rear, but other positions are as the BPz-3.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BPz-2	\$343,920	D, G, AvG, A	4.16 tons	39.8 tons	4+4	23	Passive IR (D)	Shielded
BPz-2A2	\$840,773	D, G, AvG, A	4 tons	40.6 tons	4+4	22	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
BPz-2	159/112	40/31	1410	308	Std	T6	HF38 HS10 HR6**
BPz-2A2	155/109	37/26	1410	314	Std	T6	HF40Sp HS12Sp HR6***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BPz-2/2A2	None	None	MG3 (Bow), MG3 (C)	4250x7.62mm

*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. Some operators have put AV2 or AV3 gumshields at the front or surrounding the commander's position; if surrounded by a gun shield, the vehicle's Config is changed to CiH.

**The dozer AV is 6Sp. What will be protected on the front depends on how high the dozer is raised.

***The dozer of the BPz-2A2 is a bit stronger; it has an AV of 7Sp.

MaK M47 BGs

Notes: As with the M48 ARV (see below), this vehicle was originally produced by Germany for export and as kits for those retiring

their M47 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 M48 ARV, with the turret being replaced with a raised superstructure, crane, winch, fuel pump, and dozer blade. The M47 ARV was used to recover both lighter tanks and armored vehicles and armored personnel carriers and infantry fighting vehicles. Slightly smaller than the M48 ARV, it also is somewhat less capable than that vehicle in towing capacity. The M47 ARV variant did not see as much success as the later M48 ARV (below).

The crane is capable of lifting 18.7 tons at a reach of 5.3 meters, and unlike the M48 ARV, can turn a full 360 degrees, as the crane is mounted in the center of the vehicle. The main winch of the M47 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, though it can fill trenches, move large obstacles, or dig large fighting positions or prepare AVLB anchor terrain. The M47 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 diesel engine developing 810 horsepower. Unfortunately the M47 BGs does not have an APU and the tools, crane, and winches rely on engine power.

The M47 ARV was developed for the Turkish, but has also been trialed in Pakistan. The M47 BGs has no navigation per se, though it does have a gyrocompass and a transponder. The driver is in the normal position for an M47 on the front left, the commander is to the rear and right of him, with a machinegun on a skate mount, to which the AV3 gun shields are attached. The crane operator is in a enclosure beside the crane which is mostly made of AV3 plexiglass, The additional crewmembers are mechanics who are seated inside the vehicle.

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	CiH	T5	TF3 TS3 TR3 HF50 HS14 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	MG3 (C) or MAG (C) or M2HB (C)	2000x7.62mm or 1200x.50

*The dozer blade can give a frontal AV bonus of 4Sp; what it protects depends on how high it is raised.

MaK M48 BGs

Notes: This is a recovery vehicle based on the chassis of the M48A3 or A5 main battle tank. These vehicles were first produced by Germany for export and as kits to be sold to countries retiring their M48 tanks. As such, they can be found in many of the countries that once used the M48A3 or A5 (or in some cases, even earlier iterations of the M48). These vehicles were built primarily for use by Germany herself, but the Germans decided against putting the M48 BGs in their service. The Turks have at least 4 and the Greeks have at least 3 (and they have received kits to modify more); there are a few scattered around the globe, mostly used by countries who were retiring their M48s. MaK sells these modifications as kits and knock-down setups, and in some cases, will supply instruction to other countries' technicians.

In this role, the M48 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 older Western or Eastern Bloc tank turrets) at a reach of 6 meters. The winch has a pulling strength of 35 tons without bracing and 70 tons with block and tackle, 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 M48 ARV is equipped with a welding and cutting set, an air compressor, a circular saw, a medium chainsaw, a complete hand tool set, a tow bar, several coils of rope and cable, and items such as pulleys and snatch blocks.

Many other improvements of the M48 over the years. Such as larger dust shields, side skirts, larger fuel tanks, better sand filters, and numerous automotive, hydraulic and electrical improvements, have been applied to the M48 base, particularly if the starting point was the M48A3 or earlier. The vehicles have been upgraded with a Continental AVDS-1790-21 turbocharged diesel engine developing 908 horsepower with an automatic transmission. There is no APU, however, and power for tools, crane, and winches must be supplied by the engine.

A wider driver's hatch was installed (though it is in the same place on the top front of the glacis), the commander's position is on the front right and slightly behind the driver, and his weapon is on a skate mount rather than an enclosed cupola (though the position is surrounded with AV3 gun shields), The driver has a front vision block with a night channel; the commander has a periscope with a gun reticle and a night channel. The crane operator is in a manually-rotating cupola in the center of the vehicle, with all-around vision blocks, a periscope, and a night channel which may be switched between the periscope and the front vision block. The crane operator also normally controls the winches, but these may also be operated by the driver. The driver also controls the front blade. The remaining crewman is a mechanic or technician, with a seat inside the vehicle. Like the M47 BGs, the M48 BGs has no navigation per se, though it does have a gyrocompass and a transponder. Though the M48 BGs has nothing like Overpressure protection, it does have a Vehicular NBC Pack, and the crew have hoses into which they may plug their protective mask filters into. (The hoses are not long enough, however, to reach mechanics working outside.)

Twilight 2000 Notes: No NATO country started the war with the M48 BGs; however, M48 ARV began to be used in front-line service by many countries as damaged vehicles became more common. Other countries, particularly in the Second World, used prewar versions or made their own modifications; these variants could vary wildly depending on the country making the modifications, but there are too many such different modifications to deal with them here. Other countries which were equipped with M48s also made their own M48 ARVs, again with the caution of the aforementioned differences in modifications.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$486,982	D, A	2.66 tons	50.1 tons	4	29	Passive IR (D, CO), Image Intensifier (C), WL/IR Spotlight (CO)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
132/92	37/26	1420	270	CiH	T6	TF3 TS3 TR3 HF51 HS16 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	MG3 (C) or MAG (C) or M2HB (C)	5000x7.62mm or 3000x.50

*The dozer blade can give a frontal AV bonus of 5Sp; what it protects depends on how high it is raised.

Rheinmetall 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. (A total of nine of various types were bought by the Rangers for testing, and though they are no longer working with their Wiesels, the Rangers have retained them in working condition at Hunter Army Airfield.) As of October 2020, 33 Wiesels of various types have been received by the Germans so far, and they have another 145 on order..

In this role, the Wiesel 2 carries a remote mine detector, an RF jammer for IEDs and mines, which can also jam the firing chain of some RPG-type weapons and some older ATGMs. Other sensors include an optical chemical sniffer, a Geiger counter, and radiation shielding. The ERV has an engineer demolitions chest, several kilograms of plastic explosive, and about 15 antipersonnel or Claymore-type mines and five AT mines..

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 data-capable radios, including one with a range of some 500 kilometers over flat terrain or to the top of a mountain. . 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, as well as a backup inertial navigation system and a computerized land navigation system. The ERV can be operated by a remote cable and interface up to 60 meters away.

The engine is a turbocharged diesel which develops 109 horsepower and has an automatic transmission. A modicum of applique armor was added to the front and sides (but don't get excited – the applique consists merely of thin aluminum plates).

The driver is on the front left; the commander is to the right and behind the driver, with a raised, manually-turning cupola with all-around vision blocks and a pintle mount for a machinegun. He has a laser rangefinder, but this is not linked to his weapon and cannot be used for fire control. The rangefinder can also operate as a laser designator. In the rear is a dismount crewman to take a closer look at conditions and obstacles. When the vehicle is buttoned up, the crew is protected by NBC Overpressure. Troops enter and leave normally through the twin rear doors, but may also enter and exit through commander's or driver's hatches.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,284,297	D, A	266 kg	7.25 tons	3	13	Image Intensification (D, C), FLIR (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
115//81	32/22/3	450	41	Std	T3	HF4 HS2 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	MG3 (C)	750x7.62mm, Engineer Demo Chest, 40 kg C4, 20m Primercord

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 are its customers, though it is offered on the international market. The Dutch name for the vehicle is the Bruglegger. In both countries, the PSB-2 is replacing or supplementing the Biber AVLB (above). The German Army requirement is for 36 PSB-2s, while the Dutch Army will have a total of 14.

The hull is essentially unchanged from the Leopard 2 hull, with its 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. Overall length is 28.7 meters.

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 and, 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 also be controlled from the commander's position). The third crewmember is a dedicated bridgelayer, but the PSB-2 can operate (though less efficiently) without him, the commander using the bridge laying duties. Ancillary equipment includes a number of cables, supports, blocks and tackles, ropes, etc. The PSB 2 has a GPS and BMS system.

Though the PSB-2 is officially not armed, it is common for crews to carry a bipod-mounted machinegun and a small amount of ammunition for it.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,888,088	D, A	400 kg	55 tons	2+1	31	Passive IR (D, C, BO), 4xLLTV Cameras	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
183/128	51/36	1200	557	CiH	T6	TF6 TS6 TR6 HF200Cp HS28Cp HR16

DRDO Sarath Armored Amphibious Dozer

Notes: This is the primary engineer vehicle of India. It is based on the BMP-2 chassis (which India calls the Sarath), 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 crane-like jib with 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 be replaced by an auger, larger digging bucket, a lifting hook, or pincer claws. In addition, there is a larger digging bucket at the front of the AAD and a dozer blade at the rear. The 8-ton capacity winch can be combined with a rocket anchor to throw a 100-meter cable 50-100 meters 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. The front digging bucket can be pitched upwards, allowing the bucket to carry cargo.

Power is provided by an Indian-built version of the Russian UTD-20/3 multifuel engine. It has a manual transmission. The driver and commander/equipment operator sit back to back on the left side; the driver's and commander's hatches open to the side in different directions. The commander's machinegun is at the rear of the commander's hatch on a pintle mount. The driver and commander operate their equipment while viewing on LCD screens (the same ones as provided for with their BMS) and through day/night CCTV cameras on each corner of the vehicle. The two doors on the rear face (and their fuel tanks) are retained, but the firing ports are deleted, and they can be easily obstructed during normal operation by the rear dozer blade. 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. A pair of MICLICs can be added to the rear deck, but not carried as a part of the AAD's standard kit. The AAD has a GPS and BMS.

There is an improved version of the AAD. Improvements include remote control with a controller and 60 meters of cable for use in hazardous areas. The driver's IR scope is replaced by a day/night vision block, with the night channel being an image intensifier and both channels with variable magnification. The AAD is up-armored, including the front, sides and floor, and the crew is given crash/blast-resistant seats. An air conditioner is added. The engine is replaced with a 370-horsepower turbocharged diesel, along with a matching transmission.

In addition to its military role, the Sarath AAD is often found working in disaster areas, where its combination of features lend themselves ably to investigating damaged infrastructure and buildings, negotiating flooded areas, and rescuing civilians. (The AAD does not normally carry MICLICs in this case, allowing rescued civilians to clamber onto the rear of the roof.)

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

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AAD	\$490,867	D, G, AvG, A	1.06 tons	17.2 tons	2	21	Passive IR (D), Image Intensification (C)	Shielded
AAD (Improved)	\$585,130	D, A	1.32 tons	18.37 tons	2	21	Image Intensification (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AAD	128/89	35/25/4	460	111	Std	T2	HF8 HS4 HR4
AAD (Improved)	143/100	40/28/5	460	137	Std	T2	HF10Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AAD	None	None	PKT (C)	2000x7.62mm
AAD (Improved)	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. It is, in fact based on a modified Vijayanta hull which is lengthened by one roadwheel (the same as the M46 Catapult artillery piece). 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 25 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. The Vijayanta ARV does not have an overpressure system, but does have a vehicular collective NBC Pack.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
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\$993,045	D, G, AvG, A	3.39 tons	34.2 tons	4	43	Passive IR (D), WL Spotlight	Shielded
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Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
118/83	33/23	1000	198	Std	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
\$657,552	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
101/71	28/20	1000	198	Std	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; however, despite their utility, production has been slow.

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. Each of the four boxes on each side contain twelve flags, and another is by the left rear door, and can be launched from inside the vehicle, or automatically launched at a given interval. 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, and these have a radio link to the AERV.

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. The crew, often shut up for long periods inside the vehicle, as an air conditioner with NBC filters and a heater.

Other specialist equipment include an echo-sounder to detect water depth and obstacles underwater, A rubber raft is also provided if the engineer crew must check under bridges or in streams and rivers. The interior is surprisingly roomy, as all instruments and monitors are wall-mounted and based on microprocessors and LED screens. If one crewmember spots something, all other crewmembers may view the item by slaving their monitor to the observing crewmember's instrument. There are no cameras mounted, but all crewmembers are issued a digital camera with a 1 GB flash card, which they may connect directly to the radios and transmit the pictures to higher headquarters. If necessary, the AERV can also conduct sabotage missions with a variety of explosives and tools

such as chainsaws.

Like the AAD above, the AERV is often used in support of civilian disaster relief operations.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,969,537	D, G, AvG, A	436 kg	15 tons	4	24	Passive IR (D), 2 nd Gen Image Intensification (C, Roof), 2 nd Gen Thermal Imaging (Roof)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
142/100	40/25/5	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.

For deployment to Afghanistan, the Dutch added applique armor to the sides and front of their YPR-2000-series vehicles, including most of their engineer vehicles (Don't get excited; they are thin aluminum plates bolted onto the faces). In addition, the drive sprockets were replaced with steel drive sprockets. Lugs for ERA on the glacis and sides were also added. These were later removed when the Dutch came home, but have been retained for further use if necessary.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
YPR-765GN	\$299,947	D, A	1.14 tons	13.69 tons	2+5	13	Active/Passive IR (D), WL/IR Spotlight (C)	Shielded
YPR-2000GN	\$547,543	D, A	1.11 tons	13.93 tons	2+5	16	Passive IR (D), Image Intensification (C), WL/IR Spotlight (C)	Shielded
YPR-2000GN	\$551,081	D, A	1 ton	14.06 tons	2+5	17	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	Std	T2	HF6Sp** HS4Sp HR4
YPR-2000GN	137/96	38/27/4	416	99	Std	T2	TF3 TS3 TF3 HF6Sp** HS4Sp HR4
YPR-2000GN	136/96	38/27/4	416	99	CIH	T2	TF3 TS3 TF3 HF8Sp** HS6Sp HR4

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

*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 AESV. 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.

For deployment to Afghanistan, the Dutch added applique armor to the sides and front of their YPR-2000-series vehicles, including most of their engineer vehicles (Don't get excited; they are thin aluminum plates bolted onto the faces). In addition, the drive sprockets were replaced with steel drive sprockets. Lugs for ERA on the glacis and sides were also added. These were later removed when the Dutch came home, but have been retained for further use if necessary.

Vehicles	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
YPR-806PRBRG	\$248,806	D, A	1.14 tons	13.75 tons	3	13	Active/Passive IR (D), WL/IR Spotlight (C)	Shielded
YPR-2000PRBRG	\$605,783	D, A	1.11 tons	13.99 tons	3	15	Passive IR (D), Image Intensification (C), WL/IR Spotlight	Shielded
YPR-2000PRBRG (OEF)	\$615,561	D, A	1 ton	14.23 tons	3	16	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	Std	T2	HF6Sp HS4Sp HR4
YPR-2000PRBRG	137/96	38/27/4	416	99	CiH	T2	TF3 TS3 TF3 HF6Sp HS4Sp HR4
YPR-2000PRBRG (OEF)	135/95	38/26/4	416	99	CiH	T2	TF3 TS3 TF3 HF8Sp HS6Sp 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
YPR-2000PRBRG (OEF)	+1	Basic	M-2HB (C)	2000x.50

*The floor armor of the YPR-806PRBRG and YPR-2000PRBRG is 4.

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.

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 M2's bridge is MLC 60.

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. (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.

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 equipment prevents this.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BLG-67	\$201,183	D, A	664 kg	37 tons	2+1	31	Headlights	Shielded
BLG-67 M2	\$206,698	D, A	591 kg	39 tons	2+1	33	Headlights	Shielded
Brobv 971	\$1,177,089	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	118/83	33/23	680	108	CiH	T6	TF4	TS4	TR4	HF60 HS12 HR6
BLG-67 M2	113/79	32/22	680	108	CiH	T6	TF4	TS4	TR4	HF60 HS12 HR6
Brobv 971	116/81	32/22	680	208	CiH	T6	TF4	TS4	TR4	HF60 HS12 HR6

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

IWI Merkava Mk 3 Nemmera ARV

Notes: While the Puma RAM and some other Israeli ARVs are capable, to an extent, of recovering Merkava tanks, they do so at a severe penalty to range and speed. The Israeli Army, therefore, requested an ARV based on a Merkava tank, preferably a later marque with the capabilities of that type of chassis. The result was the Merkava Mk 3 ARV. The Merkava ARV Nemmera (Leopardess) is currently still under LRIP, but results have been good. The Nemmera is meant to replace several other ARVs, including the M88 Hercules, the Puma RAM, and the Trail Blazer.

This vehicle is capable of easily recovering Merkavas, even those that have suffered mobility kills, and by extension, may recover any vehicle in the Israeli Army inventory. It may also perform many types of field repairs on such vehicles, to the extent of carrying and replacing major end items such as powerpacks to the damaged Merkava, or lifting a complete Merkava turret for repairs which cannot be done to the turret while it is still mounted on the tank. To accomplish this mission, the Merkava ARV has a heavy crane able to lift 50 tons, and a smaller crane near the rear able to lift 10 tons. The main winch has a base pulling capacity of 35 tons, or 70 tons with block and tackle. The Nemmera is capable of removing and lifting a damaged power pack out of the damaged Merkava, then replacing it with an undamaged powerpack it has carried out to the repair site, with assistance of two mechanics. It takes 90 minutes for such an operation to be carried out. In addition to the 20-ton Merkava powerpack, the Nemmera is also able to carry several tons of spare parts and tools.

Internally and externally, the Merkava ARV carries a large amount of spare parts, tools, and supplies such as oil and transmission fluid to assist in repairs. (The exterior of a Merkava ARV is literally studded with lockers, boxes, and attachment points for spare parts and tools.) The rear door is enlarged to allow large items to be carried and removed internally more easily. The Merkava ARV has a small computer which carries tech manuals for every type of vehicle in the Israeli Army inventory, as well as manuals such as BDAR manuals. The Merkava is also, to a limited extent, capable of carrying out repairs on electronic components, including radios and the electronics inside a Merkava's turret and chassis. The Merkava ARV has a 24kW APU and an air compressor able to power four heavy power tools at once. The Nemmera normal carries a driver, a commander/crane operator, and a dedicated mechanic. However, up to five other mechanics may be carries in the Nemmera.

The Nemmera is equipped with a Rafael RWS in the front of the hull roof near the commander/crane operator's position, armed with a MAG machinegun, and NBC-sealed feed which extends into the hull of the vehicle. Armor protection is basically the same as that of the Merkava Mk 3 hull.

Being a variant of the Merkava Mk 3, being powered by an Israeli-built General Dynamics AVDS-1790-9AR 1500-horsepower turbocharged diesel. and the transmission is semi-automatic and developed from the Magach's transmission. The Mk 3 incorporates a threat warning system, which detects targeting lasers and IR beams. The Nemmera has, in effect, a soft-kill APS. A hard-kill APS was considered, but with large amount of projections, lockers, and spare parts carried on the exterior of the Nemmera, was considered impracticable. The Nemmera is equipped with an NBC Overpressure system along with an interior atmosphere purge system to allow the vehicle to be re-sealed in an NBC-sense. The Nemmera has an air conditioner with NBC filters. In the missile of each side of the glacis on either side are a cluster of six smoke grenade launchers, along with the decoys and smoke used in the soft-kill APS. The Nemmera has a BMS, a GPS system, a mapping system, and an inertial position backup.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Shielded
Nemmera	\$1,969,154	D, A	6.47 tons	59 tons	3+5	33	Image Intensification (D, RWS, C), Backup Camera (D), Thermal Imaging (RWS), WL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Nemmera	145/101	40/28	1400	446	CiH	T6	TF17Cp TS10Sp TR8Sp HF220Cp HS33Sp HR19Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Nemmera	+2	Fair	MAG (RWS)	3000x7.62mm

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 they 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 an 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-9R and D-9T have Toughbook-type laptops which have a variety of manuals on them as well as maps, and can be used to mark obstacles and other dangerous areas, and transmit them to BMS-equipped vehicles or other D-9s which are equipped in the same way. The signals can also be used to mark their positions to friendly units equipped with a BMS or other D-9Rs and D-9Ts. They also have air conditioners with NBC filters and NBC Overpressure. The D-9T Tier 4 has a full BMS.

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, and the D-9T Tier 4, which uses an uprated version of that 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	\$193,606	D, A	542 kg	56 tons	2	39	WL Spotlights (4)	Enclosed
D-9N	\$161,386	D, A	551 kg	59 tons	2	43	WL Spotlights (4)	Enclosed
D-9R	\$211,651	D, A	524 kg	61 tons	2	47	WL Spotlights (4)	Enclosed
D-9T	\$576,096	D, A	545 kg	62 tons	2	52	WL Spotlights (4)	Enclosed
D-9T (Tier 4)	\$578,893	D, A	553 kg	63 tons	2	53	WL Spotlights (4)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
D-9L	76/53	32/15	821	169	Trtd	T4	TF14 TS10 TR6 HF12 HS12 HR8**
D-9N	65/45	18/13	821	137	Trtd	T4	TF15Sp TS11Sp TR9Sp HF13 HS13 HR8***
D-9R	67/47	19/13	821	148	Trtd	T5	TF18Sp TS12Sp TR10Sp HF15 HS15 HR9****
D-9T	66/46	18/13	821	148	Trtd	T5	TF20Sp TS14Sp TR8Sp HF17 HS17 HF10****
D-9T (Tier 4)	69/48	19/13	821	160	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 tank) 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 Puma's primary job is to carry a combat engineer squad and their equipment to the FEBA, and past it, if necessary. It is also designed to reduce or break through common obstacles such as rubble, debris, fallen trees, and downed wires. The Puma is also used to destroy directly minefields and IEDs, or for the engineer squad to remove obstacles.

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 are six grenades 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. 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 is equipped with an under-armor Soltam C-08 mortar; this is generally used for suppressive fire or firing illumination rounds.

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 may also be equipped with a plow, a mine plow, a mine roller, or mine flail. It can also mount long, claw-like outriggers to help clear ordinary obstacles; these are some 4 meters wide.

A feature of the Puma is its mine and IED jamming equipment; this operates on the frequencies that such devices use to detonate, and also puts electromagnetic signals which may also cause mines and IEDs to detonate prematurely. For this purpose, the Puma has a skill roll of 14; Outstanding Success means that the device is permanently deactivated (and if buried, the crew may never know its there). Normal Success means that the mine or IED goes off prematurely. Catastrophic Failure means that the device is missed by the sensor and the vehicle or personnel near it may detonate it normally. The anti-mine equipment has a range of 10 meters in a 180-degree arc in front of the vehicle and to the front sides.

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.

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.

The Puma is upgraded with a more powerful and more compact 900-horsepower Merkava-type diesel engine.

The Israelis are considering an upgraded version of the Puma for its 4th Combat Engineer Brigade. These vehicles would be beefed up to tackle minefields and deal with IEDs. I do not currently have enough information on this modified Puma to stat it.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Shielded
Puma AEC	\$973,958	D, A	2.18 tons	51 tons	3+5	35	Passive IR (D), Image Intensification (C. G), Thermal Imaging (G), 2xCCD Cameras	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), 2xCCD Cameras	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Puma AEC	129/91	56/25	1037	334	CiH	T6	TF20Sp TS14Sp TR8Sp HF100Cp HS24Sp HR20
Puma w/Superstructure	120/84	35/24	1037	334	CiH	T6	TF20Sp TS14Sp TR8Sp HF100Cp HS24Sp HR20

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

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
\$868,450	D, A	5.42 tons	44 tons	2+6	35	Passive IR (D), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
129/91	36/25	1037	334	Std	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 M4A1 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
\$344,648	G, A	1.21 tons	33.2 tons	4	19	WL Spotlight (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
108/76	30/21	636	256	Std	T5	HF27 HS8 HR4

Fire Control	Stabilization	Armament	Ammunition

None

None

M-2HB (C)

2000x.50, 20 kg C4

*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 of 4Sp.

TAAS Tagash

Notes: This AVLB is based on the chassis of the M60A1 tank. The name TAGASH is an acronym for words in Hebrew that literally means "tank bridge."

The Tagash 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 its 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 or 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
Tagash w/One-Span Bridge	\$726,310	D, A	337 kg	39.4 tons	2	47	Image Intensification (D, C), 4xCCTV Cameras (C)	Shielded
Tagash w/Tzmed Bridge	\$728,790	D, A	337 kg	50 tons	2	47	Image Intensification (D, C), 4xCCTV Cameras (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor*
Tagash w/One-Span Bridge	136/95	38/27	1457	277	CiH	T6	TF4 TS4 TR4 HF56 HS15 HR8
Tagash w/Tzmed Bridge	114/80	32/22	1457	277	CiH	T6	TF4 TS4 TR4 HF56 HS15 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
	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 a base armored vehicle – in this case, the 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, primarily for bracing the vehicle while the crane or winches are being used, though it is capable of shouldering aside some obstacles or digging large fighting positions. 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. A secondary winch has a capacity of 3 tons, or 6 with block and tackle. 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.

A cluster of three smoke grenade launchers are mounted on the glacis about a meter below the top of the glacis. They face 45 degrees outwards.

The engine is the same as on the OF-40 Mk 2 tank: an MTU MB 838 ca M 500 830-horsepower multifuel engine; it has a power take-off so full power can be applied to the crane, winches, and power tools.

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. The UAE version also has small LCD screens at the driver's and commander's positions to allow them to navigate using the GPS and a small mapping computer. The UAE also generally equips them with an extra long-range secure radio, and the other two radios are also secure radios.

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 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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
OF-40 ARV	\$264,996	D, G, A	6 tons	45 tons	4	40	Image Intensification (D, C). IR/WL Floodlight	Shielded
OF-40 (UAE)	\$321,700	D, G, A	6 tons	45 tons	4	42	Image Intensification (D, C). IR/WL Floodlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
OF-40 ARV	146/102	41/28	1000	308	Stnd	T6	HF72 HS18 HR14

Vehicle	Fire Control	Stabilization	Armament	Ammunition
OF-40 ARV	None	None	MAG (C)	2800x7.62mm

*The front-mounted dozer blade may also function as armor; what's protected by the blade depends on how high the blade is raised. The blade is 1.1 meters high and about 3.55 meters wide, and in general may be Not Raised, Medium Raised, and Fully Raised. Travel Position is different; the blade is raised to a position just off the ground, then folded flat underneath and against its arms. This may still stop a round, but the chance of an enemy gunner hitting it is only 1 in 20. The blade has an AV of 6Sp.

Mitsubishi Type 11 ARV

The Type 11 is an ARV designed specifically to service and recover the Type 10 tank. Development began at about the same time as the Type 10, and service in the JGSDF began in 2011, shortly after the Type 11 completed field trials in early 2011. Type 11 production is proceeding concurrently with the Type 10, though of course as a much lesser rate.

As the Type 11 is designed specifically to support the Type 10 tank, which is smaller and lighter than the Type 90, it is smaller than the Type 90 ARV and somewhat less capable. However, it can still recover Type 74 tanks or vehicles of about that weight, which are still being used in small numbers by the JGSDF. In addition, the tool set is largely designed for work on the Type 10, though it consists of the usual selection of broad categories of tools, including basic tools, tracked vehicles, heavy ordinance tools, small arms tools, excavating tools, two 20-ton hydraulic jacks, power tools such as and an arc welder and power bolt/screwdriver, and electrical and electronics repair kits. It also has some special items, such as a pared-down OS and software repair programs on a high-capacity flash drive to conduct computerized systems repair. The Type 11 has a portable 1 kW battery, used to provide power to dead electrical or electronic systems. Like all ARVs, the Type 11 carries a decent selection of repair parts, though with the accent on those needed to repair a Type 10. Two tow bars and several lengths of cable and rope round out the tool set. A 12kW APU is provided to run the power tools and an air compressor when needed,

The Type 11 has a crane with a 25-ton capability. This crane is mounted on the front right side, and can turn though 200 degrees. On the front of the Type 11 is a 1x9-meter blade that is normally used to anchor the vehicle during winching or crane operations, but can also be used to dig fighting positions for vehicles or plow through berms. The main winch has a capacity of 50 tons and 100 meters of cable; the lead winch has a capacity of 4 tons and has 150 meters of cable. The Type 11 is equipped with a 12 kW APU, normally used to power the power tools and the air compressor. It can, however, power the crane and the winches (but not both at the same time).

The front of the vehicle has, on the left side, a bank of six smoke grenade launchers. Above this is the driver's position and on the other side of the Type 11 is a hatchway (with the hatch pivoting open instead of opening upwards) and a manually-rotating cupola. The commander has all-around vision as well as one vision block below the gun mount with night vision capability. The commander may aim and fire his weapon from under armor with the hatches closed. At the center of the superstructure is a position for the crane operator. He can also operate the plow and the winches using four CCD cameras at the corners of the vehicle. (Normally, however, the driver operates the plow.) A fourth crewmember is another mechanic.

The Type 11 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 at the commander's position allow the crew to monitor the BMS and vehicle state 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. The Type 11 is equipped with an NBC Overpressure system and an air conditioner with NBC filters.

The Type 11 has an armor suite based on, though not equal to, the Type 10's armor. The engine is the same as the Type 10, a Cummins V8 diesel with an output of 1200 horsepower. This is coupled to the same type of Continuously Variable Transmission as on the Type 10, and this allows the Type 11 excellent cross-country mobility as well giving it the ability to travel at full speed in reverse. The suspension can also be locked to augment the plow in anchoring the Type 11.

Note that the Armor and Fuel Cap figures for the Type 11 listed here are provisional, as I have not yet done stats for the Type 10 tank, and the figures may change when I do.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,252,781	D, A	5.66 tons	44.4 tons	4	31	Image Intensification (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
182/127	51/35	895	446	Std	T6	HF90Cp HS24Sp HR12

Fire Control	Stabilization	Armament	Ammunition
None	None	M2HB (C)	1500x.50

*The plow gives the front of the vehicle 8Sp; this of course depends on how high the plow is raised. In normally traveling configuration, the plow is carried horizontally straight out about one-third up the front of the Type 11. As any hit from the front with the plow in traveling configuration would hit the plow edge on, there is only a 5% chance of hitting the plow if the Type 11 has its plow in the traveling configuration.

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 exported and production was limited to 16 vehicles. Despite the Type 67's bridge being unable to support some of the heavier vehicles being produced today, the Type 67 AVLB remains in service to work with lighter vehicles, serving as adjunct to later designs.

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 width is 3.5 meters, while the trackways are some 980 centimeters apart. The bridge weighs 7 tons. The trackway is sheathed in rubber to give

vehicles a better grip. 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.

There is a small book locker which has manuals for repair and recovery operations; this was replaced with a laptop computer in the early 1990s. In the late 1970s, the radios were augmented with early versions of US-designed Vinson encryption modules, and improved versions replaced them over the years. In the mid-1990s, the radios were replaced with FH radios, and the vehicle was given an MLU. In the early 2000s, the Type 67 AVLB was equipped with a BMS.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 67 (Base Vehicle)	\$472,124	D, A	481 kg	35 tons	3	16	Active/Passive IR (D)	Shielded
Secure Radio Upgrade	\$472,278	D, A	481 kg	35 tons	3	16	Active/Passive IR (D)	Shielded
Computer Upgrade	\$497,017	D, A	481 kg	35 tons	3	17	Active/Passive IR (D)	Shielded
MLU	\$306,795	D, A	481 kg	35 tons	3	17	Active/Passive IR (D)	Shielded
BMS Upgrade	\$553,945	D, A	481 kg	35 tons	3	18	Active/Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor			
Type 67	146/102	41/29	875	241	CiH	T6	TF4	TS4	TR4	HF51 HS12 HR8
MLU	149/105	42/29	875	194	CiH	T6	TF4	TS4	TR4	HF51 HS12 HR8
BMS Upgrade	149/103	42/29	875	194	CiH	T6	TF4	TS4	TR4	HF51 HS12 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 67	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 67 AEV 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 with 100 meters of cable. The Type 61 has long since been retired, but the Type 67 AEV is still in use. Hull layout of the Type 67 AEV and that of the Type 70 ARV are roughly similar; the Type 67 AEV was essentially used as a template for the Type 70 ARV.

The Type 67 AEV has a raised superstructure instead of a turret. The Type 67 has a front-mounted mine plow/dozer blade which is controlled by the driver. The Type 67 AEV has an A-frame crane with a capacity of 18 tons, which can lift such a weight to a height of 6 meters, and which folds up to the rear deck when not in use. The vehicle has a 5kW APU and an air compressor, primarily to power the large amount of power tools it carries, including a welding and cutting set, two sizes of chainsaws, rotary saws, jaws of like, and other power tools. The Type 67 AEV also has two sets of pioneer tools, three sizes of crowbars, and tow shackles, cables, rope, and a towbar, allowing the Type 67 AEV to pull out large stumps or lumps of concrete or operate as an ad hoc recovery vehicle.

Inside are positions for the driver and commander, with the driver on the left front deck and the commander on the center front deck. Inside the hull behind the driver and commander are two other combat engineers. Most of the power tools are also contained inside (though some of the larger power tools are in lockers on the outside of the hull). Outside, the Type 67 AEV has four clusters of five smoke grenade launchers, one on each bumper and one on each side of the vehicle near the center.

There is a small book locker which has manuals for AEV and demolitions operations; this was replaced with a laptop computer in the early 1990s. In the late 1970s, the radios were augmented with early versions of US-designed Vinson modules, and improved versions replaced them over the years. In the mid-1990s, the radios were replaced with FH radios. In the early 2000s, the Type 67 AEV was equipped with a BMS.

The APU is on the right rear of the hull; the compressor is on the left rear of the hull. A set of slave cables are provided to allow vehicles with dead batteries to be started from the AEV or its APU.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
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Type 67 AEV (Basic Vehicle)	\$437,792	D, A	728 kg	35 tons	4	19	Active/Passive IR (D)	Shielded
Secure Radio Upgrade	\$437,817	D, A	728 kg	35 tons	4	19	Active/Passive IR (D)	Shielded
Computer Upgrade	\$257,352	D, A	728 kg	35 tons	4	19	Active/Passive IR (D)	Shielded
MLU	\$398,896	D, A	728 kg	35 tons	4	20	Active/Passive IR (D)	Shielded
BMS Upgrade	\$912,699	D, A	728 kg	35 tons	4	21	Active/Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Type 67 AEV (Basic Vehicle)	144/101	40/28	875	241	Std	T6	HF51 HS12 HR8
MLU	147/103	41/29	875	194	Std	T6	HF51 HS12 HR8
BMS Upgrade	147/103	41/29	875	194	Std	T6	HF51 HS12 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 67 AEV	None	None	Type 67 (C)	2000x7.62mm, Engineer Demo Chest, 20 kg C4, 200m Primercord

*The front dozer blade can help protect the Type 67 AEV, depending on where the shot hits and how high the blade is raised. The blade has an AV of 8Sp, and can protect one third of the front as a time, depending what it is raised to.

Mitsubishi Type 70 ARV

Notes: This Japanese recovery vehicle is based on the chassis of the Type 61 main battle tank. As with many other older Japanese vehicles, the Type 70 has been retained to service smaller or lighter vehicles; it is not used to service newer tanks.

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, and tools like a pneumatic wrench/screwdriver. The vehicle has a 5kW APU. Inside, there is storage for tech manuals of various sorts of Japanese vehicles; these were later replaced with a laptop computer. In the late 1970s, the radios were augmented with early versions of US-designed Vinson modules, and improved versions replaced them over the years. In the mid-1990s, the radios were replaced with FH radios and the Type 70 given an MLU. In the early 2000s, the Type 70 ARV was equipped with a BMS.

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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 70 ARV (Basic Vehicle)	\$379,880	D, A	4.25 tons	35 tons	4	21	Passive IR (D)	Shielded
Secure Radio Upgrade	\$379,898	D, A	4.25 tons	35 tons	4	21	Passive IR (D)	Shielded
Computer Upgrade	\$419,744	D, A	4.25 tons	35 tons	4	21	Passive IR (D)	Shielded
MLU	\$408,590	D, A	4.25 tons	35 tons	4	22	Passive IR (D)	Shielded
BMS Upgrade	\$799,370	D, A	4.25 tons	35 tons	4	23	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Type 70 ARV (Basic Vehicle)	147/103	41/29	875	241	Std	T6	HF51 HS12 HR8
MLU	147/103	41/29	875	194	Std	T6	HF51 HS12 HR8
BMS Upgrade	147/103	41/29	875	194	Std	T6	HF51 HS12 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 70 ARV	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, and can protect one third of the front at a time, depending what it is raised to.

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 D9 non-armored combat earthmovers that the Japanese were using until that point. It is still in service today. It is, however, based on the D6 and not the D9.

The dozer blade is to the rear, and the vehicle is driven backwards for earthmoving operations. He sits in a turning seat which also may be raised and lowered, 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 commander 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 in 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. A self-recovery winch is mounted at the front.

The dozer blade is full-width (3.45 meters) and is hinged in the middle so it can be used as a mine plow. (Normally, the plow is in a wide V-shape, with the V forward or backward as needed..) 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. The base Type 75 has secure radios, as detailed in entries above. A laptop computer was added in the early 1990s. In the mid-1990s, the radios were replaced with FH radios. At this time, the Type 75 was also given an MLU; this had no appreciable increase in performance, however. In the early 2000s, the Type 75 ACE was equipped with a BMS.

The Type 75 ACE had a fair-to-middlin amount of modular armor plate, but this is normally removed except for the most realistic training exercises. It was mounted on the two Type 75s deployed to Afghanistan early in Enduring Freedom.

The Tr Mov stats below reflect a Type 75 using the full 345 horsepower. The Com Mov has a set of stats for 345 and 160 horsepower mode.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 75 ARV (Basic Vehicle)	\$57,334	D, A	1.62 tons	19.2 tons	2	15	Headlights	Shielded
Computer Upgrade	\$123,541	D, A	1.62 tons	19.2 tons	2	16	Headlights	Shielded
BMS	\$417,601	D, A	1.62 tons	19.2 tons	2	17	Headlights	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Type 75 ARV (Basic Vehicle)	143/100	40/28 (25/17)	595	102 (46)	Std	T3	HF7 HS7 HR7
Computer Upgrade	143/100	40/28 (25/17)	595	101 (45)	Std	T3	HF7 HS7 HR7
BMS	143/100	40/28 (25/17)	595	101 (45)	Std	T3	HF7 HS7 HR7

*The ACE's blade can protect the front of the vehicle, depending on where the shot hits and how high the blade is raised. The blade

has an AV of 10Sp, and can protect one half of the front as a time, depending what it is raised to. Normal travelling configuration is raised just enough to not block the driver's vision.

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, as while the Type 78 is currently being kept in service, the parts for them are no longer being made.

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, a power nut/bolt/screwdriver, two 20-ton hydraulic jacks, and an air compressor; A 5kW APU is mounted inside the rear right; this is normally used for the power tools, but is also able to power the winches (but not the crane). 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.

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 left; the commander is directly to his 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 front of the vehicle, about 800 centimeters below the driver's and commander's positions, are long tubes, which are smoke grenade launchers. There are three on either side of the front, angled slightly to the side.

A laptop computer was added in the early 1990s. In the mid-1990s, the radios were replaced with FH radios, and the vehicle was given an MLU. In the early 2000s, the Type 78 was equipped with a BMS.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Type 78 (Base Vehicle)	\$235,512	D, A	5.07 tons	38 tons	4	29	Passive IR (D)	Shielded
Computer Upgrade	\$271,512	D, A	5.07 tons	38 tons	4	30	Passive IR (D)	Shielded
MLU	\$217,512	D, A	5.07 tons	38 tons	4	30	Passive IR (D)	Shielded
BMS Upgrade	\$711,612	D, A	5.07 tons	38 tons	4	31	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Type 78 (Base Vehicle)	149/104	41/29	950	267	Std	T6	HF56 HS14 HR10
MLU/BMS Upgrade	149/104	41/29	950	241	Std	T6	HF56 HS14 HR10

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Type 78 (All)	None	None	M-2HB (C)	660x.50

*The front dozer blade can help protect the Type 78, depending on where the shot hits and how high the blade is raised. The blade has an AV of 8Sp, and can protect one third of the front at a time, depending what it is raised to.

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 supplement the Type 78 and Type 67 ARVs. 30 Type 90 ARVs have been delivered to the JGSDF (plus one prototype); production rate was always slow and is now considerably slower, as Mitsubishi has largely fulfilled the JGSDF's needs. However, spare parts are still being produced for the Type 90.

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. The crane may be rotated up to 300 degrees, 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. There is also a lead winch with a capacity of 4.72 tons (double with block and tackle). 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. These are normally powered by a 12kW APU; this APU is even strong enough to operate either the winches or the crane (but not both at the same time), but normally is used to power the air compressor and the power tools. 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. There are also seats for extra support personnel or the crew of a disabled vehicle. The hull layout of hatches, bins, and lockers are much the same as the Type 78; these boxes are where most of the tools and some of the spare parts are located. The selection of tools is also much like the Type 78 and 67.

Commander's and driver's positions are in the front of the nearly-vertical front of the vehicle. At the rear is a larger hatch for the recovery specialist, who can use the crane and winches from inside or outside the vehicle. The crane and winches use the same controller whether inside or outside the vehicle, but the mechanic usually clips the controller to a receptacle on the hatch ring to conserve batteries; alternatively, the controller may be put into a clip below the hatch ring and the crane and winches used while the hatch is closed. The mechanics can also enter and exit through this hatch. As using the winches may be difficult from the recovery specialist's hatch, there are two MFDs under the hatchway, which show the feed from CCD cameras on each corner of the superstructure. 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. This gun may aimed and fired from inside the vehicle with hatches closed. The Type 90 has an eight-cell line of smoke grenade launchers in front of the driver, about a meter below, on the forward superstructure.

The Type 90 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 Type 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 at the commander's position 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 driver's screens. The driver and commander also have access on their screens to the four CCD cameras. One at each point of the superstructure. Conventional maps are also carried, as well as a small computer and typed notes that summarize recovery and repair information and solutions. An air conditioner with NBC filters is installed. There is a small basic copy of the OS for the electronics and the programs necessary to operate each of the subsystems; this is contained on a small portable hard drive and can usually fix the computer-controlled components of any of the subsystems, or even run one subsystem if necessary.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,123,421	D, A	7.31 tons	49.57 tons	4+4	29	Passive IR (D), Image Intensification (C), 4xDay/Night CCD Cameras	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
200/140	56/39	1100	557	Std	T6	HF100Cp HS24Sp HR12

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

*The front dozer blade can help protect the Type 90, depending on where the shot hits and how high the blade is raised. The blade has an AV of 8Sp, and can protect one third of the front at a time, depending what it is raised to.

Mitsubishi Type 91 AVLB

Notes: The Type 91 AVLB uses a triple-stack bridge, similar to some of the German Leguan designs; it is rumored that the Japanese had support from the Germans for their Type 91's bridge design. Like the Leguan triple-stack designs, the bridge sections slide from the top down; they are already attached to each other. The bridge can span a 20-meter gap. They do not deploy upwards in the process of deploying, which is tactically more sound. Unusually, the Type 91 has a 19kW APU, allowing the bridge to be deployed in a quitter manner using APU power. The APU is inside the hull in front of the engine, with an exhaust to the right side. The Type 91 has a rear-mounted blade, used to stabilize the vehicle while the bridge is being deployed or recovered. The bridge is an MLC 70 bridge, able to support any Japanese vehicle, or even heavy vehicles like the American M1 or the British Challenger 2. The Type 91 is able to bridge a 26-meter gap. Though the commander, in the center of the vehicle, is the primary crewmember who operated the bridge, the driver in the front center also has bridge controls and operate the bridge, or the two may coordinate their efforts. The crewmembers do not have to leave the vehicle to deploy or recover the bridge; indeed, they may be under armor with the hatches closed. Two CCD cameras assist in this.

The driver may operate a dozer blade, which is normally used to prepare the banks of the obstacle on the side the vehicle is on. It is also used as a general brace when deploying or recovering the bridge. Emplacement of the bridge takes about five minutes; recovery of the bridge takes about ten. The vehicle also carries a double ser of pioneer tools, should these become necessary to

prepare the banks of the obstacle. The Type 91 is equipped an NBC Overpressure system as well as air conditioning. The crew has no mounted weapon, but the commander has a Type 62 machinegun inside his compartment with a relatively large amount of ammunition.

The Type 91 is equipped with several secure radios of various ranges. The driver and commander have two MFDs each, to go with the BMS, which also gives the vehicle state and the state of the bridge and deployment machinery. The other two crewmembers also have one MFD each, to keep track of the general situation and the condition of the bridge and deployment machinery. The Type 91 is powered by a Mitsubishi 10ZG turbocharged diesel developing 1500 horsepower, coupled to an automatic transmission; The Type 91 can lock its suspension as well as pivot turn in place, as well as use the engine to increase torque when deploying and recovering the bridge.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,290,636	D, A	444 kg	38 tons	4	28	Passive IR (D), Image Intensification (C), 2xDay/Night CCD Cameras (Front)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
219/153	61/43	1100	557	Std	T6	HF100Cp HS24Sp HR12*

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

*The front dozer blade can help protect the Type 91, depending on where the shot hits and how high the blade is raised. The blade has an AV of 8Sp, and can protect one third of the front at a time, depending what it is raised to.

KADDB AB1 Monjed ARRV

Notes: Also known as the AB1, the Jordanians still had a number of M-47-based repair and recovery vehicle in service, even in 2012 when these conversions started. 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 somewhat 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 first entered Jordanian service in 2001. Some 12 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; it has 157 meters of usable cable. Once the vehicle is recovered, the AB1 can tow a vehicle of up to 50 tons, however, combat ant travel mov is cut in half.

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 cluster of four smoke grenade launchers.

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 vehicle also has a 7kW APU, normally used to power the tools. 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 as a sort of ersatz applique armor. 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.

The AB1 was retained in service to recover smaller vehicles.

Unfortunately...

It soon became clear that the M47-based AB1s were not up to the task of servicing the Jordanian's tank fleet, most of which were based on M60s and Chieftains. Thus, after only 12 conversions to the AB1 standard were done to the M47s, similar conversions were made to M60 tanks. Some 25 conversions of this standard have been done, and the program is considered complete, though the production lines remain open for refurbishment and production of spare parts. The conversions were essentially similar, though the crane and winches were made more capable, and towing capacity is improved. In fact, the entire new AB1 was much of a quantum leap in performance over the original AB1, and was given the designation AB1 P1 ("Monjed" still). The crane is capable of lifting and manipulating the power packs and complete turrets of Jordanian tanks, or simply the engines or transmissions if the vehicle does not have an integrated power pack, or both as a sling load; it has a capacity of 9.5 tons at a reach of 4.9 meters. The hydraulics are self-contained and powered by a power takeoff from the torque in the engine. In addition, the suspension and brakes can be locked to provide additional stability. The front mounted blade can also anchor the vehicle, even against an 80-ton block and tackle pull from the winch and still keep the vehicle still, though in such operations the AB1 P1's suspension are normally locked. The blade can also dig fighting positions, for large infantry positions or for vehicles. The AB1 P1, like the AB1, has a single winch with a pulling capacity of 41 tons, or 80 tons with block and tackle. The AB1 P1 has a 12kW APU; this is enough to operate the crane and tools (but not the winch), and the AB1 P1 can, for example, change its own power pack. Towing capacity is 60 tons at half speed. A flat area on top of the rear of the hull can carry a complete power pack of any vehicle in Jordanian service.

The tool set carried by the AB1 P1 is almost the same as that of the AB1. However, there are two circular saws of different sizes, as well as two chainsaws of different sizes. It also carries a greater selection of spare parts, and a somewhat more full selection of manuals on its computer, including for all vehicles in Jordan's inventory. The AB1 P1 does, however, carry only a limited amount of spare parts for vehicles other than Jordan's tanks and APC/IFVs.

The AB1 P1 is based on the M60A1 chassis, but the engine has been replaced with a more powerful version of its normal engine developing 950 horsepower and having more torque. The suspension is also modified, able to be locked and also having locking brakes. The transmission has been replaced with an automatic transmission. Armor is essentially the same as that of the M60A1, though the front of the vehicle has only a mild slope. The driver is at and the front of the superstructure on the left; his front vision block has a night vision channel. The commander is behind him in a hatch with a manually-rotating cupola and a weapons mount. In the center of the vehicle is a hatch for one of the mechanics to operate the crane; the commander can also operate the crane from his position. The driver normally operates the winch and the blade, but the winch (but not the blade) can also be controlled from the driver's or crane operator's position. The APU is normally started and stopped from the crane operator's position, but may also be

started and stopped from any position, including the interior of the vehicle. The crew is normally those three, but there is a fold-down seat inside the vehicle on the right near the front for another mechanic or technician or other passenger. Note that the driver, commander, and crane operator are all also mechanics/technicians. There is a cluster of four smoke grenade launchers low on the glacis on the each side, slightly pointing outward. The AB1 P2 has the same BMS system as the AB1.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AB1 Monjed	\$371,305	D, A	6.18 tons	42 tons	2+1	28	Image Intensification (D)	Shielded
AB1 P1 Monjed	\$442,089	D, A	6.87 tons	49 tons	3+1	34	Image Intensification (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
AB1 Monjed	124/87	35/24	1514	161	Stnd	T5	HF50 HS14 HR8
AB1 P1 Monjed	139/97	39/27	1457	352	Stnd	T6	HF56 HS15 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AB1 Monjed	None	None	M-2HB (C)	660x.50
AB1 P1 Monjed	None	None	M-2HB (C)	900x.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 ARV/AEV

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, especially as it was armed with an 81mm mortar on the right of the glacis to help reduce obstacles as well as a number of power tools to do the same, as well as a small amount of plastic explosive and an engineer's demo chest.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$158,359	D, G, AvG, A	1.88 tons	29.2 tons	4+2	23	Active/Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
100/70	28/19	651	89	Std	T5	HF27 HS8 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M-2HB (C), MG-3 (RBoW), M-29 81mm Mortar (RFH)	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 at 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 worktable, 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
\$101,468	D, A	3.14 tons	15 tons	5	13	Passive IR (D), CCTV (D), Image Intensifier (C, CO)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
129/90	36/25/4	480	98	Std	T3	HF9Sp HS5Sp HR5

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

Obrum MID-S Bizon CEV

Notes: The MID (*Maszyna Inzynieryjno-Drogowa*, or Engineering-Roading Machine) is a Polish combat engineer vehicle based upon the PT-91 chassis, and incorporating many features of the WZT-3 armored recovery vehicle below. Development was a long process, with initial prototypes being based on retired T-72 tanks, and later using the PT-91 hull when production of the PT-91 ramped up. Development began in 1988, but the initial T-72-based Bizons were disappointing, and production of the PT-91 ramped up so slowly that the design team thought they would never receive PT-91 hulls upon which they could base the Bizon. (One almost gets the idea that they were stalling and using the T-72-based vehicles to experiment with heavy gear and tool sets). The first PT-91-based prototype appeared in 2000, with full production for the Polish Army being completed in 2005. However, with the Polish Army's recent decision to retire their PT-91 tank force and part of their Leopard 2A4 force and replace them with M1A2 SEP v3s, it is possible that more engineering vehicles based on PT-91-based hulls may appear in the future.

The Bizon's (Bison) 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, a digger bucket, or a cable attachment to lift obstacles out of (or into) the way. 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. 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. The digger bucket can lift 0.96 meters square; it can grab on a vehicle that is the right size. It can lift up to 7 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.

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 width of the blade is 4.2 meters, while the height is 0.9 meters.

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. Other equipment includes basic and tracked vehicle tools, 2 sets of pioneer tools, a chainsaw, and a 5kW generator with a voltage converter which can be used to recharge the batteries or take their place if they are drained. It normally carries two bundles of 40 meter long trackway. 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. 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, but in a pinch can be used on advancing enemy infantry or even some armored vehicles.

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. 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 (the Poles are considering replacing the NSVT with an M2HB), and a RPK-74 on the right bow and an RPK on the left side near the center of the glacis in both cases, near the fender. Both have limited traverse and elevation (about 20 degrees in any direction), and may fire directly by the driver or by a remote uplink from the commander's or the position used when the commander or driver is operating the crane arm.. The commander's position is behind and to the right of the driver's position. Four seats may carry up to four other engineers.

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 the RPK-74 and the RPK, and may fire one or both at once from his position. The commander is to the right and rear of the driver's position, 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, with a position not-quite in the center of the vehicle. 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, and a small computer with tech manuals and solutions to problems like clearing obstacles or making them. 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. The MID 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. This smoke is actuated by injecting diesel and some other chemicals into the Bizon's exhaust. This system is less effective against Thermal Imaging or FLIR systems, causing only a -3 deficit to these systems.

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. It lacks some features, most notably the BMS, the special smoke generation system, and bow automatic rifles.

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.

Vehicles	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MID-S	\$932,721	D, G, AvG, A	1.05	46 tons	2+4	59	Passive IR (D), Image	Shielded

MID-M	\$472,094	D, G, AvG, A	tons 1.05 tons	45.32 tons	2+4	57	Intensification (C) Passive IR (D), Image Intensification (C)	Shielded
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Vehicles	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
MID-S	134/94	37/26	1000	315	Std	T6	HF149Cp HS20Sp HR10
MID-M	135/95	38/26	1000	312	Std	T6	HF149Cp HS20Sp HR10

Vehicles	Fire Control	Stabilization	Armament	Ammunition
MID-S	+1	Fair	NSV (C), RPK (Bow), RPK-74K (Bow), RPG-7	300x12.7mm, 1000x5.45, 1000x7.62mm, 7xRPG-7 Rockets, 20 kg C4, Engineer Demo Chest
MID-M	+1	Fair	M2HB (C), RPG-7	1000x.50 BMG, 7xRPG-7 Rockets, 20 kg C4, Engineer Demo Chest

HSW MT-LB TRI Hors 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. Development began in 1980 and entry into service began in 1982. In 1985-86, the Hors was modernized, in the late-90s, it was again updated.

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 using a profile echograph or a simple hand weight/bob. The Hors also carries a rebreather and diving equipment for more detailed observation of water as well as two sets of snorkels/masks and swim fins. Two rubber rafts also aid this, and the Hors has a small air compressor in order to inflate these boats. Water speed may be measured with a hydro speedometer. The Hors is equipped with a hydrophone in the nose of the vehicle to detect other vehicle crossing the water up to one kilometer away.

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 vehicle has an inertial positioning device to keep it on track. 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 and detect metallic mines within a 150-degree arc in front of the vehicle at a range of 20 meters. The mine detector can also detect non-metallic mines (even the so-called "plastic" mines have a small degree of metal in them) within 10 meters. If necessary, small rocket anchors can pull up mines in its path or predetonate them. The Hors has six such rockets mounted at the bottom of the glacis, and can be rotated up to 20 degrees up, down, or to the sides. The are aimed and fired by a TV screen (later interactive LED screen) from the commander's position. On the roof of the vehicle is a laser rangefinder, a reconnaissance scissors telescope, a camera on a mast, a theodolite, The Hors also has a set of 40 flags on either side of the rear with may be fired into the ground beside the rear of the vehicle, to mark a path. Other equipment issued with the vehicle include a hand-held image intensifier, a camera with a telephoto lens, 6 sets of binoculars, a signal mine, and signal pistol. There is also a hot plate and water/ration heater. 4 computers, three with monitors, are available to the technicians, giving readouts for the chemical and radiological conditions outside the vehicle, as well as the intelligence collected by the technicians outside the vehicle. The Hors carries MOPP suits for all crewmembers as well as decontamination kits. Pioneer tools complete the tool set.

The crew consists of a driver and commander, as well as 1-6 additional engineers as necessary to operate the reconnaissance equipment. 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. At the rear of the vehicle, on each side, are clusters of five smoke grenade launchers.

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

TRI-M1 Hors

The TRI-M1 (my designation; it is not an official designation) is the result of an upgrade done in the 1985-86 period. This upgrade gave the Hors an engine derived from the BMP-1, developing 300 horsepower. Additional night vision equipment was also added, and some of the reconnaissance equipment was improved. Computer equipment and some of the reconnaissance equipment was partially digitized, and radiation shielding was hardened to protect transistors further from EMP. A 1 GB-capacity digital tape system was added to the vehicle, allowing findings to be stored; this is hooked into the computer system and one of the data-capable radios, and the radio is further improved to allow it to use a burst-transmit transmission, whether from the tape system or directly from the computers of the cameras and vision devices on the roof or in the commander's cupola or the laser rangefinder. The commander has a ballistic computer to help aim his fire from the NSVT.

TRI-M2 Hors

The M2 (again my designation, and not an official designation) Upgrade was performed in the late 1990s and replaces the older computers with ones having almost all digital architecture. The tube TV monitors were replaced with LCD screens; early in the

upgrade, only small LCD screens were available, but by 1998 much larger screens were available, and these were subsequently replaced with interactive touchscreens before the upgraded Hors' were fielded. The radios were also replaced with radios of Western make that are digital-architecture based, and all are data capable with a much high throughput. The Hors M2 has been given a NATO-compatible BMS as well as a vehicle state computer, and the cameras have been replaced with CCD devices. The engine was partially overhauled and partially modified; the powerpack may be removed in one piece, for example, and small computers keep track of various systems for the vehicle state computer. The transmission has been replaced with an automatic transmission. Many of the new components, particularly the computers, are smaller, allowing for more storage for crew equipment and ammunition; this, for example, increased the ammunition load which may be carried, and doubles the MOPP Suits which are carried along with a tripling of protective mask filters and two rebreather recharge kits. The tape backup/storage system has been replaced a pair of hard-drive-based 1 GB storage devices, far smaller than the tape system. The M2's communications equipment can also transmit a 50% shorter burst for the same amount of information. Normal data transmissions rates are in the range of 250-275 Mbps, with burst transmission speeds reaching 1 Gbps. (This of course depends upon how fast the unit or vehicle they are transmitting to can receive data.) The M2 has a laser designator in addition to the rangefinder; this allows then to call for precision-guided shells or aircraft weapons for supporting fires to convert a retreat, or confront an immediate threat. A small 3.5 kW APU has been added to allow for silent watch; this runs of vehicle fuel. Finally, radiation shielding was further hardened to protect the delicate components inside; in addition, the clothesline antenna was replaced by retractable whip antennas.

Further upgrades are currently being considered for the Hors, though most of the military leadership considers the Hors to be adequate for its role.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
TRI Hors	\$1,519,163	D, A	1.58 tons	13.15 tons	2+6	33	Passive/Active IR (D, C), 2xDay TV Camera, 2xNight TV Camera	Shielded
TRI-M1 Hors	\$1,620,362	D, A	1.52 tons	13.3 tons	2+6	34	Passive IR (D, C), Image Intensification (D, C), 4xDay/Night TV Cameras	Shielded
TRI-M2 Hors	\$1,975,628	D, A	1.84 tons	13.4 tons	2+6	37	Image Intensification (D, C), Thermal Imaging (C), 4xDay/Night CCD Cameras	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
TRI Hors	146/103	41/28/4	450	91	Std	T3	HF5 HS2 HR2
TRI-M1 Hors	169/118	47/33/5	450	111	Std	T3	HF5 HS2 HR2
TRI-M2 Hors	168/117	47/33/5	450	111	Std	T3	HF5 HS2 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
TRI Hors	None	None	NSVT (C), 6xRPG-7	240x12.7mm, 36xRPG-7 rockets, 20 kg C4, Engineer Demo Chest
TRI-M1 Hors	+1	Basic	NSVT (C), 6xRPG-7	500x12.7mm, 36xRPG-7 rockets, 20 kg C4, Engineer Demo Chest
TR-M2 Hors	+1	Basic	NSVT (C), 6xRPG-7	1000x12.7mm, 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, with some modifications. 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). It was based on the Soviet BTS-2 (which was replaced on the T-54), and further improved by the ZPDZM Institute of Bumar Labedy (the Experimental Production Institute). It was adequate for recovery of the Polish tanks of the time of introduction in the mid-1960s (modified T-55s and early T-72s), but the introduction of newer, heavier tanks and some other armored vehicles quickly rendered it inadequate for Polish Army needs.

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, though it does not have enough power to operate the crane arm or winches. 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, but have larger fuel tanks taken from the T-55A. 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. It cannot recover the heavier vehicles in the Polish inventory, It cannot recover heavy vehicles such as tanks, SP artillery, or ARVs -- however it can repair most of these vehicles and recover most vehicles lighter than 40 tons, which is why it remains in Polish service (in its WZT-M2 guise).

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. 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.

WZT-2M1 versions also have IFF, data and print-capable radios, and digital components, as well as inertial navigation and mapping computer. A number of these vehicles have been modified as railroad RRVs; in this guise, they are capable of towing 120 tons (on train tracks only).

In the late 1990s, the WZT-2M1 received a further upgrade in the form of NATO-compatible BMS, more ammunition for the commander's machinegun, and replacement of the commander's machinegun by an NSVT which can be fired and aimed from under armor, and a new cupola which allows this sort of machinegun installation. The WZT-2M2 has also been given NBC Overpressure, and the crane, dozer blade, and winches can be operated from under armor and NBC sealed (to a certain extent for the winches). The WZT-2M2 also received a computer loaded with tech manuals on Polish vehicles and recovery solutions. To power the additional equipment with the engine off as well as the crane (but not the winches), the APU has been replaced with one developing 10kW. Air conditioning, with NBC filters, has been added.

The Indians bought 196 of the surplus Polish WZT-2M1s (those that were not modified into WZT-2M2s) -- though they were further modified by the Indians. Their WZT-2M1s have the same sort of computer for tech solutions as inside the Polish WZT-2M2, as well as the Indian version of a BMS. The inertial navigation device remains installed as a backup. Air conditioning, with NBC filters, has been added.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
WZT-1	\$258,059	D, A	3.09 tons	31.5 tons	3	17	Active/Passive IR (D)	Shielded
WZT-1M	\$380,837	D, A	3.11 tons	32 tons	3	17	Passive IR (D), WL Spotlight (C)	Shielded
WZT-2	\$275,640	D, A	3.26 tons	34 tons	4+3	17	Active IR (D), WL Spotlight (C)	Shielded
WZT-2M1	\$289,950	D, A	3.27 tons	34.5 tons	4+3	18	Passive IR (D), WL Spotlight (C)	Shielded
WZT-2M2	\$1,480,500	D, A	3.18 tons	34.82 tons	4+3	21	Image Intensification (D, C), WL/IR Spotlight, 2xCCD Day/Night Cameras	Shielded
WZT-2M1 (Indian)	\$1,018,322	D, A	3.17 tons	34.74 tons	4+3	21	Passive IR (D, C), WL/IR Spotlight, 2xCCD Day/Night Cameras	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
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WZT-1	146/102	40/28	530+380	215	Std	T6	HF63 HS12 HR8
WZT-1M	144/101	40/28	680+380	215	Std	T6	HF63 HS12 HR8
WZT-2	128/90	36/25	680+380	219	Std	T6	HF66 HS13 HR6
WZT-2M1	126/89	35/25	680+380	219	Std	T6	HF66 HS13 HR6
WZT-2M2	126/88	35/24	680+380	219	Std	T6	HF66 HS13 HR6
WZT-2M1 (Indian)	126/88	35/24	680+380	219	Std	T6	HF66 HS13 HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
WZT-1/1M/2/2M1	None	None	DShK (C)	200x12.7mm
WZT-2M2	+1	Basic	NSVT (C)	1000x12.7mm
WZT-2M1	None	None	M2HB (C)	1000x.50

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 and India (after numerous modifications, in the case of Indian WZT-3s). The WZT-3 was built only from 1988 to 1989, and only 20 were built for the Polish Army, though India has a license to build more in India. Currently, the WZT-4 is its successor; it is built on the PT-91M chassis. The WZT-4 is currently used only by Malaysia, as Poland has bought superior recovery vehicles (and other engineering vehicles) from Germany. (Peace dividend, you know.)

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; if extended 5.8 meters or less, it can lift 15 tons; this is adequate to lift the turret of most tanks in Polish service. The crane can also lift up the side of most tanks, allowing engineers to access the tracks and running gear on the side lifted and go underneath the vehicle, where there are normally a number of access plates to internal components.

At the front of the vehicle is a large dozer blade for excavating or bracing purposes, and has a width of 3.61 meters. The WZT-3 has a main winch is driven by the engine and has a capacity of 31.3 tons, or 62.5 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 can tow 50 tons at full speed and 75 tons at half speed, which is adequate for Polish vehicles of the period and most of the vehicles of other countries using the WZT-3. The WZT-3 carries a pair of V-shaped tow bars and several cables for this purpose.

Tools include what is essentially a deluxe set of tracked vehicle, wheeled vehicle, basic, and power tools. The WZT-3 has specialized equipment carried include 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; it cannot power the crane or winches.

Other tools include a welding set, an air compressor, a chainsaw, a circular saw, a tool like the "jaws of life" that are used by most fire departments, and various larger and smaller saws and cutters. The WZT-3 had holding tanks for oil and transmission fluid, and can pump the oil and transmission fluids into a repaired vehicle. The fuel, oil, or transmission fluid cannot actually be used by the WZT-3 while in their holding tanks, though conceivably the WZT-3 could pump such fluids into its own partially-filled tanks. The WZT-3 also has a fuel pump to provide fuel from another source to itself or other vehicles. Though this pump is normally used to pump fuel from an external source, the WZT-3 could conceivably pump fuel from its own tanks to another vehicle's tanks, or pump fuel from an external source or another vehicle into its own tanks.

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 WZT-3 series has an automatic fire and explosion detector and suppressor.

The engine of the WZT-3 is the V-46-6 turbocharged diesel of the T-72M, with an output of 780 horsepower. The engine has further been modified to produce high torque for the winches and for towing purposes.

The dozer blade has a width of 3.61 meters, and is normally used for clearing obstacles to recovery, though it has a secondary role of digging fighting positions for itself or other vehicles.

Indian WZT-3s currently have a computer like the WZT-2M2, providing repair and recovery solutions and tech manuals. They also have the Indian equivalent of a BMS. To power the additional equipment with the engine off as well as the crane (but not the winches), the APU has been replaced with one developing 10kW.

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. Production of the WZT-3M began in 1999; production for Poland

has completed for now, though the production line remains open, primarily to supply export customers and provide spare parts for existing vehicles, 9 new WZT-3Ms were built for Poland and Bulgaria, and Poland later bought 59 more; the 20 WZT-3s were modified to the WZT-3M standard, though they still have T-72M hulls. The Indians have built 352 WZT-1Ms so far, and are considering building a second batch of 204 and using the WZT-3M1 to replace all of their heavy recovery vehicles. These are built in India by BEML. Poland has modified some 15 of Serbia's M-84AB tanks into the WZT-3M1 standard, the resulting recovery vehicle is designated the M-84ABI. These vehicles were designed by Serbia for sale to Kuwait. There are actually WZT-3Ms used only as only demonstrator versions at arms shows; these are only "stock" WZT-3Ms, and Poland has six of them.

For game purposes only, I have designated the PT-91M-based vehicles as WZT-3M1, and the T-72-based vehicles WZT-3M2.

The primary differences were the basing of the armor suite on the Twardy and the use of the Twardy's PZL-Sokol S-12U turbocharged diesel, developing 850 horsepower, but is modified to supply a large amount of torque upon need. This engine is also installed on all variants of the WZT-3M.

The WZT-3M has a main winch capable of pulling 31 tons, or 62 tons with block and tackle, with 200 meters of cable. It has a secondary winch, which has 400 meters of cable and a pulling capability of 200 kilograms, or twice that with block and tackle. They have a tool set similar to that of the WZT-3. It also has the pumps to remove fuel, oil, and transmission fluid from the vehicle being repaired or recovered, with the same restrictions. The WZT-3M is equipped with a modernized version of the crane on the WZT-3, with the same specifications, except that the crane operator may extend the crane out to eight meters; the crane is able to lift a maximum of 13.5 tons at this range. Again, it uses modernized winches from the WZT-3, with the same specifications.

The vehicle has a self-protection heavy machinegun, but this is manned by the gunner/mechanic from a hatch on the center right of the superstructure rather than by the commander. The gun may be aimed and fired from within the vehicle. The WZT-3M has the same composite laminate armor found on the PT-91, and is better protected than most recovery vehicles. The crew has an air conditioner with NBC filters and an NBC Overpressure system. The WZT-3M has an automatic transmission. Suspension is by torsion bars. The WZT-3M has a more powerful APU of 10kW capacity.

The Polish WZT-3M1s have inertial navigation and GPS with a mapping computer, as well as the standard NBC overpressure, air conditioner with NBC filters, and a 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. On the lower glacis on each side is a cluster of four smoke grenade launchers. The machinegun has been moved to the commander's position, who has a cupola that allows him to aim and fire the weapon with hatches closed, and has a vision block with an aiming reticle and a night vision channel. He also has the assistance of a ballistic computer. They are also equipped with a NATO-compatible BMS.

Indian WZT-3M1s are modified; their NATO-compatible BMSs have been replaced with Indian-compatible BMSs. The APU has been replaced with a 15kW APU, which is able to power the tools or the winches or the tools and crane. These vehicles entered Indian service in 2014. They have an air conditioner, though these are not equipped with NBC filters. Indian WZT-3Ms use clusters of five smoke grenade launchers instead of four.

M-84ABI's are also modified; they are not equipped with BMSs, though they do have vehicle state computers and do retain the LCD screens at the commander's, driver's, and crane operator's positions. They are equipped with inertial positioning and a mapping computer. They otherwise have the WZT-3M's equipment set.

WZT-3M2

The WZT-3M2 is mostly similar to the WZT-3M1 in the crane, winches, and tools, but the smaller hull reduces towing capacity somewhat, as well as the ability to pull a stuck vehicle out of jam. It does, however, have the Twardy's PZL-Sokol S-12U turbocharged diesel, developing 850 horsepower and large amount of torque upon need. The WZT-3M2 has a raised superstructure and the armor suite of the T-72M, as well as the general chassis and running gear of the T-72M. Of course, the interior is much different than the T-72M, being outfitted as a recovery vehicle.

The driver is in the front left, with the commander to the right and behind him. The crane operator has a position in the center of the vehicle. The commander, however, similar to that of the WZT-3M1. They have the same electronic equipment as the T-72M1, as well as NBC Overpressure, an air conditioner with NBC filters, a heater, and a NATO-compatible BMS. The fourth member of the crew has a seat inside the vehicle, below and behind the driver.

Though being phased out of service in the Polish Army in favor of Western European recovery vehicles, many Polish engineers and mechanized troops say they will miss the WZT-3M2, as the WZT-3M2's response time and speed are fast.

WZT-4

The Malaysians call their version of the WZT-3M the WZT-4. It is almost identical to the WZT-3M, but uses an improved PT-91M tank chassis as a base. The crane is improved and has a capacity of 20 tons at 5.8 meters and 18 tons at the maximum extension of 8 meters. The WZT-4 also has a thermal smoke generating device, which produces a thick, oily smoke screen that defeats all visual and IR observation, including Thermal Imaging and FLIR viewers, by both injecting diesel fuel and special chemicals into its exhaust. The WZT-4's first aid kit also includes splints, burn gel and dressing, the equivalent of a doctor's medical bag, bandages, slings, and refills for the crews' and the recovered crews' personal medical kits. This is because the recovery crews of WZT-4 are cross-trained as semi-medics (about equivalent to an American Combat Lifesaver), and are expected to treat any injuries possible among the recovered vehicle's crew. The engine is an S-1000R turbocharged diesel with a capacity of 1000 horsepower, coupled to an automatic transmission with power steering and brakes. The APU is replaced with one delivering 15.1 kW. The winches are the same as on the WZT-3M, but the Malaysians use redesigned block and tackle and the main winch of the WZT-4 can pull 93 tons with their main winch

with that block and tackle. It should be noted that the Malaysians use rope in their winches instead of cable; the rope is made of synthetic material and is almost as strong as steel cable, and is easier to repair than cable. The Malaysians have also equipped their WZT-4s with GPS navigation with an inertial navigation backup, a mapping computer, a vehicle state computer, and a small laptop which contains information on repairing and recovering all vehicles found in the Malaysian military forces; however, they do not have a BMS.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
WZT-3	\$416,166	D, A	6.31 tons	42 tons	4	26	Passive IR (D), WL Spotlight	Shielded
WZT-3M	\$420,857	D, A	6.57 tons	42 tons	4	28	Passive IR (D), Image Intensification (C), WL Spotlight	Shielded
WZT-3M1	\$938,200	D, A	6.66 tons	42.29 tons	4	31	Image Intensification (G, C), Backup Camera (D) WL Spotlight, 2xDay/Night CCD Cameras	Shielded
WZT-3M1 (Indian)	\$912,457	D, A	6.54 tons	42.42 tons	4	37	Image Intensification (G, C), Backup Camera (D) WL Spotlight, 2xDay/Night CCD Cameras	Shielded
WZT-3M2	\$895,079	D, A	5.84 tons	36.29 tons	4	36	Passive IR (G, C), Backup Camera (D) WL/IR Spotlight, 2xDay/Night CCD Cameras	Shielded
M-84ABI	\$693,628	D, A	5.15 tons	43 tons	4	34	Passive IR (D), Image Intensification (C), WL/IR Spotlight (C), 2xDay/Night CCD Cameras	Shielded
WZT-4	\$752,394	D, A	6.02 tons	45 tons	4	30	Image Intensification (G, C), Backup Camera (D) WL Spotlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
WZT-3	148/103	41/29	1126+400	293	Std	T6	HF140Cp HS22Sp HR12
WZT-3M	156/109	43/30	1126+400	293	Std	T6	HF149Cp HS20Sp HR10
WZT-3M1	155/109	43/30	1126+400	293	Std	T6	HF149Cp HS20Sp HR10
WZT-3M1 (Indian)	155/108	43/30	1126+400	293	Std	T6	HF149Cp HS20Sp HR10
WZT-3M2	172/122	48/34	1200+400	293	Std	T6	HF136Cp HS20Sp HR12
M-84ABI	132/93	37/26	1050+400	290	Std	T6	HF158Cp HS15Sp HR12
WZT-4	155/109	43/30	1126+400	372	Std	T6	HF149Cp HS20Sp HR10

Vehicle	Fire Control	Stabilization	Armament	Ammunition
WZT-3/3M/M-84ABI	None	None	NSV (G)	500x12.7mm
WZT-3M1/M2	+1	Basic	NSVT (C)	1000x12.7mm
WZT-3M1 (Indian)/WZT-4	+1	Basic	M-2HB (C)	1000x.50

Morozov BAT-2

Notes: The BAT-2 is a combat engineer vehicle used by Russian and Pact forces. The vehicle is based on an MT-T chassis, which is itself a derivation of the T-64 chassis. It's primary purpose is cutting or scraping a path through uneven ground for following vehicles, including mine clearing, but can also function to a limited extent as a CEV, primarily due to it's large obstacle-clearing power tool set.

The BAT-2 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 flat dozer shape or angled into a grader 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 spike, which may be lowered or raised, and is the width of the vehicle. Ditches and fighting positions may also be prepared, and banks on rivers may also be prepared; depending on the material and density of soil or rock, 200-250 cubic meters may be moved per hour.

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, or 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 of the cab is an entire combat engineer squad; they have bullet-resistant windows on either side 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. The BAT-2 can ford up to 1.3 meters.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$125,031	D, G, AvG, A	3.65 tons	39.7 tons	2+6	29	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
130/91	36/25	1000	262	Std	T6	HF8 HS3 HR3

Fire Control	Stabilization	Armament	Ammunition
None	None	None	Engineer Demo Chest, 75 kg C4

*The front blade may protect the vehicle with an AV of 10Sp. What it protects depends on how high the blade is raised.

Sozvezdie R-330ZH Borisoglebsk 2

Notes: Also known as the R-330 Mandat (primarily during development), the R-330ZH is part of a recent push to modernize Russia's ground EW capability, the first ten Borisoglebsk 2s were deployed with Russian units along the Polish border in August 2015, with 14 more being delivered and deployed in Poland and, though the Russians deny it, at least one has been spotted in Ukraine. In October 2015, one was spotted in Syria near the Turkish border. Ten more were delivered in 2016, and an unknown number were delivered in 2017; these appear to have been sent to eastern Russia. The Borisoglebsk 2 has not yet been offered on the international market, but rumors state that the Russians are surreptitiously looking for buyers.

The Borisoglebsk 2 is based on the chassis of new-build MT-LBu tracked carriers. The MT-LBu chassis is equipped with special electrical systems and wiring harnesses to support the powerful EW gear. The Borisoglebsk 2 essentially fills the role of four older EW platforms. It can also interact with Russian AWACS-type aircraft. It has its own surveillance radar, mostly used in GSR mode, but also scanning the skies.

The R-330ZH appears for the most part to be a standard MT-LBu hull, but atop this is a pair of long rectangular boxes which contain the ELINT and EW equipment. These boxes unfold to four times their normal height, with equipment unfolding under it, when the EW suite is operating. The radar dish unfolds and rotates into position at the left rear; the right rear roof has a powerful APU to power the electronics, as well as three canisters with spare parts and tools for the electronics. Despite the power, the system must sometimes be augmented by running the engine. The dish is not protected and has only an AV of 2, but the APU is in an armored box and tuns off the R-330ZH's fuel, supply, or an external fuel supply may be hooked up, or fuel may be added manually to the APU's reservoir by hand. Like all MT-LBus, the R-330ZH has an optical chemical detection device mounted in front of the commander's position. The normal MT-LBu's inertial navigation system has been replaced with a GPS and a mapping computer, while keeping the INS as a backup. The radios receive and transmit via a mast-mounted 30-meter antenna, or operate at a shorter range (and without the satellite connection) using a shorter 12-meter mast. Both may be used to increase bandwidth. (The 30-meter mast is normally used only when stationary, as for it to be stable guy lines need to be attached.)

The driver and commander retain their positions and hatches, but there is no weapon's position; the normal such position is plated over under the EW boxes, as are all the firing ports, other roof hatches, and vision ports. The rear doors remain, but their vision ports and firing ports are plated over. The entire interior of the vehicle is equipped with air conditioning and heating, with NBC filters. In addition, the crew is protected by an NBC Overpressure system. In a remote, little-used, cramped corner is a small chemical toilet, one of a very few military vehicles which have one.

Being based on an MT-LBu hull, the Borisoglebsk 2's hull has that look of a larger version of the MT-LB. It is equipped with a 500-horsepower turbocharged diesel engine; this engine is actually an upgrade of a truck engine common in Russia. The vehicle may be driven at normal speed with the EW suite unfolded and active, but Driver rolls to increase speed are one level harder when the EW

suite is open. However, it cannot be driven while the antennae are elevated, as shearing off of the antenna is almost guaranteed.

Up to nine R-330ZHs may be electronically linked provided each is within 5 kilometers of each other (i.e., they may be laid out in a chain) and have an LOS radio connection to each other.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$24,406,880	D, A	374 kg	18.07 tons	2+3	49	Image Intensification (D, C), FLIR (Mast), Color Day/Night BW (Mast) Night CCD TV (30 km/20 km) (Mast), Radar (100 km)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
191/134	53/37/5	540	185	Std	T3	HF5 HS2 HR2

Combat Equipment	Fire Control	Stabilization	Armament	Ammunition
ELINT 4, ECM 3, ECCM 2, Secure Data Capable Radios (1 Satellite, one 1500 km AM, two 300 km, one 120km, two 40 km), 24kW APU	None	None	None	None

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 it 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 chassis remains that of the T-72A, including the suspension and the V-46 780-horsepower turbocharged diesel engine, with an automatic transmission. Normal fording capability is 1.2 meters, but with preparation, five meters may be forded.

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 its main role is to lift turrets clear of a tank for repair and to act 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 crane folds along the left side of the superstructure for travel. 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. There are V-shaped towbars and tow cables, as well as ropes and hooks of various sizes. As a Repair and Recovery Vehicle, the BREM-1 carries a copious supply of spare parts for most tanks in the Russian arsenal, as well as some for other vehicles in the Russian inventory.

The driver is on the front left, with the commander on the front right. His machinegun is equipped with a VK-10T sight using a collimating telescope. 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.

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 main winch can pull 35 tons base pull, or up to 140 tons with the proper block and tackle setup. The lead winch is the same as that on the BREM-1. The right side of the BREM-1M's superstructure has bins for carrying spare parts as well as some of the smaller tools. Many recovery and some of the repair functions may be carried out while the crew remains under armor. 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	\$342,470	D, A	2.84	41 tons	3+1	49	Active/Passive IR (D)	Shielded

BREM-1M	\$924,439	D, A	tons 2.98 tons	45 tons	3+1	52	Passive IR (D)	Shielded
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Vehicles	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BREM-1	137/96	38/27	1000+400	290	Std	T6	HF140Cp HS22Sp HR12**
BREM-1M	155/109	43/30	1000+400	371	Std	T6	HF140Cp HS22Sp HR12**

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

*The front dozer blade may serve as ad hoc armor; what it protects depends upon how high it is raised. The blade protects with an AV of 5Sp.

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

Kurganmashzavod BREM-2 ARRV

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. Previous to the adoption of the BREM-2, the Soviets were using the BREM-1 for recovery and repair of the BMP-1 and BMP-2; however, this created a deficit in the number of BREM-1s available for recovery and repair of tanks and that the BREM-1 was basically overkill for the recovery of light armored vehicles and IFVs. As more BMP-2s were built, an increasing number of BMP-1s became available for conversion to BREM-2s. Russia and other Pact forces use the BREM-2. Russia and other Pact forces use the BREM-2, though many have been replaced with newer vehicles. Russia, in particular, is in the process of replacing the BREM-2 with the BREM-L (below).

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. 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.

The driver remains on the front left of the vehicle. The commander is on the front right. The crane is operated from the driver's position; the driver is also the crane operator.

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
\$134,126	D, G, AvG, A	2.37 tons	13.6 tons	3	13	Active/Passive IR (D)	Shielded

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

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

*The dozer blade may function as armor for the front of the vehicle; what part of the front it protects depends on how high it is. The blade functions as AV 5Sp.

Omsk BREM-80U

Notes: The intent of the BREM-80U was 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 inherited from the T-80U) 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 are Cyprus and Russia, 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. With the acquisition of newer tanks and recovery vehicles, the BREM-80U is rapidly being retired.

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 the front half of the vehicle is 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-80U's 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. If necessary, the tracks of the BREM-80U can be replaced with a set that has claws to help traction when using the winch or crane or when towing a vehicle over soft ground.

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 (with the accent on T-80 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 16kW 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 cupola has access to a night channel. (Note that the night vision devices for the commander are actually on top of the hull to the right of the commander's cupola.) 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. (This crewmember is often a dedicated welding technician.) The vehicle is protected with an automatic 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 equipped with two clusters of five smoke grenade launchers; one is a standard 902V Tचना smoke grenade cluster, while the second cluster is a TDA thermal grenade launcher.

The BREM-80U is powered by the GTD-1250 gas turbine engine, developing 1250 horsepower. Some early models used a GTD-1000F gas turbine, but these were quickly found to be inadequate and replaced with the GTD-1250. The engines are known to be difficult to maintain and have high fuel consumption; while the intervals between routine servicing is longer, when they have 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. Wading is otherwise limited to 1.3 meters.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BREM-80U (1250 hp Engine)	\$601,828	D, G, JP, AvG, A	4.42 tons	45 tons	4+1	61	WL/IR Spotlight (C), Passive IR (D), Image Intensification (C)	Shielded
BREM-80U (1000 hp Engine)	\$599,968	D, G, JP, AvG, A	4.31 tons	45 tons	4+1	61	WL/IR Spotlight (C), Passive IR (D), Image Intensification (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BREM-80U (1250 hp Engine)	186/130	52/36	1100	535	Std	T6	HF152Sp HS21Sp HR14
BREM-80U (1000 hp Engine)	155/109	43/30	1100	446	Std	T6	HF152Sp HS21Sp HR14

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

*The dozer blade may function as armor for the front of the vehicle; what part of the front it protects depends on how high it is. The

blade functions as AV 5Sp.

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. Though most sources state that the BREM-L uses a UTD-29 turbocharged engine developing 500 horsepower, some sources assert that the BREM-L's engine is actually a UTD-29T, with high torque and developing 450 horsepower. Though this would make the BREM-L slower, it would actually increase towing capability and winching ability (if the winches are being powered by the engine). The transmission is manual. The suspension is hydropneumatic, allowing the driver to adjust the suspension to suit the ground being covered, or to hunker the vehicle lower to the ground for extra stability when using the winch or the crane.

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 150 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. 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 and vision equipment to spot enemy groups and positions and relay them to higher units. The vehicle's BMS helps in this regard. It is also equipped with FLIR, a laser rangefinder, and a laser designator.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BREM-L (500 hp)	\$858,374	D, G, AvG, A	3.37 tons	18.7 tons	3+2	16	Passive IR (D), Image Intensification (C), FLIR (C), WL Spotlight (G), Day/Night CCTV (G)	Shielded
BREM-L (450 hp)	\$858,946	D, G, AvG, A	3.15 tons	18.7 tons	3+2	16	Passive IR (D), Image Intensification (C), FLIR (C), WL Spotlight (G), Day/Night CCTV (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BREM-L (500 hp)	180/130	52/36/10	460	193	Std	T3	HF9 HS5 HR4
BREM-L (450 hp)	165/116	46/32/9	460	167	Std	T3	HF9 HS5 HR4

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

*The dozer blade may function as armor for the front of the vehicle; what part of the front it protects depends on how high it is. The

blade functions as AV 5Sp.

Volgograd JSC BREM-D

Notes: The BREM-D is based on the BTR-D and is meant to service and recover the BMD series of IFVs. The BREM-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 BREM-D uses an A-frame crane that can rotate through 180 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 BREM-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 BREM-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 BREM-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 of 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 PKTS 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 BREM-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 BREM-D's role; it is a variable-height hydropneumatic suspension that allows the BREM-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 BREM-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 BREM-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 BREM-D can tow another vehicle while swimming if that vehicle is also amphibious.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$86,265	D, A	2.02 tons	8 tons	4	11	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	Std	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

*The dozer blade may function as armor for the front of the vehicle; what part of the front it protects depends on how high it is. The blade functions as AV 5Sp.

Volgograd JSC RKhM-5 Pvozka

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 as 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 dismantled 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
\$906,499	D, A	471 kg	13.2 tons	5	16	Passive IR (D, C), Image Intensification (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
222/157	62/44/16	300	167	Std	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 was 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, though the BTS-1 is inadequate for recovering something like a T-55 or heavier tank in this way. 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 are 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 (not to be confused with the BTS-2 below), is equipped with a crane 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 more support to the 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 from the BTS-1M largely in that is based on the T-55A 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 it back down on top of the vehicle. It locks down just left of center. Alternatively, a slight explosive charge may be fired which jettisons the snorkel from the vehicle; I suppose one could give the commander a big surprise and fire the charge while he is in the snorkel, but generally the commander climbs back down into his hatch and locks it down before the charge is fired. 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	\$193,590	D, A	1.29 tons	36 tons	3+2	21	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-2 (Finnish)	\$224,290	D, A	1.29 tons	36.03 tons	3+2	21	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-1M	\$227,634	D, A	1.39 tons	34 tons	3+2	21	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-2	\$244,739	D, A	1.93 tons	32 tons	3+2	17	Active/Passive IR (D), WL Spotlight (C)	Shielded
BTS-4	\$254,634	D, A	1.91 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	Std	T6	HF63 HS12 HR8
BTS-2 (Finnish)	108/76	30/21	812	149	Std	T6	HF63 HS12 HR8
BTS-1M	126/88	35/25	812	173	Std	T6	HF63 HS12 HR8
BTS-2	132/93	37/26	812	173	Std	T6	HF60 HS12 HR6
BTS-4	132/92	37/26	812	173	Std	T6	HF60 HS12 HR6

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

*The rear of the BTS series has a dozer blade. It can be used as ad hoc armor, what it protects depends on how high the blade is raised. The blade provides an AV of 5Sp.

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 has a secondary role of technical reconnaissance, primarily to find out when vehicles are suitable for recovery or should be abandoned or destroyed, and to see if the damaged or destroyed vehicle has any parts worth scavenging. The RM-G often operates in conjunction with a BREM-2 or BREM-L ARV.

The RM-G is built on the chassis of the BMP-1, though it is modified almost beyond recognition. However, a different turret is mounted at the rear of the vehicle, and this turret mounts the crane, with which the crane is able to slew 228 degrees. The RM-G 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. The RM-G is a repair vehicle, not a recovery vehicle, and does not have a winch for recovery or a dozer blade for bracing (though it does carry two tow bars). It does have, however, a small computer with repair and BDAR solutions for various vehicles.

Due to the RM-G's secondary role of technical reconnaissance, the RM-G is equipped with a TV camera and two long-range data-capable radios.

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 repairs while swimming, though the crane is not useable when swimming, and performing repairs while swimming can be problematic.

Most RM-Gs are based on the BMP-1 chassis; however, newer conversions (the RM-GM) have been based on the BMP-2 chassis. This variant is nearly identical for many game purposes, but does have some differences, such as a different armor suite and the addition of a BMS, GLONASS navigation system, a Vehicular State system, and test equipment for damaged vehicles to help determine if they are salvageable.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
RM-G	\$164,864	D, A	447 kg	14.8 tons	4	11	Passive IR (D, C), WL Spotlight (C), TV Camera (CO)	Shielded
RM-GM	\$635,238	D, A	467 kg	14.88 tons	4	15	Passive IR (D), Image Intensifier (C), WL Spotlight (C), CCD Camera (CO)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
RM-G	143/100	40/28/5	462	89	Trtd	T3	TF10 TS6 TS6 HF8 HS4 HR4
RM-GM	143/100	40/28/5	462	89	Trtd	T3	TF11 TS7 TR6 HF9 HS5 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
RM-G/GM	+1	Basic	PKT (C)	2000x7.62mm

OKB-520 IMR

Notes: This predecessor of the IMR-2 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 can turn through 360 degrees and has a capacity of 2 tons. 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 mines, or other work.

The IMR normally carries an assortment of tools, including basic tools, excavating tools, power tools, construction tools, and air compressor, and a welding and cutting set. A fascine roll is often carried above the dozer blade, strapped to the front below the driver's position, and it is ejected from the commander's position.

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 and 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 (though the items are distributed around the inside of the vehicle in lockers).

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; an 8-meter snorkel is used at the commander's position when deep fording is done. 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 retencionmeter for radiation detection and measuring the amount of contamination. The IMR has VHPR device, which detects chemical contamination and to a limited extent, 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
\$2,990,714	D, A	1.69 tons tons	37.5 tons	2	27	Active/Passive IR (D, C), WL/IR Searchlight ©	Shielded

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

Vehicle	Fire Control	Stabilization	Armament	Ammunition
RM-G/GM	Nil	Nil	None	50 kg C4, Engineer Demo Kit

*The IMR has an armored mine plow in front which can function as ad hoc armor. What it protects depends on how high the plow is raised. The plow has an AV of 12Sp for this purpose.

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 plow is also hinged near the bottom, allowing it to operate as a grab bucket. 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; instead of a snorkel, the IMR-2 is completely watertight, and the commander gives instructions to the driver using a periscope. 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 Klin-1 is a remote-control version of the IMR-2 and did much of the ground work at Chernobyl. The Klin-1 was essentially a hasty modification of existing IMR-2s. It could be controlled over a range of one kilometer, but control over the crane arm and tools got noticeably fuzzy at ranges of over 600 meters. The Klin-1 was equipped with external TV cameras, and while it did have space and controls for a crew, a crew is not normally present except when the vehicle is moving on roads or cross-country at high speed. The Klin-1 does not normally carry the manual tools the IMR-2 carries, such as a welding set or something like that, or stuff like fascine rolls, but it is capable of carrying them, normally if a crew is present. The Klin-1 is equipped with a DP-38 retencionmeter for radiation detection and measuring the amount of contamination. Most Klin-1s were parked in an open field near Pripjat after their use at Chernobyl and, contaminated more than Soviet decontamination could deal with, they have been left to this day to "cool off."

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 is roughly equivalent to an optical chemical detector. It adds to the tool set for the crane arm with a more useful digging bucket. The mine plow has additional armor. 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	1.53 tons	44.3 tons	2	29	Passive IR (D), WL Spotlight (C)	Shielded
IMR-2 Klin-1	\$752,706	D, A	1.53 tons	41.87 tons	2	31	Passive IR (D), WL Spotlight (C)	Shielded
IMR-2M1	\$923,410	D, A	1.65 tons	43.64 tons	2	27	Passive IR (D), WL Spotlight (C)	Shielded
IMR-2M2	\$797,160	D, A	1.76 tons	44.28 tons	2	31	Passive IR (D), WL Spotlight ©	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-2 Klin-1	145/102	40/28	1000+400	310	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12*
IMR-2M1	141/99	39/27	1000+400	310	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12*
IMR-2M2	139/97	39/27	1000+400	310	CiH	T6	TF30Sp TS30Sp TS30Sp HF140Cp HS22Sp HR12**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
IMR-2/2M1	None	None	NSVT (C)	500x12.7mm, 50 kg C4, Engineer Demo Chest
IMR-2 Klin-1	None	None	None	None
IMR-2M2	None	None	None	50 kg C4, Engineer Demo Chest

*The dozer blade can act as ad hoc armor for the frontal arc of the IMR-2 series. What part of the front the blade protects depends on how high it is raised; the blade can be raised so high that it protects the front of the top armor (and this is actually the travel position for the blade of the IMR-2). The blade has an AV 12Sp. For this purpose.

**The dozer blade of the IMR-2M2 can be used as ad hoc armor as other IMR-2s, but the AV is 14Sp. The IMR-2M2 also has strengthened belly armor which has an AV of 12.

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-3 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, as is the space for personal and vehicle equipment and for electronic equipment.

The IMR-3 has a DP-38 retentometer for radiation detection and measuring the amount of contamination. The IMR-3 has VHPR device, which detects chemical contamination and to a limited extent, 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
\$1,298,437	D, G, AvG, A	2.49 tons	47.4 tons	2	32	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 inscribed into the top of the turret, and two radios with a range 300 kilometers in addition to the normal vehicle complement. These radios are data capable, and can also transmit visual data from the vehicle's cameras. The IRM also has a medium-range radio and a short-range radio. 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 (with NBC filters and four replacement filters) 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. There is a laser designator and laser rangefinder, normally operated by the commander through an interactive LCD screen (the actual rangefinder and designator are on a post on the roof).

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. However, the suspension also has an extra shock absorber attached to the center roadwheel, which does smooth the ride somewhat. The BMP-1 turret is removed; instead, there is an armored plate where the turret was, and there is a small turret up front. The roof where the turret was also has a number of the instruments for the crew; they are mostly mounted on retractable masts.

The IRM-M1 is essentially a modernized IRM, equipped with a BMS and GLONASS and better, modernized electronics. The radios' long-range antenna is replaced with a smaller retractable antenna which extends from the right rear of the roof.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
IRM	\$1,368,038	D, A	943 kg	17.2 tons	2+4	19	Passive IR (D), Image Intensification (C), FLIR (C), 4xDay/Night CCTV	Shielded
IRM-M1	\$1,476,479	D, A	986 kg	17.31 tons	2+4	21	Passive IR (D), Image Intensification (C), FLIR (C), 4xDay/Night CCTV	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
IRM	132/94	36/25/8	600	89	CiH	T3	TF4 TS4 TR4 HF8 HS4 HR4
IRM-M1	131/92	36/25/8	600	89	CiH	T3	TF4 TS4 TR4 HF8 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
IRM	None	None	PKT	2000x7.62mm, 50 kg C4, Engineer Demo Kit.
IRM-M1	+1	Basic	PKT	2000x7.62mm, 50 kg C4, Engineer Demo Kit.

Chelyabinsk MTP Technical Support Vehicle

Notes: Russia and Pact forces used this armored repair 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 is not considered a recovery vehicle, but one to assist in field repair and BDAR of BTR and BMP-class vehicles. It is able to pull out stuck vehicles to an extent, and tow damaged vehicles up to 18 tons in weight (at half-speed). 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 of 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. Other 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. A high-speed fuel pump is added in this case, though most

other tools and spare parts are removed.

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
\$53,668	D, A	1.64 tons	15.5 tons	5	15	Headlights	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
133/67	37/18/6	400	69	Std	W(3)	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 designed to be a replacement for the MTP and is designed to service the BMP and BTR-series of vehicles. Like the MTP, it is not considered a recovery vehicle, but one to assist in field repair and BDAR of BTR and BMP-class 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 repairs (with the MTP-LB partially in the water, not full swimming) as well as land repair. The MTP-LB is able to pull out stuck vehicles to an extent, and tow damaged vehicles up to 18 tons in weight (at half-speed). 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 replaced 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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTP-LB	\$58,459	D, A	2.08 tons	12.3 tons	2+2	13	Headlights	Shielded
MTP-LB (Polish)	\$62,927	D, A	2.08 tons	12.3 tons	2+2	13	Headlights	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
MTP-LB (Both)	143/100	40/28/4	450	71	Std	T3	HF5 HS2 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
MTP-LB	None	None	PK (C)	2500x7.62mm
MTP-LB (Polish)	None	None	NSV (C)	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 7 tons and can support 50 tons, taking 5 minutes to deploy and 7 minutes to recover. The bridge is 3.3 meters wide and many vehicles, even those of the right weight, cannot negotiate the MTU-20's bridge for that reason. The bridge is 20 meters long, with an effective length of 18 meters. 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 end ramps fold up and down to decrease the size of the bridge when it is in travel position. 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.

And Then There Was the MTU-12...

The MTU-12 (variously known, depending on the country, the MTU-54, K-67, MTU, MT-54, or Object 421 during development) was an earlier design for an AVLB based on the T-54 chassis. The bridge of the MTU-12 was a single-span bridge that deployed by being slid forward and down from its berth atop the chassis. The MTU-12 was used for a couple of decades; though the bridge is shorter at 12 meters (and able to span a gap of 11 meters), it was an MLC 60 bridge, able to take more weight than the MTU-20. The bridge can be deployed in five minutes and recovered in eight minutes. Like the early versions of the MTU-20, the MTU-12 has a 520-horsepower engine, NBC Overpressure protection, and the crew can deploy and recover the bridge without so much as cracking a hatch. And, like the MTU-20, the commander has difficulty firing his machinegun while the bridge is mounted. However, this is not so much about the bridge deployment machinery as the lack of head space when the bridge is mounted, though his hatch does pivot to the right instead of opening vertically.

In its day (1950s-1970s), the Soviets and Warsaw Pact made good use of the MTU-12, but now the few examples still working are found primarily in some African nations. Most MTU-12s, however, are in museums or are range targets, though some have been sold on the collector's market and may be found in various countries in collectors' hands.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-20 (Early)	\$583,875	D, A	436 kg	34 tons	2	51	Active/Passive IR (D)	Shielded
MTU-20 (Late)	\$584,107	D, A	436 kg	34.04 tons	2	51	Active/Passive IR (D)	Shielded
MTU-12	\$693,119	D, A	390 kg	32 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
MTU-12	124/87	34/24	960	153	CiH	T6	TF4	TS4	TR4	HF67 HS16 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(All)	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, but I have no further information on that.) The MTU-72 is used only by Russian and former Pact forces.

It uses a bridge similar in design, but much larger and heavier than the bridge of the MTU-20 listed above. This bridge can span a gap of 18 meters (although it is a total of 20 meters in length) and support 50 tons. By utilizing a second MTU-72's bridge, a gap of 30 meters can be spanned. (MTU-72s are watertight with the hatches closed and can ford and can ford 5 meters of water, or run underwater with the aid of a pair 8-meter snorkels for the engine.) 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. It has an automatic transmission.

The bridge of the MTU-72 is unusual in that the ends of the bridge have no center section. They are wide enough to take most military vehicles, but one must cross very carefully.

The commander has a full, rotating cupola; he is armed with a medium machinegun. Unfortunately, the commander has poor visibility to the front and is physically obstructed by part of the bridge machinery. The commander is in the center of the vehicle; he is also the bridge operator. 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.

The MTU-72M is T-72B-based; it has an 840-horsepower engine. They are equipped with inertial navigation systems and mapping systems. The MTU-72M is otherwise the same as the MTU-72.

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 (6 tons). This is partially due to a heavier ammunition load for the commander's machinegun, their small arms, and an RPG-7 stored inside, as well as a more substantial stabilizing blade. It is based on the Czech version of the base T-72, the T-72M3 CZ. The Czechs equipped them with NATO-compatible BMSs and Vehicle State computers, as well as a mapping system. Though they were built for the former Czechoslovakian Army, they are all used by the Czech Republic today.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-72	\$791,241	D, A	344 kg	40 tons	2	27	Passive IR (D, C)	Shielded
MTU-72M	\$923,630	D, A	352 kg	41.1 tons	2	30	Passive IR (D, C)	Shielded
MT-72	\$1,205,184	D, A	351 kg	41.5 tons	2	33	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	288	CiH	T6	TF20	TS20	TR20 HF129Cp HS17Sp HR12***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
MTU-72	None	None	DShK (C)	500x12.7mm
MTU-72M	None	None	NSVT (C)	500x12.7mm
MT-72	None	None	NSVT (C)	1000x12.7mm

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

**The stabilizing blade can act as ad hoc armor to the front of the vehicle; what it protects depends on how high it is raised. The blade has an AV value of 4Sp.

***The MT-72 has the same sort of stabilizing blade as the MTU-72 and MTU-72M, but its AV value is 5Sp.

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. However, rumors state that in 2010, production went into general and more of them are now available to the Russian Army.

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 chassis 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 as well as a vehicle state computer and a mapping system.

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 Russian service in 2013. Again rumors state that the MTU-90M is currently in slightly-greater-than-LRIP production for the Russian Army. Azerbaijan ordered an undisclosed number of MTU-90Ms in 2014, and they went into service as soon as they were 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 most purposes. However, it does not have the Shtora-1 APS as the bridge, when mounted, makes the Shtora-1 ineffective.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
MTU-90	\$1,257,032	D, G, AvG, A	282 kg	45.5 tons	2	30	Passive IR (D),	Shielded

MTU-90M	\$1,334,436	D, G, AvG, A	282 kg	45.3 tons	2	30	Image intensification (C) Passive IR (D), Image intensification (C)	Shielded
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
MTU-90	137/96	38/27	1200	310	CiH	T6	TF20 TS20 TR20 HF180Cp HS30Sp HR18
MTU-90M	137/96	38/27	1200	310	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 Wolna

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. (And of course, the MT-T have common suspension components with the T-64.) It is service only with Russia. Production is now complete, but the assembly lines can resume at any time if necessary; however, if production does resume, it will probably be in the form of a PMM-2M, but based on an older version of the T-72, and be designated something like PMM-2M2 (with the PMM-2M becoming the PMM-2M1). Currently, there is no information on this possible variant, so it is not covered below. Originally, the Soviets were going to base this vehicle on a modified ZIL-135 heavy truck, but this proved unsatisfactory and a tracked chassis was chosen.

The PMM-2M has seen use in the recent fighting in Syria; a pontoon bridge 210 meters long was built of PMM-2Ms near Deir ez-Zor as part of a Russian military operation, with the PMM-2Ms being supplied power by an offshore generator..

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), and float 80 tons. If three PMM-2s are latched together, the weight limit is 127 tons. 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 2.5 hours 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, but not a true BMS. The PMM-2 has an automatic fire detection/suppression system.

The new version, the PMM-2M1, has a load carrying capacity when used as a bridge or ferry of 45 tons base. However, the spotters have been removed and there are only three crewmembers. It is otherwise mostly the same as the PMM-2 for game purposes.

The Chinese bought PMM-2Ms from Ukraine in 1993, and designated them GZM-003; these are virtually identical to the PMM-2M except in minor details. It should be noted that as of now (Sep 2021), these were the last PMM-2Ms built.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PMM-2	\$855,829	D, A	563 kg	30 tons	5	22	Headlights	Enclosed
PMM-2M	\$908,155	D, A	563 kg	29.86 tons	3	22	Headlights	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
PMM-2	163/114	45/32/11	1000	263	Stnd	T6	HF6 HS3 HR2
PMM-2M	163/114	45/32/11	1000	263	Stnd	T6	HF6 HS3 HR2

MTI Belgrade VIU-55 Munja

Notes: The Munja is based on the chassis of a Serbian-built T-55 tank, which are obsolete as tanks in Serbian service. The role of the Munja is that of combat engineer and engineer reconnaissance vehicle, and it is designed to clear obstacles and fill in ditches and some smaller water hazards for Serbian vehicles following it. It's secondary role is to find these obstacles and getting a head start on reducing these obstacles.

The Munja itself has an enhanced suspension, with torsion bars for each roadwheel, shock absorbers on the two rear roadwheels and on the front roadwheel, and enhanced travel for all roadwheels.

The Munja may have a crew of up to eight, though the normal crew is two. The other optional crewmembers are usually combat engineers who help reduce obstacles, an extra gunner, and experts on obstacle reduction, one of which mans a ruggedized laptop computer that has information on how to reduce even more obstacles (and, it is rumored, games, as the Munja has data-capable radios with high-speed modems). The crew has two complete sets of pioneer equipment, and equipment such as two chainsaws, an air hammer, basic tools, and a "jaws-of-life"-type spreader. An air compressor powers these tools, as well as a 20 kW APU. The air compressor and APU are contained under armor and are protected.

The Munja's hull essentially has the same armor as a standard Serbian T-55, and also has side skirts to protect the tracks. The power pack is a more modern, smaller version of the T-55's standard 780-horsepower turbocharged diesel, though Serbia is rumored to be desiring to increase the engine power (most rumors center around an increase to an 850-horsepower engine), and replace the transmission with something more modern like an automatic transmission. This updated version is listed in the stats below as the VIU-55-1, though this is not an official designation; it is a guess by myself as to what the designation would be.

The standard armament of the Munja is a 30mm AG-30 and an M84 machinegun, behind armored shields which surround the gunner/commander and also have bullet-resistant windows. Some Munjas are instead armed with a large RWS armed with a 30mm autocannon, a machinegun, an antitank missile launcher, and an AG-30 AGS, along with necessary night vision and optronic sights. A Munja with an RWS has designation of VIU-55M, and I have given one with an 850-horsepower engine the designation of VIU-55M-1, though it should be stressed that though while the VIU-55M is a real designation, the VIU-55M-1 is not.

The crew is protected by an NBC Overpressure system with a vehicular NBC backup (with special long hoses that attach to their protective masks, if they must work outside the vehicle in an NBC environment). In addition, an additional overpressure fan is activated is if NBC conditions are found or if a nuclear explosion occurs within 100 meters. The Munja has an air conditioner with NBC filters. About halfway up the glacis are clusters of four smoke grenade launchers on both sides. There is a multicompartment fire detection and explosion system, for the driver's compartment, main compartment, engine and transmission, and APU/Air Compressor. The Munja is equipped with GLONASS and a mapping system which displays on driver's and commander's LCD screens, and the Munja also has a vehicle state computer (though it does not have a full BMS). The engineers in the rear have two rotating periscopes on the roof of the vehicle and a pair of firing ports on each side of the vehicle.

The vehicular equipment include a dozer blade which is as wide as the Munja, and has special ripper teeth as the bottom of the blade. This blade can move 10 cubic meters at once. The Munja is equipped with a 20-ton capacity crane with a bucket which can hold 3 cubic meters of dirt, and the bucket can be replaced with an auger or an earth anchor, which can be shot 20 meters. The bucket can also be replaced with a hydraulic hammer 50 centimeters wide, or a guillotine-like blade which can punch through a tree trunk (if it is on the ground) 61 centimeters wide or up to 15 centimeters of concrete or asphalt. The main winch can pull 25 tons, or 50 tons with block and tackle, and a lead winch with a capacity of 750 kilograms. The Munja has a UV sensor to help detect NBC conditions, along with a day/night vision suite (which depends upon how it is armed). The vehicle has an optical chemical sniffer.

Though the Munja is not an ARV, it can fulfill this role in a very limited manner and *is* equipped with a tow bar (though it is primarily to pull vehicles across obstacles).

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
VIU-55 Munja	\$1,008,516	D, A	528 kg	32 tons	2(+6)	24	Image Intensification (D, C), Backup Camera (D), 40x Day Sight	Shielded
VIU-55-1 Munja	\$1,047,376	D, A	669 kg	32 tons	2(+6)	32	Image Intensification (D, C), Backup Camera (D), 40x Day Sight	Shielded
VIU-55M Munja	\$1,169,656	D, A	527 kg	32.2 tons	2(+6)	34	Image Intensification (D, C), Backup Camera (D), 40x Day Sight, Thermal Imaging (RWS), Image Intensification (RWS)	Shielded
VIU-55M-1 Munja	\$1,188,205	D, A	702 kg	32.2 tons	2(+6)	34	Image Intensification (D, C), Backup Camera (D), 40x Day Sight, Thermal	Shielded

Imaging (RWS),
Image Intensification
(RWS)

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
VIU-55 Munja	173/121	48/34	680	290	Stnd	T6	HF66 HS13Sp HR6
VIU-55-1 Munja	196/140	56/40	680	316	Stnd	T6	HF66 HS13Sp HR6
VIU-55M Munja	172/121	48/34	680	290	CiH	T6	TF15 TS10 TR5 HF66 HS13Sp HR6
VIU-55M-1 Munja	194/136	54/38	680	316	CiH	T6	TF15 TS10 TR5 HF66 HS13Sp HR6

Vehicle	Fire Control	Stabilization	Armament	Ammunition
VIU-55 Munja	+1	Basic	AG-30, AGL (C), M84 (C)	500x30mm Grenades, 4000x7.62mm
VIU-55M Munja	+2	Fair	30mm 2A42 Autocannon, 2xAT-5 ATGM Launchers, AG- 30, M84	250x30mm, 3000x7.62mm, 500x40mm Grenades, 2xAT-5 Missiles

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 M113-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.

As 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 M2 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 Bionix APC/AFV, and the same appliqué and ERA can be added for additional protection. Construction is largely of all-welded steel.

For foreign customers, STK is willing to make almost any modifications to the RCV desirable.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$170,124	D, A	2.52 tons	24 tons	3+1	19	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	171	Std	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; however, each individual bridge is only MLC 30. 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 M2 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 Bionix 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/bridgelayar 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 M72 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
\$222,949	D, A	327 kg	28.3 tons	2	23	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	171	Std	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 Std.

**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, primarily with those used by the Russian Army. It is based on the BMP-1 and 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, and a maximum lift height of 6.11 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 medium machinegun in 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. The Indians use a decent number of BMP-2-based VPVs; theirs are referred to as the AVT-LR (Armored Vehicle Tracked – Light Repair).

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$520,295	D, G, AvG, A	3 tons	14.3 tons	3	13	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 roughly 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.

Some half of the VT-72Bs were kept by Czechoslovakia, and the others distributed to Warsaw Pact nations. Some of these were later retained in Czech Republic and Slovakian Armies, and a few by former Warsaw Pact countries. Others were sold to overseas countries, and a few were even sold to museums or to private owners. The Australian Army has one VT-72B, used in field problems as an OPFOR vehicle.

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 chilled drinking water, though any of them may hold hot water if desired (though the thermoses themselves may not be chilled or heated). There is also a ration heater and water heater. VT-72Cs are built on an Ajeya (T-72M1) base and so also differ slightly from the VT-72B for that reason. VT-72Cs are also armed with NSVT/PKT pairs instead of the single NSVT; the NSVT is meant for anti-aircraft defense and the PKT to kill infantry on the ground. However, the interior of the VT-72C has only one assault rifle (the Indian Army uses several assault rifle types so a specific one cannot be specified), three pistols (again, the Indian Army uses several pistol types), and eight fragmentation grenades. The sides and glacis of the VT-72C have lugs for ERA.

Most VT-72Cs have been modified from Ajeyas in-country, as the Ajeya (T-72M1) has been totally replaced in the Indian Army by T-90Ss.

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 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 worktable 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.

The interior of the engine and transmission compartments have thermal blankets installed, with exhaust channeled low on the vehicle. This gives them the equivalent of IRCM 1.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
VT-72B	\$558,791	D, A	3.9 tons	46.5 tons	5	38	Passive IR (D, C), Image Intensification (C)	Shielded
VT-72C	\$1,226,618	D, A	4.21 tons	46.7 tons	6	31	Passive IR (D, C), Image Intensification (C)	Shielded
VT-72M4 CZ	\$1,590,170	D, A	4.68 tons	51.5 tons	2+1	38	Passive IR (C), Image Intensification (Dx2, Cx2)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
VT-72B	124/87	35/24	1000+400	290	Std	T6	HF120Cp HS18Sp HR8
VT-72C	132/93	37/26	1200+400	314	Std	T6	HF138Cp HS20Sp HR8
VT-72M4 CZ	139/97	39/27	1000+400	371	Std	T6	HF 129Cp HS17Sp HR 12**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
VT-72B/C	+1	Basic	NSVT (C)	500x12.7mm
VT-72C	+1	Basic	NSVT, PKT	500x12.7mm, 2000x7.62mm
VT-72M4 CZ	+1	Fair	NSVT (C)	960x12.7mm

* The dozer blade may act as ersatz armor to the front, and protects part of the front depending upon where the blade is raised – full down, medium/travel position, and high.

**Belly armor for the VT-72M4 is 7. The bracing blade may contribute to frontal armor; where it contributes depends upon how the blade is raised. The blade, when it contributes, has an AV of 6Sp.

ZTS MTU-72 AVLB

Notes: As the Slovaks 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 MTU-72 is thus far used only by Slovakia and the Czech Republic, though it is available for export sales.

The bridge designed for the MTU-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 MTU-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 folding bridge, with the ends folding inwards towards the center. 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 MTU-72. This, however, takes twice as long.

The MTU-72 cannot swim, but with a special adapter, can ford up to 4.2 meters. Smoke grenade launchers are not normally mounted, but the MTU-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-64-4Turbocharged 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/bridgelay. 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 MTU-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. Survivability is enhanced with the Polish-made Obra laser warning/countermeasures system, which can detect laser designation beams within 6 kilometers and automatically launch one or more of ten prismatic smoke grenades; these are on the rear of the hull. There are lugs for ERA on the glacis and sides.

Though the MTU-72 is not nominally armed, the commander may pull out a PKM machinegun for local defense with 500 rounds of ammunition. The commander also has a pistol, and the driver has an assault rifle. The crew also have eight fragmentation grenades.

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

\$1,473,409	D, A	447 kg	41.5 tons	2	38	Passive IR (D), Image Intensification (C), WL/IR Searchlight	Shielded
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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 Olifant ARVs were built in the late 1990s and early 2000s. They are primarily meant to service Olifant 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 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 Olifant powerpack.

During the conversion, Olifant 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. One mechanic rides in the center of the hull; he usually mans the radios when traveling. The Olifant 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 Olifant 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 purposes, 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	\$298,403	D, A	5.05 tons	57.5 tons	4	29	Passive IR (D), Image Intensification (G, C)***	Shielded
Olifant 1A ARV	\$344,897	D, A	5.33 tons	57.5 tons	4	31	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	278	Std	T6	HF60 HS13 HR8**
Olifant 1A ARV	115/81	32/22	1240	278	Std	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 Rotem K1 ARV

Notes: This South Korean armored recovery vehicle is based on the chassis of the K1 main battle tank, and assisted by Rheinmetall of Germany. 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 K1 ARV, which they designate the K1M. The K1 ARV's primary duties are recovery and repair, but it also tows vehicles to field maintenance depots and areas. Development started in the late 1980s, with first issue in 1993. Hyundai offers it for export, but there have no takers so far.

The K1 ARV is a powerful vehicle capable of towing a tank the size of the M1A1, or the K1 (the vehicle it is meant to recover). The K1 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 K1 has no turret, but has a superstructure in its place. The crane is on the right of this superstructure and displaces the superstructure on the right side. It has a capacity of 25 tons, has a traverse of 270 degrees, and can be raised to 70 degrees angle. The crane is controlled from the commander's position, as the commander doubles as a crane and winch operator. Exceeding 25 tons results in an automatic cutoff of the crane's hydraulics. The crane is also used as a jack by raising one end of the sides of the distressed vehicle.

The K1 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 K1 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 a vehicle for repairs underneath. There is a platform on the rear deck that can carry an M1, K1, M48, K2, or M109 or K9 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, including a hand-held circular saw, welding set, and ten fire extinguishers. The K1 ARV has a fuel/defuel pump, impact wrench, and an automatic chainsaw. The K1 ARV can also be hooked up to an external power source, which can work in concert with the K1 ARV's APU.

The K1 ARV has a crew heater, air conditioner, an automatic fire detection and suppression system, and NBC Overpressure system; the vehicle has three doors in each side of the hull to allow access to crewmembers and storage for equipment (but are accessible only from the outside). The driver is at the top of the glacis on the left, while the commander is behind him, on a raised manually-turning cupola, 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 K1 ARV is equipped a BMS which is interoperable with US BMSs, along with a vehicle state computer.

The engine is the K1'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 K1 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
\$1,817,933	D, A	6.83 tons	51.1 tons	4	32	Passive IR (D), Image Intensification (C), WL Spotlight (Rear Corners, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
174/122	48/34	1815	445	Std	T6	HF183Cp HS26Sp HR14

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

*The dozer blade on the K1 ARV can be used as ad hoc armor for the front. What it protects depends upon how high the blade is raised; the blade may be full down, off the ground/travel position; or fully raised. The dozer blade on the K1 ARV is thicker than most such vehicles' blades, and has an AV of 8Sp.

Hyundai K1 AVLB

Notes: This is a South Korean armored vehicle-launched bridge based on the chassis of the K1 main battle tank. The bridge is a British design, but the vehicles and bridges are built in South Korea. Development began in 1989, and first issue was in the mid-1990s. It has been placed on the international market, but has had no orders as of yet.

In this role, the K1'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. The bridge is 4 meters wide and 22 meters long and deploys in a scissoring-action. The bridge weight is 12.7 tons. The bridge can be laid so that one end is 0.8 meters higher or lower at the end, and at up to 3 degrees side slope. Deploying takes 3 minutes, and recovery 10 minutes. Two bridges may be laid together to cross a large gap. On each front fender is a cluster of six smoke grenade launchers.

The K1-M has an automatic fire detection and suppression system for each compartment in the vehicle, an NBC Overpressure system, an air conditioner, a heater, and a BMS with GPS. There is a small cupola below the folder bridge that has a small hatch, all-around vision blocks, and a pintle mount for its 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. The driver is in the center front of the vehicle, with the

commander/bridge operator behind him. They do not need to leave the vehicle or open a hatch to deploy or recover the bridge. There is a narrow connecting tunnel between the driver's and commander's positions.

The engine and transmission are the same as that of the K1 – an MTU MB 871 Ka-501 turbocharged diesel developing 1200 horsepower, and a fully automatic transmission, adjustable hydropneumatically. The suspension is by hybrid torsion bar and hydropneumatic suspension. The K1 is not amphibious, but can ford up to 2.3 meters.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,575,576	D, A	436 kg	53.7 tons	2	28	Passive IR (D), Image Intensification (C), CCTV (Front, Rear)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
155/109	43/30	1815	445	CiH	T6	TF7 TS7 TR7 HF183Cp HS26Sp HR14*

Fire Control	Stabilization	Armament	Ammunition
None	None	M-60 (C)	1650x7.62mm

Daewoo K288

Notes: This South Korean armored recovery vehicle is based on the Korean Infantry Fighting Vehicle. It is primarily designed for the repair and recovery of the K200A1 series and smaller vehicles, but can be useful on larger vehicles like the BMP-3 and K21. It has been offered for export, but has been sold only to Malaysia (who call it the K288A1M).

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. It can also use the crane as a jack when working on the underside or tracks or roadwheels of the stricken vehicle. The recovery winch is located internally, has a capacity of 10 tons, (up to 40 tons with block and tackle and extra cable) and has 150 meters of cable. The K288A1 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 also has a welder, an impact wrench, and an electric drill set for replacing armor sections and track sections. At the front of the superstructure on the left side is a small floodlight for working at night. On each rear side are hydraulic jacks to stabilize the vehicle when using the crane.

The driver's position remains on the front left deck, and the commander remains the same spot as on the K200A1. 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, though also have a hatch on the roof on the right side of the superstructure. The firing ports of the KIFV are deleted. It should be noted that the K288 normally deploys with only three crewmembers, though a fourth is carried about half the time for extra mechanic support. On the front left side of the superstructure is a cluster of six smoke grenade launchers. The original K288 was replaced by the K288A1 in the early 1990s. The primary difference was the use of a MAN D248T diesel, developing 280 horsepower, and coupled to an automatic transmission. The driver uses tiller steering. Instead of a technical computer, the K288 has a small (book) library of tech manuals.

The K288A1 has the engine and transmission of the K200A1: a MAN-Doosan D248T turbocharged diesel developing 350 horsepower, and coupled to an Allison X200-5K automatic transmission. The driver has normal steering controls. The K288A1 has a small computer with a library of tech manuals and such documents.

In the early 2000s, the K288A1s, like most South Korean armored vehicles, were fitted with a BMS system and GPS, as well as a mapping computer.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
K288	\$120,219	D, A	2.31 tons	12.7 tons	4	13	Passive IR (D), WL/IR Floodlight (C)	Shielded
K288A1/A1M	\$156,327	D, A	2.99 tons	14.5 tons	4	14	Passive IR (D), WL/IR Floodlight (C)	Shielded
K288A1 Modernized	\$977,795	D, A	2.97 tons	14.7 tons	4	15	Passive IR (D), Image Intensification (C), WL/IR Floodlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
K288	166/116	46/32/5	400	83	Std	T3	HF7Sp HS5Sp HR4
K288A1/A1M	177/124	49/34/5	400	129	Std	T3	HF8Sp HS5Sp HR4*
K288A1 Modernized	176/123	49/34/5	400	129	Std	T3	HF8Sp HS5Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
K288	None	None	M-2HB (C)	600x.50
K288A1/A1M	None	None	M-2HB (C)	800x.50
K288A1 Modernized	None	None	M-2HB (C)	800x.50

*The K288A1 has a roof AV of 3, and a Floor AV of 4Sp.

GDLS VZCAP Castor

Notes: The Castor, which began delivery in 2019, is based on the Spanish version of the ASCOD, known as the Pizarro; the Castor is based, specifically on the Pizarro 2 version. The Castor is to partially replace the Alacran (mainly for smaller jobs or when a faster response is necessary). However, the Alacran will remain in service, at its current numbers (36 in total). The Castor has a primary role of engineer reconnaissance, and a secondary role of digging fighting positions.

Compared to the Pizarro 2, the Castor has a taller hull and more beefed-up suspension, further making the hull of the vehicle higher off the ground. Of course, like most such vehicles, it has no turret. The Castor has additional applique armor, making it armor-wise equivalent to a Pizarro 2 35, and additionally can mount cage armor. The Castor also has a double floor, making almost the entire vehicle protected by thick spaced armor. The double floor is interspersed with thick springs, offering further resistance to mines and IEDs.

The Castor is designed to carry an entire six-man combat engineer team, but in practice only four engineers are carried, allowing for more equipment to be transported inside. (The stats below are for a full squad.) The seats are special seats which are partially suspended from the ceiling and have bases with the same sorts of springs found beneath the double floor, and the engineers' equipment is meant to be kept when not in use in a number of boxes which are locked into the floor and inside lockers on the walls. The fuel tanks are of hardened construction and are mounted at the rear on either side of the door, like those of an M113A3; they have the same armor protection as the vehicle rear.

On each side of the lower glacis are clusters of six smoke grenade launchers; this smoke is opaque to normal vision, IR (though thermal imaging can penetrate the smoke) and lasers. The smoke may fire automatically if incoming missiles are detected or a laser designation or targeting beam is detected; the Castor, in effect, has a soft-kill APS.

In its engineer reconnaissance role, the Castor has an OMS system which detects route contamination and marks it with flag dispensers on each side of the vehicle, each with 120 flags. The Castor has two optical chemical detectors (one on each side of the roof, and two laser radiation detectors, also on each side of the vehicle. (These are long distance devices with a range of 5 kilometers; two Geiger counters are also mounted on the roof.) These devices have a detection angle of 180 degrees each. A non-powered raft is part of the vehicle equipment, as it a variety of coring devices to measure strengths of road and bridge surfaces. The Castor crew has two 14-inch tablets which transmit their information to a computer on the vehicle; the crew can take pictures of the underside and pilings of bridges and other findings and the computer can analyze them to help the engineers in their conclusions. The RWS has powerful vision enhancement equipment, and the Castor itself has the same.

On the right side of the glacis is a winch with a capacity of 30 tons, upon which there is a CIT adapter to allow the installation of various tools like grapples. This winch can also be shot forward and up for 50 meters, usually with a grapple on the end. The Castor is normally equipped with an EAB straight dozer blade; this blade may be angled to use as an ad hoc mine plow, and is strengthened for such a purpose. A TWMP mine excavator or an LWMR demining track (which stands out about 1.2 meters from the front of the Castor when mounted) may be mounted instead of the blade. Finally, machinery and a low-capacity VFB Cobra bridge may be mounted, making the Castor into an ad hoc AVLB. The lower part of the glacis has a mine detector which can detect even small amounts of metal (such as the metal circuits inside a plastic mine).

The Castor has an NBC Overpressure System, and many functions, such as vehicle tools or the vehicular weapon RWS (a Rafael Mini-Sampson 12/70), can be controlled from inside the vehicle with the hatches closed. In addition to five C-90 antitank rockets, the Castor also normally carries a number of C-90s with HE warheads for reduction of obstacles. The engine is an MTU 8V-199-TE22 engine which develops 720 horsepower. GPS is installed with a mapping system and a transponder; note, however, this is not a full BMS. The Castor has air conditioning with NBC Filters.

One implement that the Castor lacks is a light crane/tool combination, a major omission that the Spanish Army intends to rectify in later iterations of the Castor.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$528,600	D, A	550 kg	33 tons	2+6	27	Image Intensification (D, Rear View), 2 nd Gen Thermal Imaging (RWS)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
153/107	42/30/4	860	323	CiH	T3	TF4Sp TS4Sp TR4 HF25Sp HS12Sp HR7**

Fire Control	Stabilization	Armament	Ammunition
+4	Fair	M2HB (RWS)	1050x.50, Engineer Demo Chest, 20 kg C4.

*Belly armor is 8Sp.

**If fitted with the EAB Blade, the blade can help protect the front of the Castor; where it protects on the front depends on how high the blade is raised. The EAB has an AV of 9Sp. The TWMP can also do this, but has an AV of 7Sp. Again, the LWMR can contribute to frontal armor, but though the mine tracks have an AV of 20Sp against mines that the tracks run over, the device itself has an AV of only 5Sp against rounds incoming from the frontal arc.

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Peugeot Talbot CZ-10/25E Alacran

Notes: This CEV was converted from older M60 and M60A1 stocks in Spain with the help of General Dynamics. The first Alacran (Scorpion) prototype was built in 1995, with first issue being in 1997 and deliveries being complete in 1999. The Spanish had 50 M60A1s when the modification process began; 38 were modified into Alacrans and the rest were modified into AVLBs (as per the standard M60 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 M60 tank-series vehicles.

For this conversion, the turret is retained, but the gun is replaced by a Cace 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 M60 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. It should be noted that when the Alacran is in traveling order, the turret is traversed to the rear and whatever tool is attached and placed in their cradles.

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, and may be set with one-meter teeth sets on with side of the blade to tear up road or concrete surfaces. (These teeth may also be mounted on the mine plow.) 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 of the turret, where ammunition on an M60 tank is stored, is a 25-ton winch, which can be 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 cable is 80 meters long, and uses 26mm wide cable. An auxiliary cable has a short 10-meter cable and a 15-ton capacity.

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.

Some other tools carried include a pneumatic manual jackhammer, a welding set, a spreader, and circular saw with several diamond-studded blades.

The crew retains their M60 positions, with the "gunner" controlling the crane, the commander in the same cupola as in the M60 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. In addition, the telephone attached to the rear of the M60 was retained on the Alacran, and there are hookups for a field telephone.

The engine is a Continental AVDS-1790-2 750-horsepower turbocharged diesel, with an automatic transmission. The four compartments (turret, chassis, engine, and fuel) have an automatic fire/explosion detection system and an automatic fire suppression system. This is in addition to three manual fire extinguishers in the turret and chassis and one in the driver's compartment.

It should be noted that among the Spanish MoD and Army and GDLS there is a controversy as to whether the Alacran modification was wise. The Spanish Army has seen signs that use of the tool arm with the heavy digging bucket attached and a load of material in it, causes cracks in the mounting machinery for the arm and the (still present, but modified) mantlet. GDLS has concerns that the same arm may put too much strain on the turret ring – the reason for the traveling position of the turret and arm. Only time will tell, but the Spanish MoD says that the Alacran is working in its assigned role, and that it does not need to be replaced. (And they hold the pursestrings.) In addition, GDLS recommended that the dozer blade be used to brace the vehicle when the tool arm is used. GDLS also recommends that if something appropriate is available in the general area, the main winch should be looped and locked around the object to further brace the Alacran.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$443,508	D, A	1.27 tons	53 tons	3	29	Passive IR (D, C), Image Intensification (C), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
110/77	30/21	1420	278	Std	T6	HF56 HS15 HR8*

Fire Control	Stabilization	Armament	Ammunition
None	None	M85 (C)	900x.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 plow has an AV of 14Sp. The mine roller has an AV of 20. The mine flail has an AV of 6Sp.

GAMESA M47 VR

Notes: In 1994, the Spanish Army decided to rework a number of their aging or obsolete vehicles; one of these was the M47E1

main battle tank. The tank was rebuilt into the M47 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 M48s and M60s, 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, something they have finally done. It has not been offered on the export market, and the M47 VR is used only by the Spanish Army.

Unlike most such vehicles, the M47 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 from the former turret 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 M47 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 M47 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 M47 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 M48, M60, or Leopard 2 powerpack can be carried on the flat rear deck.

The M47 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 M48 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 M47 VR have fire detection and suppression systems. Selected M47 VRs have had air conditioning installed, but as they soon were slated for replacement, this work was halted within a few months. 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. The commander has access to a sort of mapping system based on inertial navigation and a small computer with digitized versions of maps of the expected area of operations.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$359,000	D, A	6.26 tons	48.5 tons	4	29	Passive IR (D), WL Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
118/83	33/23	1514	282	Std	T6	HF50 HS14 HR8*

Fire Control	Stabilization	Armament	Ammunition
None	None	M2HB (C), MG3 (R)	1000x.50, 3000x7.62mm

* The front-mounted dozer blade may serve as ad hoc armor to part of the front, depending on how high it is raised. The AV for this purpose is 8Sp.

Peugeot Spain M60 VLPD 26/70 E

Notes: Spain had operated a number of M60 AVLBs they had converted from M60 and M60A1s they had earlier bought from the US in the 1970s. With the acquisition of Leopard 2s from Germany, the Spanish M60 fleet was officially declared obsolete as tanks, and may were converted to other roles. The Spanish had also bought a small number of M60 AVLBs, but they too were declared obsolete, as the Leopards were heavier than the M60s and M60A1s and earlier tanks that the M60 AVLBs were bought to support.

However, until the Spanish could buy a sufficient number of Biber AVLBs from the Germans (as of Jan 2022), the Spanish have bought a small number of Biber, but nowhere near the 24 they hope to acquire. The Spanish still needed an MLC 70 AVLB. To this end, they bought a number of surplus Dornier Leguan bridges from several sources in Western Europe who were modernizing their AVLBs. They mounted these on the M60A1-based M60 AVLBs, of course removing the bridge and deploying machinery, as well as upgrading the electrical and hydraulic system. The suspension was also upgraded, as the M60 chassis was not able to support the weight of the heavier Dornier Leguan bridge. 12 of these interim modification were done by Jan 2022; the Spanish expect to have their full complement of Biber AVLBs by about Aug 2022, so no more such conversions are expected to be made. It is undecided whether the VLPD 26/70 Es or even the remaining M60 AVLBs will be retained for use with other vehicles; the M60 AVLBs are getting a bit long in the tooth, and the VLP 26/70 Es, being based on equally-old chassis (though heavily upgraded) are also mostly rather old.

The VLPD 26/70 E uses a slide-out-type bridge instead of a scissors-type bridge, making deployment more tactical. The deployment machinery is specific to the Leguan bridge and is similar to the deploying machinery of the Biber. The bridge is MLC 70 and has a length of 26 meters, with 22 meters usable. The driver remains in the normal place for an M60 driver, and the

commander/bridge operator is in the center of the vehicle. He has a cupola with all around vision blocks, and is manually rotating. The commander's front-most vision block has a night channel, as does the driver's frontmost of his three vision blocks. The commander is able to deploy and recover the bridge from under armor with the hatches closed. Between the driver and commander is a narrow tunnel (about as wide as a person), and a space for personal gear and combat gear. There are no mounted weapons, but the crewmembers have their assault rifles, and in that space I mentioned are two pistols, eight fragmentation grenades, and a pair of C-90 LAWs.

The engine is a Continental AVDS-1790-2 750-horsepower turbocharged diesel, with an automatic transmission. The three compartments (chassis, engine, and fuel) have an automatic fire/explosion detection system and an automatic fire suppression system. This is in addition to one manual fire extinguishers in the commander's position and one in the driver's compartment. The engine is separated from the crew positions by a thick steel firewall. The vehicle is equipped with a GPS system and a mapping system, as well as a long-range and medium range secure radio. On the center front deck are a cluster of four smoke grenade launchers.

Many officials of the MoD and Spanish Government are of the opinion that the VLPDs should remain in service even after the full complement of Bibers is acquired, considering that the VLPDs can do just about the same job (though they are slower in speed), and also considering the amount of money the MoD spent on refurbishing and modifying the M60A1 chassis and buying the Leguan bridges. The Spanish Army is of the opposite opinion, saying that the VLPDs are, while adequate as stopgap solutions, that the M60A1 chassis will break down sooner than later without a major (and costly) upgrade and overhaul. The Spanish Army also feels the VLPD's speed is not adequate for modern warfare (and none of the Spanish M60 conversions are).

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$977,036	D, A	224 kg	56 tons	2	39	Passive IR (D), 2xWL Spotlight (D, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
105/73	29/20	1425	282	Std	T6	HF50 HS14 HR8*

Fire Control	Stabilization	Armament	Ammunition
None	None	None	None

*The VLPD has a front-mounted bracing blade which can protect the front of the vehicle if necessary. This blade has an 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 lkv-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.) If 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
\$250,349	D, A	5.5 tons	19.8 tons	4	19	Passive IR (D), Telescopic Sight (G), WL Spotlight (C)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor**
118/82	33/23/3	550	114	CiH	T3	HF3Sp HS2Sp HR2*

Fire Control	Stabilization	Armament	Ammunition
+2	Basic	20mm Rh-202 (G)	505x20mm

*Floor and Roof AV are 2Sp.

**The front blade can act as ad hoc armor for the front; what it protects depends upon how high it is raised. AV is 5Sp.

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
\$187,034	D, A	681 kg	28.4 tons	4	23	Passive IR (D)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config**	Susp	Armor
102/72	28/20/3	550	114	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 wire rope comes out of each or the rear corners. 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. A heavy-duty crane can be fitted which 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 on vehicles and transportation, as well as BDAR.

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 Bgbv-90 also has a small computer loaded with tech manuals for most of the vehicles in the Swedish Military. The Bgbv-90 is equipped with a full BMS and with a vehicle state computer and a GPS with a mapping computer.

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	\$700,343	D, A	4.14 tons	23.6 tons	5	22	Passive IR (D), Image Intensification (C), WL Spotlight	Shielded
Bgbv-90 with Heavy Crane	\$713,843	D, A	4.14 tons	24.1 tons	5	22	Passive IR (D), Image Intensification (C), WL Spotlight	Shielded
Bgbv-90C	\$972,509	D, A	4.42 tons	26.7 tons	5	28	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	204	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	56/39	610	301	Std	T4	HF23Sp HS11Sp HR5**
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Vehicle	Fire Control	Stabilization	Armament	Ammunition
Bgbv-90 (All)	None	None	Ksp m/39C	4000x7.62mm

*The Bgbv-90 may be protected by its front bracing blade. What it protects depends on how high the blade is raised. The blade has an AV of 5Sp.

**The Bgbv-90C has a deck AV of 3, and a hull floor AV of 5Sp. The Bgbv-90C benefits from the same protection that the front bracing blade offers the other iterations of the Bgbv-90. The Bgbv-90C can be fitted with ERA on the glacis and sides and is normally fitted with cage armor on the sides, front, and rear (except where the rear door is). This gives the Bgbv-90C additional AV of 3Sp.

EKT Brückenlegepanzer 68

Notes: In the original design for the BruPz, the AVLB was meant to be based on the Pz-61 MBT, with prototyping beginning in 1967. There were, however, considerable design and production delays, and when it came time for further prototypes in 1972, the Pz-68 MBT became available. ENT dispensed with the original design and based it on the chassis of the more powerful Pz-68 instead. Some 30 were produced from 1974-1977. These received MLUs in 1988 and 1992. There have been no export sales, and Switzerland has never put it on the export market. In 2005, 16 BruPz 68s were decommissioned, and the remaining BruPzs were retired in 2011. 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 BruPz 68/88 was replaced by an M48-based AVLB, similar to the Spanish M48-based AVLB.

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 spaces 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.

In 1988, the first MLU was applied. Originally, the BruPz 68/88 had a short-range and a long-range radio; in the 1988 MLU, the short-range radio was removed, and the long-range radio replaced by a frequency-hopping radio with the further security measure of an encryption module. As one radio was removed, the antenna for this radio was removed, and the place where the matching unit was was plated over. The bridge pickup assist was improved, and the BruPz 68/88 received a new camouflage finish based on the German vehicle camouflage pattern.

The second MLU was applied in 1998. CCTV cameras were added to the front and the rear corners. The front cameras are wide-angle and face front, while the rear cameras face inwards and watch the bridge machinery operation. Night vision for the driver has been improved, and night vision has been added to the bridge operator's position. The bridge operator has an LCD screen allowing him to monitor the deployment and recovery operations. Obviously, the aim of these improvements was to allow the crew to deploy and recover the bridge from under armor and sealed, and the BruPz 68/88(/98?) is equipped with an NBC Overpressure system and air conditioning with NBC filters. A small laptop is at the bridge operator's position, containing all applicable manuals. The bridge machinery was modified to make it easier to operate from under armor. The electrical system was upgraded, in view of the extra electronics and vision equipment in the vehicle and the modified bridge machinery. The bridge was replaced with an MLC 60 bridge as standard. The long-range radio was replaced with one that had the same stats, but was also data-capable.

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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BruPz 68	\$617,941	D, A	715 kg	47 tons	3	35	Passive IR (D)	Shielded
BruPz 68/88	\$585,236	D, A	716 kg	47 tons	3	35	Passive IR (D)	Shielded
BruPz 68/88/98	\$802,701	D, A	710 kg	47 tons	3	36	Image Intensification (D, C), 4xCCD Day/Night Cameras	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
BruPz 68	108/76	30/21	855	243	CiH	T6	TF4 TS4 TR4 HF43 HS13 HR8*
BruPz 68/88	108/76	30/21	855	243	CiH	T6	TF4 TS4 TR4 HF43 HS13 HR8*
BruPz 68/88/98	108/76	30/21	855	243	CiH	T6	TF4 TS4 TR4 HF43 HS13 HR8*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(All)	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.

EKT Entpannungspanzer 65

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. Work began on the vehicle which would become EntpPz 65 in 1961, a long development period full of modifications and updates, as well as new ideas, led to successive prototypes, none of which satisfied ENT or its engineers. When the Pz 68 became available, ENT switched to the Pz 68 chassis, and the vehicle finally went into production in 1970. The Entp 65 nor the Entp 65/88 was ever exported, nor was it ever shown at international shows or industry shows. After the upgrade of the vehicle to the EntpPz 65/88 standard, the vehicle served until 2008, when it was replaced by the German-made Buffel ARV. The Entp-65s and 65/88s were largely scrapped, with less than a half a dozen in museums, and one which is privately owned.

The EntpPz 65 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 rear area is open, with several equipment lockers and room to take a Pz 61 or 68-series power pack.

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; he has a cupola with all-around vision blocks. The commander also has two vision blocks on the front of the hull at the top of the glacis, which have a primitive form of downloading to the commander. The crane operator's cupola has all-around vision blocks as well. The crane operator's position faces to the rear and is behind the driver. 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 operator's gun shields may be easily removed to give him more visibility for operating the crane. (The gun shields are not normally mounted in peacetime.) There are two clusters of five smoke grenade launchers on each side of the glacis. In addition, behind the crane operator's position are four smoke grenade mortars; these fire 81mm mortar shells and can also fire illumination rounds. The crane operator also operates the machinegun which is the vehicle's armament; in addition, the crew has their personal weapons, 20 fragmentation grenades, and an antitank rocket launcher. The crew compartment has an NBC overpressure suite and a heater. In the crew compartment of the vehicle is an 18-liter drinking water tank.

The main A-frame crane has 120 meters of cable and has a capacity of 15 tons. At each base of the A-frame is a hydraulic jack, used to make minor adjustments while lifting. The crane is also equipped with a tow cable which can be used to increase the towing capacity of the EntpPz 65 by 25%. It faces to the rear and has a turntable which allows it to traverse to give it a reach of 4.8 meters in any direction. The crane is mounted to the front of the rear area of the vehicle and faces to the rear when traveling, though in normal operation the best results are obtained when used towards the front of the vehicle.

The main winch has a capacity of 25 tons, or up to 75 tons with block and tackle. It has 120 meters of 30mm cable. The auxiliary winch has 240 meters of 6mm cable and has a capacity of 10 tons.

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. An auxiliary power unit is used to power the tools at a halt and develops 28.3kW.

Being a subtype of the Pz-68, the EntpPz-68 is powered 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 EntpPz-68 has a Bellville-type suspension and each roadwheel is independently sprung, giving a decent ride.

The 65/88 improvements were in many ways similar to the BruPz 68/88 MLU; however, the short-range radio was not removed, allowing the commander and driver to communicate with engineers working outside the vehicle through the use of walkie-talkies. Both radios were, however, replaced with frequency-hopping radios with the further security measure of an encryption module. Like the BruPz-68/88, the Entp 65/88 received a new camouflage finish based on the German vehicle camouflage pattern. The night vision was improved and extended to the commander and crane operator. An air conditioner, with NBC filters, was added. 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.

The EntPz 65/88 never received the 1998 MLU.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological**
EntpPz 65	\$352,441	D, A	6.04 tons	39.8 tons	5	37	Passive IR (D)	Shielded
EntpPz 65/88	\$361,710	D, A	6 tons	39.8 tons	5	37	Image Intensification (D, C, CO)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
EntpPz 65	123/86	34/24	870	244	Stnd	T6	HF43 HS13 HR8*

Swiss Tracked Engineer Vehicles

EntpPz 65/88	123/86	34/24	870	244	Stnd	T6	HF43 HS13 HR8*
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Vehicle	Fire Control	Stabilization	Armament	Ammunition
(Both)	None	None	M-51 (CO)	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 5Sp.

**The rear area is not NBC sealed and its Radiological rating is Open.

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. A 2021 upgrade gave the ACV-300 ARV an RWS armed with an M2HB or Mk 19 GMG and vision equipment on the RWS; the gunner normally controls the RWS.

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 of field and tech manuals. He is facing to the rear at a sort of desk.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ACV-300 ARV	\$722,336	D, A	1.54 tons	14 tons	4	12	Passive IR (D, G, C), WL/IR Spotlight (C)	Shielded
ACV-300 ARV w/RWS	\$770,151	D, A	1.46 tons	14.4 tons	4	12	Thermal Imaging (G), Image Intensification (G), Passive IR (D, C), WL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
ACV-300 ARV	150/105	42/29/4	410	111	Std	T2	HF6Sp HS4Sp HR4Sp*
ACV-300 ARV w/RWS	147/103	41/29/4	410	111	CiH	T2	TF6Sp TS5Sp TR4 HF6Sp HS4Sp HR4Sp*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
ACV-300 ARV	None	None	M2HB or Mk 19 (G), M2HB (C)	4000x.50 or 2000x.50 and 635x40mm
ACV-300 ARV w/RWS	+2	Fair	M2HB or Mk 19 (RWS), 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-19 chassis, and was built not only to give the crew more room to work but carry engineer supplies. Users include the Turkish Army and the Malaysian Army, who call the vehicle the Adnan.

Engineer supplies include two engineer demo chests and 40 kilograms of C4 to remove obstacles; other supplies include a chain saw, a round saw, a "jaws of life" tool, a welding/cutting set, a jackhammer, 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.

The driver and commander are in the same place as on the ACV-300 ARV, 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 BMS and GPS. 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 has a compact 5kW generator/APU to run either the power tools or the surveillance equipment with the engine off. Some of the power tools also run off an air compressor, so an air compressor is included.

The RWS has a pair of color CCD cameras in it to photograph the conditions the engineers find and transmit them to higher headquarters.

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 attached 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
\$691,348	D, A	3.21 tons	20 tons	4	15	Passive IR (D, C), Thermal Imaging (G), Image Intensification (G), WL/IR Spotlight (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
128/90	36/25/4	501	125	Std	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.

FNSS Kunduz AZMIM

Notes: AACE stands for Armored Amphibious Combat Earthmover, or in Turkish, AZMIM (Amfibik Zrhli Muharebe Isthkam is Makines). The English equivalent is AACE (Amphibious Armored Combat Earthmover). The first prototype was delivered to the Turkish Army and, after a few tweaks, began large-scale production in 2014. The AZMIM is also in the process of deliveries to the Filipino Army, who are pleased with their new acquisition and interested in more FNSS products. It is similar in concept, and in many ways design, to the Israeli D9-series of ACEs.

The AZMIM is designed primarily to stabilize low-water crossings, the banks of small rivers vehicles may cross, and the strengthen and build up the stabilization points of floating bridges and AVLBs. In addition, the AZMIM is meant to dig fighting positions, lower steep slopes, demolish structures, and to an extent, blow mines and IEDs. It's primary equipment for this is a full-width hull which may fold in half into a digging bucket with a capacity of 30 tons if necessary, and is otherwise AV 30. The bucket, when folded and containing an amount of material, may function as a ballast container. Unlike most such vehicles, the AZMIM does not need to be completely stable when operating its blade, and can plow on a side slope of up to 30% or on unstable surfaces. The AZMIM also has a cylinder under the vehicle near the center, which may open and take on ballast when working in water or as a counterweight for the dozer scoop. The tracks are likewise heavily strengthened. The AZMIM has a 15-ton capacity winch at the rear, and this is primarily used to haul large debris out of the way. The AZMIM is fully amphibious, including swimming, and is propelled through the water using 360-degree steerable waterjets.

The AZMIM operates primarily with a driver in the front left and an operator behind him, who operates the equipment by Day CCD. The crew can operate the camera at night, but it's kind of a kludge – the camera sends it's input through the operator's thermal imaging, which then produces a night vision picture for the cameras. The AZMIM may also carry a spotter on the front right side, but normally operates without one. The operator has his own driving controls, and if necessary, may pivot his seat and drive the AZMIM in reverse or forwards. The AZMIM is NBC-sealed and has an air conditioner with NBC filters, as well night and magnified day vision and LED screens for the driver and operator. The AZMIM is not normally armed, but a pintle-mounted weapon may be mounted at the commander's position. It also has a small computer containing field manuals and tips on clearing obstacles. LCD panels allow the crew to operate the vehicle while buttoned up. A vertical-launch compartment on the front right side below the passenger position fires up to 12 smoke grenade launchers. The AZMIM is equipped with GPS and a mapping computer, as well as a BMS.

The AZMIM is powered by a CAT 3408 high-torque turbocharged 402-horsepower diesel engine. This is coupled with an Allison fully automatic transmission. The engine is powerful for its weight, and allows it to keep up with large armored formations moving at top speed, even in off-road conditions. Armor is surprising for such a vehicle, and of course, frontal shots will have to contend with the dozer blade. Belly armor is heavy for such a vehicle, and heavier under the crew, and the treads and roadwheels are reinforced. The engine/transmission compartment has an integrated fire detection/suppression system, and several portable fire extinguishing bottles.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$646,440	D, A	2.02 tons	19.5 tons	2+1	19	Day CCD (D, O), Thermal Imaging (D, O), Image Intensification (D, O), WL/IR Spotlight (D, O)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
148/102	40/28/8	446	150	Std	T8	HF12 HS8 HR6*

Fire Control	Stabilization	Armament	Ammunition
None	None	MG3 (C)	2500x7.62mm

*Belly armor for the AZMIM is 8. Armor for the dozer/bucket is 30; it can protect the front of the vehicle; what it protects depends on

how high it is raised. If the ballast container is filled, it can provide armor in a 1.5-meter wide side-to-side strip in the center rear of the vehicle with an additional AV 4Sp.

FNSS/MaK M48A5T5 Tamay

The Tamay is a more heavy-duty recovery vehicle than the ACV-300 ARV; it is used, often in pairs, to service the larger Turkish vehicles, including tanks. The Turkish are trying to decide about which vehicle will replace the Tamay (or if they will make an indigenous version of an ARV), but sources say the Turkish have all but decided on the South Korean K1 ARV as a replacement. For now, the Tamay, though long in the tooth, continues to serve Turkey, and will probably continue to serve the Turkish Army after its replacement arrives, servicing medium armored vehicles and heavy trucks.

As might be gathered by the designation, the Tamay is a variant of the American M48A5 main battle tank, sold to Turkey by the Germans in the early 1960s. It is heavily modified from the German ARV version for its role, however, with an upgraded engine, fire/explosion detection and suppression systems, a BMS, GPS with a mapping system, a vehicle state system, and the usual crane, winches, generator, and the set of tools that are typical for such a vehicle. In addition, the turret is removed and replaced by a raised superstructure, and almost all surfaces have applique armor, including the roof and belly.

To further delineate the tool set, Tamay has a fuel pump (to pump fuel from external sources; the Tamay does not itself carry extra fuel in most cases), and dozer blade are added. The crane is mounted on the front right side and can lift 30 tons (enough for most older Western or Eastern Bloc tank turrets) at a reach of 6 meters. The crane may be equipped with a hook to lift up the front, back, or side of a vehicle for repair; the winch may also be equipped with an eight-armed adjustable chain assembly used for lifting turrets. The winch has a pulling strength of 45 tons without bracing and 90 tons with block and tackle, and has 90 meters of cable. There is a secondary winch with a capacity of 7.5 tons, or 15 tons with bracing, and 100 meters of cable. The dozer blade can excavate 200 cubic meters per hour but is mostly used to brace the vehicle during heavy lifting or winching operations. The Tamay is equipped with a welding and cutting set, an air compressor, a circular saw, a medium chainsaw, a complete hand tool set, a tow bar, several coils of rope and cable, and items such as pulleys and snatch blocks. The tool set, winch, or crane may be powered from a compact 15kW generator with engine off. The Tamay has a locking differential and locking brakes to further stabilize the vehicle during crane or winch operations. The crew has access to a small computer which has field manuals for all Turkish vehicles and manuals delineating various recovery and BDAR solutions. The crew is protected by an NBC Overpressure system and have a heater and air conditioner with NBC filters.

The commander is on the front right, with a cupola with all-around vision blocks and a night channel and an aiming reticule on one of the blocks. The Tamay can button up and the commander can still aim, fire, and reload his machinegun. The driver is on the front left, slightly forward of the commander; he has vision blocks from the left and slightly to the rear around to the front and slightly to the right. He also has a night vision channel in his forward block and a backup camera. The equipment operator is in the center of the superstructure, with a high cupola and vision blocks all around. He does not have a night vision channel, but normally has NODs at his position. The equipment operator can control the crane and winch though the use of a remote operating set connected to the controls in his cupola by a 3-meter cable.

The M48A5 chassis has been upgraded with the M60's 908-horsepower engine; however, upgrades had been started (but stopped once the Turkish began searching for a new ARV) to upgrade the Tamay to a MAN 1050-horsepower engine. Perhaps 10% of Tamays received this upgrade before such upgrades stopped. Some mention of replacing the commander's machinegun position with an RWS was considered, but no known such upgrades were actually carried out.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Tamay w/908 hp Engine	\$911,306	D, A	2.28 tons	60 tons	4	30	Image Intensification (C), Image Intensification (D), Backup Camera (D), WL/IR Spotlight (EO)	Shielded
Tamay w/1050 hp Engine	\$917,179	D, A	2.29 tons	60 tons	4	30	Image Intensification (C), Image Intensification (D), Backup Camera (D), WL/IR Spotlight (EO)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
Tamay w/908 hp Engine	115/81	32/22	1420	270	Std	T6	HF61Sp HS19Sp HR8
Tamay w/1050 hp Engine	129/90	36/25	1420	390	Std	T6	HF61Sp HS19Sp HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Tamay w/908 hp Engine	+1	Basic	M2HB (C)	4000x.50
Tamay w/1050 hp	+1	Basic	M2HB (C)	4000x.50

Engine

*Roof and Belly AV is 8Sp. The dozer blade may also act as ad hoc armor to the front; what it protects depends on how high it is raised. The dozer has an AV of 6Sp.

FNSS/MaK M48A5E5

Notes: About the same time that the M48A3 was being heavily modified into the M48A5T5 Tamay, the older M48A3 AVLBs were also being modified to be more effective and to try to keep them relevant in the Turkish Army. As MaK did a lot of the design work for the Spanish M60 VLPD, many features of that vehicle were also put into the M48A5E5. In addition, the base chassis was brought up to the M48A5 standard, and the M60's 908-horsepower was mounted in the normal engine space.

Perhaps the largest modification was the use of a Dornier Leguan MLC 70 bridge. The Leguan bridge used is an earlier version of a similar MLC 80 bridge; it slides out in two 14-meter sections and can span a 26-meter gap. As the sections slide out to deploy or recover, it tactically better than standard scissors AVLB bridges. The bridge is four meters wide, and when folded atop the vehicle, is four meters high. It weighs 11 tons; the Turkish had to strip out the base M48A5 of many components and replace many with lighter, more modern components to be able to mount such a heavy AVLB. As a result, the M48A5E5 has no fire/explosion detection system, though the crew can manually trigger an internal Halon fire suppression system. The fuel tanks are also not explosion-proof. There is no bracing dozer blade, though a locking transmission and locking brakes are installed. Even so, the M48A5E5 is heavy and underpowered, and as the M48A5E5 is slated to remain in service until at least the late 2020s, modifications have begun to replace the engine with a compact MAN 1200-horsepower engine.

The M48A5E5 has a commander's machinegun position similar to that of the Tamay, though the commander is not in raised cupola. It does rotate. The driver is in the center of glacis, while the bridge operator is in the center of the vehicle. The bridge operator has a standard infantry MG3 machinegun inside his compartment. Each compartment also has a smaller space where the crewmember may keep his personal weapon, ammunition grenades, personal equipment, etc. The commander also has a space to keep the belt for his mounted machinegun. The crew has an NBC Overpressure system and an air conditioner with NBC filters, though a common complaint is that the conditioned air does not reach well to the commander's or driver's compartment. The crew may deploy the bridge while buttoned up and in complete darkness, using internal controls, LCD monitors, and night vision which includes day/night short-range CCD cameras.

The M48A5E5 is equipped with a BMS, GPS, mapping computer, and a small computer at the commander's position which can display all manuals related to the use of AVLBs and the Leguan bridge in particular. There is also a vehicle state computer which includes the bridge and its deploying/recovery equipment.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M48A5E5 w/908 hp Engine	\$1,250,156	D, A	300 kg	58 tons	3	36	Image Intensification (C), Image Intensification (D), Backup Camera (D), Image Intensification (BO), 2xDay/Night CCD Cameras	Shielded
M48A5E5 w/1200 hp Engine	\$917,179	D, A	300 kg	58 tons	3	30	Image Intensification (C), Image Intensification (D), Backup Camera (D), Image Intensification (BO), 2xDay/Night CCD Cameras	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M48A5E5 w/908 hp Engine	121/85	34/24	1420	270	CIH	T6	TF6 TF5 TR5 HF51Sp HS16Sp HR8
M48A5E5 w/1200 hp Engine	129/90	36/25	1420	390	CIH	T6	TF6 TF5 TR5 HF51Sp HS16Sp HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M48A5E5 w/908 hp Engine	+1	Basic	M2HB (C)	2000x.50
M48A5E5 w/1200 hp Engine	+1	Basic	M2HB (C)	2000x.50

KMDB/Malyshev BREM-84 Atlet

Notes: Based on the T-80UD chassis, the BREM-84 Atlet (also spelled as Athlet; either way, the name translates in English as "Athlete") is an ARV initially-designed to use up Ukraine's T-80 tanks (which they were replacing) and be able to recover tanks currently used by Ukraine. It is referred to as an ARR (Armored Recovery and Repair Vehicle, able to recover damaged or broken-down vehicles or repair them in the field. The BREM-84 is up for sale on the export market; rumors state that some sales have been made to unnamed countries, and India trialed one in their never-ending process of finding the right vehicles for their military. Thailand operates five BREM-84s, along with 49 Oplot tanks. Serial production of the BREM-64 for the Ukrainian Army did not begin until 2018; the Thais actually got theirs first, in late 2017.

The BREM-64 is somewhat heavier than the T-80UD, due to the recovery and repair equipment mounted. Armor protection is the same as that of the T-80UD. The BREM-84 uses a 6TD2 turbocharged multifuel diesel engine (replacing the gas turbine of the T-80UD) with a power output of 1200 horsepower, though some early Atlets had a 1000 6TD engine. Both are turbocharged diesel engines. This means that despite its weight, it has a surprising amount of power, and the transmission has been modified to provide a lot of torque. The Atlet may ford 1.8 meters of water without preparation, but by deploying special screens, 5 meters may be forded.

The main winch can provide 25.5 tons of pulling power, or double that with block and tackle. Experienced engineers can rig up a double block and tackle, increasing pulling power to 76.5 tons. The cable is 130 meters and takes 10 minutes to wind or unwind to or from its maximum length. The Auxiliary/lead winch has a capacity of 918 kilograms and has 260 meters of cable. While the main winch operates by hydraulics, the aux winch uses hydrostatic operation. The dozer blade, used primarily for bracing, is 3.38 meters wide and can move up to 120 cubic meters in one bite of soil or clay. The crane, used to lift large parts of items such as a replacement powerpack, has a capacity of 25 tons, a maximum reach of 6.8 meters, and is able to reach over the entire vehicle (though reaching to the rear of the vehicle is a bit tight). The BREM-84 is not amphibious, but can ford up to 1.8 meters without preparation or, with about 10 minutes of preparation, ford 5 meters. The Atlet has a front-mounted dozer blade normally used to brace the vehicle during crane or winch operations, but is 2.06x3.4 meters and large enough to dig fighting positions.

The BREM-84 has a 22.2kW APU, used primarily to power tools which require electrical or hydraulic power, including tools such as a power separator, standard power tools, a welding/cutting set, a chainsaw, and a rotary saw. Other tools include two sets of pioneer tools and wheeled, tracked, large-caliber gun, and basic tools. The BREM-64 is often seen carrying the 1.5-ton powerpack for T-72-series tanks or other powerpacks, and is generally festooned inside and out with spare parts. The BREM-84 has large double doors on each side; these are lockers and compartments for parts and tools. The BREM-84 has a tow bar and several lengths of cable for towing purposes. The BREM-84 can also tow a trailer of up to 60 tons.

Generally, the crew of the BREM-84 is normally four, but up to three other mechanics of engineers may be carried in the back, and there are folding seats for them. The commander's position has an RWS armed with an NSVT, which has the commander's night vision and day magnification devices, along with CCD cameras in the front and the rear of the RWS. The observation gear is slaved to the commander's position in an LCD; the commander does not actually have any vision equipment at his station. The position also has all-around AV3 gun shields for when the commander chooses to stand in the commander's hatch. The equipment operator is in the center of the superstructure; he has a KMT machinegun (Polish-manufactured copy of the PKT) and all-around AV3 gun shields. He has controls and an LCD panel at his position, or can control the crane and winches by controls connected to his position by a 4-meter cable. When buttoned up, the crew has NBC Overpressure system; air conditioning is also installed. (Note that the air conditioner has no NBC filters.) The Atlet has a BMS, GPS with mapping module, and a vehicle state system. There are automatic fire/explosion detection systems for the powerpack, driver's compartment, main crew area, and fuel tank. The driver is in the center of the glacis, with a 180-degree half-ring of vision blocks.

Under armor, above the engine compartment, is a layer of insulation that helps dampen the IR signature of the engine (IR Stealth 2). Lugs for ERA (usually the Ukrainian Nozh or Nozh-2, but customers may specify lugs for other types of ERA if desired) are found on the glacis and the forward third of the hull sides.

The Atlet has an interesting armor package; the Polish were unable to equip the Atlet with composite armor, so they used an armor suite which consists of a thick plate of steel, then a thick sheet of rubber, and then a thinner plate of steel. This armor is used all over the Atlet, including the roof and belly. It was not able to be used on the engine deck, and was not used on the rear. This, in game terms, act as spaced armor, but stops 4d6 of HE-type rounds and 1D6 against kinetic energy penetrators (such as AP, APDS, APFSDS, APFSDSU, etc.). This, combined with the ERA the Atlet is normally equipped with, makes for a very protected vehicle.

Thai BREM-84T Athlet

The Thai BREM-84s are designated BREM-84T and have minor modifications made to them. The most obvious is the replacement of the NSVT with an M2HB, and the KMT with an M60. The internal systems, most notably the engine, is modified for hot and humid conditions. The standard engine for the Athlet is the 1200-horsepower engine. Instruments and labels are redone in Thai. The Athlet is capable of mounting ERA lugs for various types of ERA blocks, but mounting them is rare. The Athlet does not have a BMS or a vehicle state system, but does have a GPS system without a mapping module.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
BREM-84 Atlet (1000 hp Engine)	\$1,413,681	G, D, A	2.27 tons	46 tons	4+3	29	Thermal Imaging (RWS), Image Intensification (RWS), Two Day/Night	Shielded

BREM-84 Atlet (1200 hp Engine)	\$1,495,526	G, D, A	2.64 tons	46 tons	4+3	29	Day/Night Cameras (RWS, 13x Day Magnification Telescope (RWS), Image Intensification (D), Backup Camera (D) WL/IR Spotlight (C)	Thermal Imaging (RWS), Image Intensification (RWS), Two Day/Night Day/Night Cameras (RWS, 13x Day Magnification Telescope (RWS), Image Intensification (D), Backup Camera (D) WL/IR Spotlight (C)	Shielded
BREM- 84T Athlet	\$763,311	G, D, A	2.99 tons	45.5 tons	4+3	26	Thermal Imaging (RWS), Image Intensification (RWS), Two Day/Night Day/Night Cameras (RWS, 13x Day Magnification Telescope (RWS), Image Intensification (D), Backup Camera (D) WL/IR Spotlight (C)	Thermal Imaging (RWS), Image Intensification (RWS), Two Day/Night Day/Night Cameras (RWS, 13x Day Magnification Telescope (RWS), Image Intensification (D), Backup Camera (D) WL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
BREM-84 Atlet (1000 hp Engine)	159/111	44/31	501	372	Std	T6	HF163Sp HS24Sp HR15
BREM-84 Atlet (1200 hp Engine)	183/128	51/36	501	446	Std	T6	HF163Sp HS24Sp HR15
BREM- 84T Athlet	185/129	51/36	501	446	Std	T6	HF163Sp HS24Sp HR15

Vehicle	Fire Control	Stabilization	Armament	Ammunition
BREM-84 Atlet (1000 hp Engine)	+2	Fair	NSVT (RWS), KMT (EO)	1500x12.7mm, 1500x7.62mm
BREM-84 Atlet (1200 hp Engine)	+2	Fair	NSVT (RWS), KMT (EO)	1500x12.7mm, 1500x7.62mm
BREM-84T Athlet	+2	Fair	M2HB (RWS), M60 (EO)	1500x.50, 1500x7.62mm

*The Atlet and Athlet have special spaced armor on all surfaces, including the roof and belly, but not including the engine deck and the rear. This special spaced armor stops 4D6 from HE-type rounds, and 1d6 from KE-type penetrators. This may be in addition to any ERA the Atlet or Athlet is mounting). Belly armor is 12Sp, and roof armor is 10Sp. The dozer blade may provide an AV to the front; what it protects depends upon how high it is raised. The dozer blade provides an AV of 6Sp against such frontal attacks.

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 South Korean examples are made in-country by Samsung Techwin and are new-build vehicles, designated the KAAVR7A1; the rest of the countries use surplus vehicles sourced from the US and some countries who have retired the AAVP7 series. Upgrades mean that, at least in the US and South Korea, the AAVP7-series, including the AAVR7A1, will remain in service until their predicted replacement date (with an as-yet unknown vehicle) in 2035. This was supposed to be the EFV series, but that vehicle was cancelled due out-of-control rising costs. A common nickname for the AAVR7A1-series vehicles are "tuna boats."

The cupola of the AAVP7A1 is not present on this vehicle; instead, the AAVR7A1 has a mount on the commander's position for an M60D 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 23 tons. Also installed in the vehicle is an air compressor, 5 kW generator, workbenches, welding gear, and a complete range of tools and power tools, as well as a circular saw. 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 powerpack and chassis are the same as on the AAVP7A1; in fact, virtually the entire hull of the AAVR7A1 is identical to that of the AAVP7A1, and the AAVR7A1 is able to take the same applique armor kit as the AAVP7A1. One complaint common to the entire AAVP7-series is that it is underpowered, and that is due to its Cummins VT400 diesel engine, which outputs only 400 horsepower, not enough for a vehicle of the AAVR7A1's size. The transmission is manual, but with a power assist, a type of transmission known as "semiautomatic." 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

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.

The AAVR7A1 has a small computer which contains all of the USMC's vehicle manuals as well as manuals for recovery solutions. The AAVR7A1 generally carries several extra shovels as well as six sets tough plastic pipes zip-tied in groups of four to perform its secondary duty as a BARV.

Applique armor is commonly used today, and consists of corrugated aluminum sheets on the sides and front. The corrugations allow the applique to act as spaced armor, yet save weight. Nonetheless, 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.

Newer versions under the AAV RAM/RS Program version use an M2A1 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 AAVR7A1 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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AAVR7A1	\$97,976	D, G, AvG, A	7.94 tons	23.64 tons	5	17	Passive IR (D)	Shielded
AAVR7A1 w/Appliqué	\$151,913	D, G, AvG, A	8 tons	25.64 tons	5	17	Passive IR (D)	Shielded
AAVR7A1 RAM	\$169,734	D, A	8.14 tons	24.95 tons	5	15	Passive IR (D)	Shielded
AAVR7A1	\$310,110	D, A	8.16 tons	26.92 tons	5	17	Passive IR (D)	Shielded

SUP AAVR7A1 SAIC	\$682,403	D, A	8.18 tons	27.52 tons	5	24	Passive IR (D), Thermal Imaging (C)	Shielded
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Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AAVR7A1	101/71/18	28/20/5 (4)	647	111	Std	T3	HF10 HS7 HR5
AAVR7A1 w/Appliqué	108/75/19	30/21/5 (3)	647	111	Std	T3	HF10 HS10Sp HR5
AAVR7A1 RAM	148/104/27	41/29/7 (5)	647	194	Std	T3	HF12Sp HS12Sp HR6
AAVR7A1 SUP	139/98/25	39/27/7 (5)	647	194	Std	T3	HF12Sp HS15Sp HR6*
AAVR7A1 SAIC	137/96/25	38/27/7 (5)	647	194	Std	T3	HF16Cp HF18Cp HF8**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
AAVR7A1 (Inc. Applique, RAM)	None	None	M60D (C)	850x7.62mm
AAVR7A1 SUP	None	None	M60D (C)	1700x7.62mm
AAVR7A1 SAIC	+2	Fair	M60E2 (C)	1700x7.62mm

*Floor Armor is 5Sp. Roof Armor is 4. The crew has blast-resistant seats; these reduce the damage done to the crew if they are sitting in these seats and the AAVR7A1 runs over a mine or IED, reducing damage to those crewmembers by 2D6.

** Floor Armor is 7Sp. Roof Armor is 5. The crew has blast-resistant seats; these reduce the damage done to the crew if they are sitting in these seats and the AAVR7A1 runs over a mine or IED, reducing damage to those crewmembers by 2D6.

BAE M1 M1150 ABV Assault Breacher

Notes: Though cancelled in the US Army, the US Marines saw great promise in the M993 Grizzly CEV with its plethora of obstacle clearing tools. Though the Army decided to cancel it the Grizzly (it can be found in Best Engineer Vehicles that Never Were) , 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 primary 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 limited-traverse oversized turret that has been enlarged and modified for its new role. The turret may rotate through a traverse of 180 degrees. The chassis is an M1A2 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 rear of the turret have a pair of MICLIC launchers.

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 limited-rotating enlarged turret have been heavily modified.

It is not conventional armor, but the turret and glacis typically has several roadwheels and track sections mounted on it, and it is AV2 armor if it is hit (50% chance).

The ABV has a smoke grenade cluster on either side of the front of the superstructure. 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 is 1.63 meters high, and the bottom has scarifying teeth to dig up mines and IEDs, as well as having a secondary role of tearing up road surfaces and can also be driven into walls and the plow then used to topple the wall. 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 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 M2HB 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 with NBC filters, heating, and

an NBC Overpressure system; it also has BMS and a GPS setup and a vehicle state computer. The Shredder uses an Integrated Vision System, allowing the driver to see through the commander's vision gear and vice versa. Each crewmember may draw with a finger or stylus on his screen, pointing out important features or plans to the other. The Shredder is equipped with an experimental system. It is equipped with DUKE, which is an ECM system for the Shredder, and functions as ECM 2.

The rear of the Shredder has flag dispensers on the rear corners, each with 50 flags. The Shredder has a laser rangefinder; this can be used with the M2HB or the MICLIC launchers.

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	\$3,498,385	D, G, AvG, A, JP8	302 kg	65.32 tons	2	42	Image Intensification (D, C), Thermal Imager (C), CCD Camera (D, C)	Shielded
ABV w/RWS	\$5,085,843	D, G, AvG, A, JP8	266 kg	65.47 tons	2	44	Image Intensification (D, C, RWS), Thermal Imager (C, RWS), CCD Camera (2xD, C, RWS)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
ABV	159/111	44/31	1920	557	Std	T6	HF262Cp HS34Sp HR27Sp
ABV w/RWS	159/111	44/31	1920	557	Std	T6	TF 8Sp TS6Sp TS6Sp HF262Cp HS34Sp HR27Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
ABV	+2	Basic	M2HB (C)	1500x.50, 2000 kg C4, 4 Engineer Demo Chests
ABV w/RWS	+2	Fair	M2HB, 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 M2A2 ODS-E E-BFV

Notes: What that giant acronym means is that this vehicle is the engineer squad vehicle version of the M2A2, with Operation Desert Storm modifications. Some are also M2A3 E-BFVs, allowing them to interoperate with Bradley BCTs that are based on the M2A3; 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 normally deploys in a squad with an E-BFV mounting a dozer blade, and an ACE.

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 designate 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 an M105 trailer that carries extra equipment and supplies, a MICLIC system, or a Volcano minelayer mechanism. This is not included in the stats below.

The biggest difference between the E-BFV and the standard M2A2 ODS or M2A3 is the lack of a TOW missile launcher in the box on the left side of the turret. Instead, the E-BFV's box carries additional observation equipment such as LLTVs (at the front and back of the box, a FLIR, and a 2nd Gen Image Intensifier, amongst other vision items). The vision equipment marked "SQL" is in the box, and can be canted to the side or up and down. The vision equipment in the SQL box is downlinked to the commander if it is marked "C"; this information, in its entirety, is also downlinked to the engineers inside the vehicle. 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; it can inflict damage, but causes only 1 point of damage per shot. 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 300 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. Due to the lack of TOW missiles, the E-BFV carries two Javelin missiles inside the vehicle.

The E-BFV has a primitive soft-kill system, which detects radio and wire-guided missiles and targeting lasers and puts out an electrical field that shorts out the wires and interferes with the radio guidance. This system is 65% likely to cause the incoming missile to detonate its warhead immediately. (Troops within 30 meters will have a feeling of having their hair standing on end.) The interference effect has a range of 3 kilometers.

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. (A squad of four is what is stated below.) 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. In addition, behind the turret are eight more smoke grenade launchers, which not only block normal IR and visual observation but laser guidance beams as well. These are launched automatically when a laser targeting beam is detected. The vehicles have a 15kW APU to run the sensors and tools when the engine is off. This includes a four-ration heater/water heater.

Being a variant of the M2A2, the following features are common to the two. Lugs for reactive armor blocks are found on the upper sides of the M2A2 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 M2A2 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 M2A2ODSs, included the addition of a GPS system, an IFF system, and thermal imaging for the driver.

Other improvements a CIS (Commander's Independent Viewer), similar to the CITS of the M1A2 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 M2A3 has an automatic dual target tracking ability, and as the gunner's sighted target is destroyed, the turret can be set to rotate automatically and the gun trained automatically on the commander's sighted target. Fire control is also improved (the system called the IBAS – Improved Bradley Acquisition System), and boresighting is essentially automatic instead of requiring a stop and extensive adjustments. The gunner's sight (the TAS – Target Acquisition System) has received particular attention in the fire control department. The main gun and coaxial machinegun is better stabilized and the ballistic computer improved (able to tap into, to a small amount, the primary computer of the Bradley). The TAS uses a 2nd-generation FLIR and a day TV/image intensification device, with a digital zoom from 4x to 48x, and twice the field of view of the zoom sights of earlier Bradleys. The day TV/image intensifier sees in near-infrared as well visible light, making it usable even in heavy smoke, IR-obscuring smoke, and conditions of low thermal contrast where FLIR imaging would be of little use.

M2A3 E-BFVs have the upgrades of the M2A2 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 M2A3 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 E-BFV is therefore a true counterpart to the Abrams on the digital battlefield.

The turret roof of the M2A3 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 M2A3 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 M2A3 (and some M2A2s 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
M2A2 ODS E-BFV	\$1,286,143	D, A	812 kg	27 tons	3+4	21	2 nd Gen Image Intensification (C, SQL), Image Intensification (G), 3xLLTV w/Image Intensification (D, SQL), Thermal Imaging (D, G), FLIR (C, SQL), Telescopic sight (SQL, C)	Shielded
M2A3 E-BFV	\$1,370,636	D, A	815 kg	28 tons	3+4	26	Thermal Imaging (D), FLIR (C, SQL), 2 nd Gen FLIR (G), 2 nd Gen Image Intensification (G, SQL), 2xLLTV w/Image Intensification (SQL), Telescopic	Shielded

sight (SQL, D)

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
M2A2 ODS E-BFV	151/106	43/29	662	222	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp
M2A3 E-BFV	147/103	41/29	662	222	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M2A2 ODS E-BFV	+3	Fair	M242 Bushmaster Autocannon, M240C	900x25mm, 2200x7.62mm, 300 kg C4, 4 Engineer Demo Chests
M2A3 E-BFV	+3	Good	M242 Bushmaster Autocannon, M240C	900x25mm, 2200x7.62mm, 300 kg C4, 4 Engineer Demo Chests

*Floor Armor is 7. For the M2A3 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 M113 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 M113A3, is has a steering wheel instead of tillers. Like the MTVL, it has styrofoam 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 M2A1 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 one-man turret containing two machineguns (but an alternate installation on some CESVs replaces the M2HB 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 conditioner, 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 M113A4 Sapper Vehicle.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$658,038	D, A	4.1 tons	18.14 tons	3+7	20	Image Intensification (D, G), Thermal Imaging (G, C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
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140/98	39/27/4	757	131	CiH	T3	TF4Sp TS4Sp TR4 HF10 HS5Sp HR4*
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Fire Control	Stabilization	Armament	Ammunition
+2	Fair	M2HB or Mk 19, MAG	1000x.50 or 320x40mm, 1500x7.62mm, 40 kg C4, Engineer Demo Chest.

*Belly armor is 4Sp.

United Defense M9 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. The basic vehicle is an international Harvester tractor, with further modification by International Harvester, Caterpillar, and the US Army Engineer Laboratory at Ft Belvoir, Virginia. 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, who call them the K9. 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 – it could literally scoop up a mine and have it detonate inside the bucket.

The ACE's 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. Early ACEs have no night vision equipment, but have a periscope which leads out to the right side and a telescope which is mounted in front of him. The periscope and telescope is also connected to a small video monitor in front of the driver. The sometimes-carried second crewmember is sometimes armed with a weapon, but not usually.

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.

The hub and sprocket design on the earlier D9s required a pair of sprockets on each side, and the hubs were judged as being the weak spot in the entire track and roadwheel system. The SIP improvements eliminates the inner sprocket, with the dozer operating off the single sprocket. The hub is piloted onto the final drive output shaft, reducing the shear load. The SIP also features both semiautomatic track tensioning and track tension adjustable by the operating, reducing thrown tracks. The dozer blade is made from steel instead of the earlier D9s aluminum dozer, reducing damage to the blade.

A possible future SIP is an OHWS with an M2HB, 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 "M9A2," 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 "M9A3" though this not an official designation.

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 M9 and M9A1 normally operate with only one crewmember, and the M9A2 and M9A3 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
M9 ACE	\$159,326	D, A	1.43 tons	16.28 tons	1+1	15	Headlights	Shielded
M9A1 ACE	\$191,608	D, A	1.43 tons	17.31 tons	1+1	15	Headlights	Shielded
M9A2 ACE	\$642,614	D, A	1.05 tons	17.82 tons	2+1	19	Thermal Imaging (G)	Shielded
M9A3 ACW	\$741,626	D, A	1.31 tons	17.87 tons	2+1	20	Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M9 ACE	144/101	40/28/4	507	109	Std	T3	HF3Sp HS3Sp HR2Sp*
M9A1 ACE	138/96	38/27/4	507	109	Std	T4	HF9Sp HS6Sp HR4Sp**
M9A2 ACE	123/86	34/24	507	109	CiH	T4	TF4Sp TS4 TR4 HF9Sp HS6Sp HR4Sp**
M9A3 ACE	155/109	43/30	507	148	CiH	T4	TF4Sp TS4 TR4 HF9Sp HS6Sp HR4Sp**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M9A2/A3 ACE	+2	Fair	M2HB, Mk 19	2000x.50, 500x.40mm

*The dozer blade has an AV of 6, and is 50% likely to be hit if 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 if 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 M58 Wolf

Notes: This is the US Army's current standard smoke generation vehicle, along with the M56 Coyote. The vehicle is also known as the SGS (Smoke Generation System) or the MSOC (Mechanized Smoke Obscurant Carrier). It is also used by several of America's allies who also use the M113-series. It uses a tactical smoke generator of the 1994-2000 period type on the latest M113A3 chassis, featuring large area multispectral obscurants. It has the RISE improvements that are normally fitted to the M113A4. 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 M113A3. 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 M113A4 – 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, as well as 30 minutes of obscuration for laser spotting and targeting beams. 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 M113 series.

Two variants are listed below; they are supposed to have been developed or be still in development, but I don't know exactly the stats and I used notional designations. The M58A1 has a chaff emitter to jam MMW and low-power radar beams from aircraft or GSR. It also has a BMS and GPS with mapping computer and vehicle state computer. The M58A1 has an NBC overpressure system. The M58A2 is the same as the M58A1, but has better obscurants of modern specifications; the weapon mount is also fully operable from within the vehicle and is equipped with a ballistic computer slaved to its reticle.

Just to confuse matters further, the M58 is often known as an M58A3, as it is based on an M113A3.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M58 Wolf	\$1,063,304	D, A	361 kg	13 tons	3	13	FLIR (D, C)	Shielded
M58A1 Wolf	\$1,484,610	D, A	379 kg	13.1 tons	3	16	FLIR (D, C)	Shielded
M58A2 Wolf	\$1,558,841	D, A	380 kg	13.1 tons	3	17	FLIR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M58 Wolf	163/114	45/32/5	400	104	Stnd	T2	HF6 HS4 HR4
M58A1 Wolf	162/113	45/32/5	400	104	Stnd	T2	HF6 HS4 HR4
M58A2 Wolf	162/113	45/32/5	400	104	Stnd	T2	HF6 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M58 Wolf	+1	Basic	M2HB (C)	2000x.50
M58A1 Wolf	+1	Basic	M2HB (C)	2000x.50
M58A2 Wolf	+2	Fair	M2HB (C)	2000x.50

GDLS M60 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 M60A1 main battle tank, with a bridge that has a capacity of 54.43 tons; some are based on an M48A3 or A5 chassis that has been brought up to M60A1 standards, or the chassis from the retired M60A2 (and all are identical for game purposes). Current plans call for a slow-rate replacement by the M104 Wolverine, though Congress and the President have killed the M104 more than once (only to raise from the dead); currently, though, the M104 is in full production. Export operators include Egypt, Iran, Israel, Pakistan, Singapore, and Spain. It should be noted that the M60 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 M60 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 M60 AVLB chassis is virtually identical to the M60A1; 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 M60A1 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 M60 AVLBs have clusters of five.

The M60 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, as well as a vehicle state computer. Even later improvements (early 2000s) added a BMS and GPS. These did not have special designations, though for game purposes I have labeled them Upgrade 1 and 2.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M60 AVLB	\$638,531	D, A	286 kg	55.21 tons	2	45	Passive IR (D)	Shielded
M60 AVLB (Upgrade 1)	\$1,070,576	D, A	286 kg	55.23 tons	2	46	Passive IR (D)	Shielded
M60 AVLB (Upgrade 2)	\$1,179,181	D, A	299 kg	55.78 tons	2	49	Passive IR (D), Image Intensifier (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
M60 AVLB	118/83	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8
M60 AVLB (Upgrade 1)	118/83	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8

M60 AVLB (Upgrade 2)	117/82	33/23	1457	276	CiH*	T6	TF4 TS4 TR4 HF56 HS15 HR8
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*The CiH configuration refers to the AVLB with the bridge mounted. If the bridge is deployed, Config is Stnd.

GDLS M60 AVLM

Notes: The M60 AVLM (Armored Vehicle Launched MICLIC) began as a field modification of a standard M60 AVLB during Desert Storm (Upgrade 1). The bridge is removed from the vehicle, the bridge deployment machinery retracted, and up to two line charge machinery of two standard M58A3 MICLIC (Mine-Clearing Line Charge) trailers are 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 M60 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 M60 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 M60 AVLB, it has the same automotive characteristics and most of the chassis is unchanged from the M60A1 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 M60 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
\$766,297	D, A	251 kg	51.33 tons	2	48	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
112/78	31/22	1457	276	CiH	T6	TF5 TS5 TR5 HF56 HS15 HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	2xMICLIC Launchers	8xLine Charge

*The "turrets" are actually the raised housings for the MCLICs. They are not actually turrets, but for purposes of fire combat, are treated as such.

BMY M88 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 M88A2 and M5 in US service and by the M88A2 in some other countries, but the M5 was killed in the budget and the M88A2 suffered a dramatic slowing of the purse strings.

The original M88 was introduced in 1961 and replaced (largely by upgrading) by the M88A1 in 1977, and the M88A2 (mostly new-build vehicles) in 1997. Most Marine M88s are M88A1s; they are slowly and steadily building up a stock of M88A2s, but nowhere near the rate of the Army. The M88 is a veteran of the Vietnam and Gulf Wars; the M88A1 and A2 were used in Operation Iraqi Freedom and Operation Enduring Freedom. The M88 in its various forms, are used by 23 countries (and almost all of them use the M88 in its A1 form, though the new Iraqi Army and Kuwait use the M88A2). The Egyptians license-produce the M88A1 and M88A2. At this time, 850 M88A2s are scheduled to be produced, but this could change at any time.

The M88 is described as a vehicle with something for every mechanic, from the wide selection of tools and power 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 M60 machinegun and four M136 or six M72 rockets; as well as the personal weapons of the crew and the recovered crew. The M88 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 M88 and the M88A1 the winches are normally used by commander and fourth crewmember. The M88 and M88A1 are based on the M60 tank chassis.

The driver is on the top left; the driver of the M88 uses a tiller setup, while the M88A1 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 M88 has air conditioning and a heater, as well as a Vehicular NBC system; M88A1 were retroactively fitted with an air conditioner in the late 1990s. The M88A2 was fitted with a BMS and GPS. The crew of the M88A2 has a small computer that has the tech manuals and bulletins for most Army (or Marine) vehicles. The M88 and M88A1 have a cluster of six smoke grenade launchers on the upper glacis on either side; Marine M88A2 use five-grenade clusters. M88-series vehicle have two spotlights, one in the rear and one in the front, both of which are controlled from the commander's position by remote controls.

The M88 is powered by a gasoline engine developing 750 horsepower; The M88A1 is powered by a 908-horsepower diesel engine. The M88A2 has a 1050-horsepower turbocharged diesel. The M88 and M88A1 have manual transmissions, while the M88A2 has an automatic transmission.

The biggest difference between the base M88 and the M88A1 is that the M88A1 is equipped with an 8.1 kW APU. The M88A1 also has a fuel pump that allows the vehicle to pump fuel from an external source. (This pump is not normally used to refuel an M1-series vehicle, as the hose is reeled on the outside, and one does not want to get debris in the M1-series' fuel tanks and engines.) Finally, the M88A1 has a 19mm hydraulic impact wrench to assist in track maintenance of tracked vehicles. The APU is also powered by diesel (and later, JP8) fuel. The M88 series can refuel other vehicles from its own fuel tanks, but there is a 10% chance per refueling operation of clogging the M88s 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 M1; the APU can also be used to jump-start vehicles. The dozer of the M88 series can also be used to dig larger fighting positions or conduct general earthmoving. The M88 series is not amphibious, but can ford bodies of water up to 2.6 meters deep with preparation. The M88A1 and later have NBC Overpressure.

The M88A2 is a progressive development of the M88A1, able to recover (earlier) M1 tanks. The M88A2 is based on new-build vehicles. The general layout is similar to the M88A1, but the M88A2 adds armored side skirts, appliqué armor, stronger suspension, an upgraded engine, improved brakes, and more powerful winches. It has a 10kW APU. The M88A2 is able to recover and tow a 70-ton vehicle at one-third speed, or a 30-ton vehicle at full speed. The M88A2's crane can lift 35 tons, or 19.4 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 XM5 but is much cheaper, and crews familiar with the M88A1 can use it with ease (and the M88A2 has not been killed in the budget process). The M88A2 is at its limits when towing an M1 Abrams; the M88A1 is really straining to do this and more normally, two M88A1s are used to tow an Abrams. The M88 is not capable of this feat. The crane of the M88A2 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.

With the gradual increases in weight of the M1-series tanks, the M88A2 became less and less able to recover those tanks from about 2014-forward. Certain parts also needed to be carried under special conditions (such as electronics). In 2017, modifications began to be made for this purpose. The powertrain was upgraded and the engine upgraded to 1300 horsepower, along with the steering system and transmission, which is based on that of the M1. The M88A3 was given another roadwheel to reduce ground pressure, and the M88A3 was given locking brakes, a locking differential, and locking suspension. They are not new-build vehicles, but instead modifications from the M88A2. The M88A3's crane has a capacity of 38 tons

The M88A2 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. In OIF, OAF, and in the Balkans, many M88-series vehicles sported wrap-around AV2 gun shields around their gunner's position.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M88	\$274,070	G, A	3.04 tons	50.4 tons	4+4	37	Passive IR (D), 2xWL/IR Spotlight (C)	Enclosed

M88A1	\$293,477	D, A	3.37 tons	50.8 tons	4+4	39	Passive IR (D), 2xWL/IR Spotlight (C)	Enclosed
M88A2	\$781,523	D, A	3.67 tons	63.05 tons	3+5	48	Passive IR (D, G), 2xWL/IR Spotlight (C)	Shielded
M88A3	\$808,501	D, A	3.75 tons	63.05 tons	3+5	48	Passive IR (D, G), 2xWL/IR Spotlight (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M88	126/88	35/24	1514	417	Std	T6	HF7 HS5 HR4
M88A1	130/91	36/25	1514	337	Std	T6	HF7 HS5 HR4
M88A2	124/87	34/24	1628	390	Std	T6	HF12Sp HS9Sp HS5*
M88A3	146/102	41/28	1628	482	Std	T6	HF12Sp HS9Sp HS5*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(All)	None	None	M2HB (C)	1500x.50

*Belly Armor for the M88A2 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 M104 Wolverine

Notes: This is a limited production mechanized bridging vehicle based on the chassis of the M1A2 SEP main battle tank, also known as the HAB (Heavy Assault Bridge). The shortcomings of the M60 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 M1A2 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 M104 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 M1A2 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 M1A2 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
\$1,869,560	D, G, AvG, A, JP8	701 kg	63.32 tons	2	53	Image Intensification (D, C), 2xWL Spotlights (C)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
175/123	49/23	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 Std.

BMY M578 Light Recovery Vehicle

Notes: This vehicle is common in US units that still use the M113 series as a primary vehicle; it's original purpose, however, was to

provide a vehicle able to make rapid barrel replacements on the M107 and M110 SP howitzers, whose barrels wore out quickly. After Desert Storm, remaining US VTRs were gradually replaced by M88-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 M578 is a US-built recovery vehicle with a chassis as the M107 and M110 howitzers. The turret, however, is based on the M109 SP howitzer. The rear-mounted turret has a crane capable of lifting 13.6 tons; I've personally seen one lift an M113A2 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; otherwise, the turret can rotate 360 degrees. 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 M578 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 it 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 M88A1s when we got our Bradleys. However, I did see some VTRs during Team Spirit 89 in Korea. The M578 was generally called by the troops a VTR (Vehicle, Tracked, Recovery).

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$211,331	D, A	1.99 tons	24.3 tons	3	21	Passive IR (D)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
128/90	36/25	1100	157	Trtd	T4	TF3 HS3 TR3 HF6 HS4 HR2

Fire Control	Stabilization	Armament	Ammunition
None	None	M2HB (C) (L-7A2 (C) on British vehicles)	500x.50 (750x7.62mm on British vehicles)

GDLS M728 CEV

Notes: This vehicle was designed soon after the M60A1 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. None are still used in the US Army, though until the early 2000's, 29 were used by selected engineer units. 262 are in boneyards, USAR service, National Guard, and certain FBI and ATF uses. In the US, the M728 was no longer used by active duty units after 2000; Desert Storm taught the military that the M728 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 M728 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 M728 is by the FBI in the Waco Siege, where it 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 M728 retains the base M60A1 chassis (though some were made using the hulls of retired M60A2s), but a new turret armed with a 165mm M135 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 M60A1 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 M60A1 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 M728 is not amphibious but can ford up to 2.4 meters. The M728 does have an NBC Overpressure system; however, there is no provision for firing the M2HB from inside the M728.

The M728A1 has updates in the area of the winch/crane (cable increased in width and length increased to 100 meters). In addition, the supply of .50 BMG ammunition was increased to 728 rounds.

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 M60A1. There were several proposals to re-engine the M728 to regain its mobility; the 1050-horsepower option in particular would have been good for this. However, re-engining even a small portion of the M728s on the rolls was not considered budgetworthy. (I have included such a beast below as a "what-if;" it is listed as "M728A2" and has some other gear such a beast might have, such as a BMS with a GPS system, as well as an upgrade in night vision.)

Twilight 2000 Notes: Just prior to the Twilight War, the M728 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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M728	\$648,886	D, A	714 kg	52.2 tons	4	31	Passive IR (D), WL/IR Searchlight	Shielded
M728A1	\$844,555	D, A	714 kg	52.2 tons	4	31	Passive IR (D), WL/IR Searchlight	Shielded
M728A2	\$1,085,336	D, A	746 kg	52.5 tons	4	36	Image Intensification (D, C), Thermal Imaging (G, C), WL/IR Searchlight	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M728	111/77	31/22	1420	277	Trtd	T6	TF45 TS17 TR13 HF56 HS12 HR8
M728A1	111/77	31/22	1420	277	Trtd	T6	TF45 TS17 TR13 HF56 HS12 HR8
M728A2	142/100	40/28	1420	389	Trtd	T6	TF45 TS17 TR13 HF56 HS12 HR8

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M728	+1	None	165mm M135 Demolitions Gun, MAG, M2HB (C)	30x165mm, 3600x7.62mm, 600x.50, 20 kg C4, Engineer Demo Chest
M728A1	+1	None	165mm M135 Demolitions Gun, MAG, M2HB (C)	30x165mm, 3600x7.62mm, 728x.50, 20 kg C4, Engineer Demo Chest
M728A2	+2	Fair	165mm M135 Demolitions Gun, MAG, M2HB (C)	30x165mm, 3600x7.62mm, 1500x.50, 20 kg C4, Engineer Demo Chest

FMC M1059 Lynx

Notes: This was the US Army's standard smoke generation vehicle until adoption of the M58 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 M113A2 base vehicle. The vehicle carrier remained the M113A2, but was sort of a hybrid vehicle as it had most of the RISE powerpack upgrades, but, for example, steering remains by tillers. The M1059 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. (These are designated M151A2, but are essentially equivalent to the M58 Wolf SGS.)

The M1059A1 is an upgrade of the earlier M1059 SGS. (The M1059A1 is the M1059 with some electrical improvements.) It produces visual-blocking smoke screens by using dual 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 M113 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 M1059A2 uses a smoke generator of the 1994-1999 period. It also has a chaff generator, as on the M58 Wolf. It also has a vehicle state computer, with the accent on the smoke generator's condition. The M1059A3 adds a GPS system and a BM, as well as NBC Overpressure.

The driver occupies the standard left front position as on the M113A2; the commander has a standard M113A2 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 for the SGS system is primarily by pushbuttons. The operator has a hatchway above him. A small 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, and only small items

can be placed around the SGS system. . 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 night vision and lasers.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M1059 M1059A2 M1059A3	\$1,118,904	D, A	372 kg	12.2 tons	3	9	FLIR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M1059 M1059A2 M1059A3	168/118	47/33/5	360	102	Std	T2	HF6 HS4 HR4

Fire Control	Stabilization	Armament	Ammunition
None	None	M2HB (C)	2000x.50

Leonardo DRS M1074 JABS

Notes: In the mid-2010s, the Army and Marines perceived that they had a problem with the M104 Wolverine HAB. The Wolverine was expensive to operate, partially due to the many parts of the M1's electronics suite, but primarily to the Wolverine's long-span bridge, spanning a length that was deemed too far for tactical considerations. The Wolverine's bridge was also thought to take too long to deploy and recover. The Army's and Marines' solution was to make a smaller, but tactically more relevant, AVLB, which became the M1074 JABS (Joint Assault Bridge System).

The JABS was in LRIP production from 2016-2018, during which 51 JABS vehicles had been built (some by Anniston Army Depot). Several of these initial vehicles were used in field trials, with the attendant accelerated wear and tear that occurs in field trials and initial issue. Full-Rate Production began in 2019, and is expected to be finished in 2024. Some sources say that the JABS will replace all M60 AVLBs and Wolverines on a one-for-one basis; other sources say that as many as a third of presently in-service Wolverines will remain in service, but all M60 AVLBs will be replaced. In any case, the US Army has placed an initial order for 168 JABSs, and the US Marines 29 JABSs. In addition, in 2021, delivery began to the Australian Army of what will be 18 JABSs. These deliveries are expected to be finished in the summer of 2022.

The JABS is based on an M1A1 hull refurbished to a zero-miles condition and powered by a similarly refurbished engine. The suspension, however, is largely an M1A2's suspension. The M1074 has also has the M1A2 SEP4's TIGER-ED improvements, including a computer and interface that keeps track of 21 engine parameters, as well as 10 transmission parameters and parameters for the other various subsystems which relate to the M1074's drive train, roadwheels, idlers, and drive sprockets, and also keeps track of the APU. The commander has, as part of his screen, an interface for the TIGER-ED upgrades so he can keep track of his systems. (The driver's screen can keep track of selected elements of the TIGER-ED system which pertain to his job.) This system increases reliability and also helps out the mechanics diagnosing problems. (It also makes the M1074 sort of an "M1 Frankenvehicle.")

The bridge itself is a twin-span scissors-type bridge (yes, some of you out there are already yelling "A scissors-type bridge is tactically unsound!"); despite the tactical implications of this type of deployment, such a bridge (especially when using the advanced BLM the M1074 uses) takes only 3 minutes to emplace and two to recover, a little over half the length of time required for the Wolverine to emplace its bridge. The bridge is about 19 meters long; however, as is the case with most AVLBs, the actual gap it can span is smaller, in this case, 18.3 meters. The bridge is powerful yet lightweight due to the use of titanium, composites and light alloys of various sorts, though crucial structural components are of high-strength steel, leading to a bridge which weight only 15 tons. The first bridges mounted to the then-XM1074 were MLC70, but they were rapidly improved in design and materials, first to MLC80, then MLC85 then MLC92, and finally to an astounding MLC95 (in other words, the bridge can support 95 tons at once). Therefore, multiple vehicles can cross at once if room is available, or heavily laden vehicles like tank-transporters that actually have tanks *on* them.

The M1074 can keep up with rapidly advancing units as it is as light as an early M1-series tank, yet has the same engine. It is not armed except for the crews' M4s and M9 pistols, plus a decent amount of fragmentation grenades and a couple of AT-4s, and a flare gun with illumination and colored smoke shells. The electronics suite includes a BMS, GPS and mapping system, and secure radios. The chassis is heavy enough and the bridge light enough that no bracing blade or bracing legs are necessary for employing the bridge. The M1A2D's battery APU system is installed, able to deliver 17.5 kW for 8 hours. In the case of the M1074, this APU is enough to power the electronics and the BLM (Bridge-Laying Machinery) with the engine off.

The M1074 is able to use a portion of the TUSK kit – specifically, the belly applique armor, the enhanced antimine driver's seat, the RVSS (Rear View Sensor System), and the TIP (Tank Infantry Phone) – basically the components of the TUSK that do not need to be mounted on a turret. The M1074 is also equipped with an IFF device. The M1074 may mount ERA on its side skirts, but cannot mount an APS due to the bridge being too low over the chassis.

Crews have decent-sized lockers beside (or in case of the driver, to the right and rear) of their positions for ammunition, personal items, rations, etc. On their other side are kept their weapons when not using them. Australian M1074s differ primarily in the types of tools in the pioneer kit, and items like the personal weapons, as well as minor differences like spelling and grammar in the technical manuals and on the LCD displays.

Some US Army M1074 crews have taken to putting an M249 SAW inside the commander's position "just in case." This of course

depends on whether they can scrounge one from the infantrymen or scouts...I suppose the same thing could be happening on the Marine side, with the M27 instead...

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
\$1,723,650	D, G, AvG, A, JP8	458 kg	62.3 tons	2	34	Image Intensification (D, C, Backup Camera), Thermal Imaging (C), CCD Cameras (2xFront Corners, 2xRear Corners)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
166/116	46/32	1911	974	CiH	T6	TF10 TS10 TR10 HF240Cp HS30Sp HR20

*The rating of "CiH" applies only if the bridge is mounted. If it is deployed, the rating reverts to "Std." However, even when the bridge is deployed, the BLM can be damaged by appropriate results on fire combat tables.