ARTILLERY SUPPORT VEHICLES

British Artillery Support Vehicles
Canadian Artillery Support Vehicles
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Czech Artillery Support Vehicles
French Artillery Support Vehicles
German Artillery Support Vehicles
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Alvis/BAE FV-432 FDC

The FV-432 FDC vehicle is essentially a specialized version of the FV-432 command vehicle, and in form does not differ greatly from that vehicle; the primary differences in the FV-432 FDC are inside, where a more comprehensive fire control computer is installed that allows the FDC crew to quickly computer coordinates using FIST information or information from troops in the field calling for supporting fires by position and map coordinates; it also generally carries extra radios, including two long-range, two medium-range, and one short-range radios. Mk 2 and (and Mk 3 versions, if they appear), have one long-range radio being data-capable, and the internal computer can wirelessly connect with the mortar carrier's hand-held mortar fire control computers and transmit coordinates and other information directly to them, such as method of fire and types of rounds to be used. The FV-432 FDC did, in fact, receive the Mk 1/1 and Mk 2 upgrades, the same as the FV-432 and FV-432 Mortar Carrier.

The Mk 1 version of the FV-432 FDC uses a Rolls-Royce B-Series 240-horsepower gasoline engine, coupled to a GM TX-200 4A semiautomatic transmission. Though this is not a fully-integrated powerpack, the engine and transmission are mounted on a common sub-frame and can be removed in one piece. As with the FV-432 Mk 1, the FV-432 Mk 1 FDC was designed with amphibious capability, but this requires that a large flotation screen be erected, a trim vane extended, and a bilge pump turned on – an operation that could take up to a half an hour with inexperienced troops. Due to the heavier weight and height of the FV-432 FDC, swimming is even more dicey, and less recommended than swimming the FV-432 APC. A minor upgrade, the Mk 1/1 version, primarily dealt with small automotive and electrical problems. The Mk 2 version has a new Rolls-Royce K60 multifuel engine, and a few other mechanical and electrical improvements. The Peak Engineering light turret that was applied to some Mk 2 FV-432 APCs was not applied to any FV-432 FDCs. This version is known as the Bulldog, as will be the possible upcoming Mk 3. The short-lived Mk 2/1 modification, which moved the NBC pack inside the FV-432 APCs walls, was never applied to the FV-432 FDC.

The Possible Mk 3 Upgrade

A big question is whether the FV-432 FDC version will receive the Mk 3 upgrades. I am assuming the maximum possible Mk 3 upgrades in the stats below, but as a minimum, the new integrated power pack and driver's position are being looked at for a possible Mk 3 version. The engine used in the upgrade is a 260-horsepower diesel engine, along with a fully automatic transmission. The laterals for vehicle control are gone, replaced by a steering yoke and a standard gas pedal and brake pedal. The FV-432 Mk 3 FDC has an air conditioning unit, though it is modular and may be removed if it is deemed unnecessary, such as if a war occurs in cold climates, freeing up some interior space. Other improvements include a beefed-up suspension for the crew and troops seats. The FV-432 Mk 3 FDC is equipped with a GPS unit. The smoke grenade clusters have increased from three to four.

Externally, the upgrade is rather stunning, with appliqué aluminum armor applied to basically every surface of the FV-432, especially the hull floor; on the glacis and hull sides, this appliqué is armor spaced by stand-off bars. The Mk 3 upgrade also includes lugs for ERA on the glacis and hull sides. Ahead of the driver and commander's station is a short, wire-cutting mast to keep low-hanging wires from taking the driver's and/or commander's heads off. The commander's position is equipped with a light weapon, as on other FV-432 Mortar Carriers; however, this weapon is standard. Also standard are the AV2 gun shields for the commander's cupola. The FV-432 Mk 3 FDC is not slated to receive the RCWS station (any iteration of it). In the lower hull, the British have taken a page out of the Russian T-90s tech manual and installed a mine/IED electrical jammer; when the jammer encounters a magnetic mine or one with an electrical fuze within 10 meters, the jammer will disable the fuze from operating on a roll 14 or better on a d20. Note that the mine must be in a 20-degree radius of the front of the carrier. The jammer device is also not a mine *detector* – if the device does not detonate the mine and the mine does not actually go off, the FV-432 FDC's crew will not know that the mine is there.

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

Twilight 2000 Notes: No Mk 3 variants of the FDC are available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
FV-432 Mk 1 FDC	$136,278	G, A	660 kg	16.2 tons	2+5	11	Passive IR (D)	Enclosed
FV-432 Bulldog Mk 2 FDC	$138,278	D, G, A	660 kg	16.2 tons	2+5	11	Passive IR (D)	Shielded
FV-432 Bulldog Mk 3 FDC	$185,834	D, A	375 kg	17.8 tons	2+5	11	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
FV-432 Mk 1 FDC	106/74	26/16/2	454	142	Stnd	T2	HF6 HS4 HR3
FV-432 Bulldog Mk 2 FDC	106/74	26/16/2	454	106	Stnd	T2	HF6 HS4 HR3
FV-432 Bulldog Mk 3 FDC	101/71	24/15	454	136	Stnd	T3	HF8Sp HS6Sp HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
FV-432 FDC	None	None	L-7A2 (C)	1600x7.62mm

*Hull floor AV is 4.

Alvis/BAE Warrior MAOV

Notes: The Warrior MAOV (Mechanized Artillery Observation Vehicle) was developed in the early-1990s to give effective FISTV support to units equipped with quicker Warrior ICVs and Challenger tanks. It was one of the original vehicles planned for what was supposed to be an extensive family of vehicles based on the Warrior chassis, and was one of the few such vehicles to actually make into service. So far, the Warrior MAOV is used only by the British Army; I have not been able to determine whether it was ever offered for export.

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

The turret has two hatches atop it, with the commander's hatch to the left. The commander and gunner have a decent view around the vehicle through vision blocks. Fuel tanks are found in the walls of the passenger compartment, with stowage boxes in the rear and a large bustle rack in the rear of the turret. The rear passenger compartment is crammed with mission gear and a 4kW APU as well as one of the crewmembers. No dismount troops are carried, though the crew generally have L-85s or pistols for personal defense. There is no room for any other weapons, except a small store of ammunition for the small arms. The rear deck's double hatch is deleted, replaced by one small roof hatch. The rear compartment's two rotating periscopes have also been deleted. The hot plate/water boiler is retained, though there is only one and not two, as on a standard Warrior ICV.

The turret is stuffed with extra communications gear and equipment necessary for the MAOV to fulfill its mission. There is so much extra gear that the "autocannon" is in fact a dummy, and the MAOV retains only its machinegun. The MAOV is equipped with a combination ground surveillance/mortar and artillery counterbattery radar, GPS with inertial navigation backup, a computer system to allow it to compute fire solutions for several friendly artillery and/or mortar batteries at once and process the information from its radar, and two long range radios (data-capable), one medium-range radio, and one short-range radio. The turret has two independently-trainable laser rangefinders, including one with double normal range, plus one for the machinegun. It can transmit the information from its radar and vision devices to other units equipped to receive them. The MAOV has a greatly enhanced vision suite. The gunner and commander are in fact artillery spotters and run the radar, and the fourth crewmember runs the computers and some of the radios and communications.

Power is provided by the same Perkins/Rolls-Royce Condor CV8 TCA diesel engine developing 550 horsepower; this is coupled to an Allison X300-4B automatic transmission. Hull armor is of all-welded aluminum, often with appliqué armor plates on the sides and sometimes on the glacis (especially during and after Desert Storm, during deployments to the former Yugoslavia, and during the recent fighting in Iraq). Floor armor is notoriously thin, something that is being addressed by current upgrades. The turret, on the other hand, is armored in welded steel, and compared to most vehicles of its class, is relatively well armored. (Even compared to the Warrior's hull, the turret is well-armored.) On the other hand, it does make the vehicle heavier than it might have been if an aluminum armor turret had been used. The vehicle has a collective NBC system for the crew and passengers, and this system also shields the airflow to the radios and some other electronic equipment. The Warrior has automatic fire detection and suppression systems, with separate systems for the turret and passenger compartments, the driver's compartment, the engine compartment, and the fuel tanks. In addition, there are a pair of manual handles to actuate the fire extinguishing system.

The Warrior MAOV is not slated to receive more than a small part of the WSCP (Warrior Capability Sustainment Program). The MAOV already has a lot of the vision and navigation equipment of the WSCP; the armament augmentation is not applicable to the MAOV, though the MAOV may receive a new turret and dummy autocannon and ATGM launcher, just to blend in. The WMPS modular appliqué armor suite is not currently set to be applied to the MAOV.

Before the addition of Wrap Two applique armor, some Warrior MAOVs were armored with bar/slat/cage armor. This covered the front, sides, and rear of the hull, and sides and rear of the turret. This is designed to pre-detonate HE-type warheads, and has no effect on AP or KE-type warheads. The rear door is covered with cage armor which opens with the door.

Twilight 2000 Notes: The Warrior MAOV was a latecomer to the British TOE; perhaps 20 were built before the Twilight War, and another 20 during the war. Late in the war, surviving MAOVs were often used as command vehicles. Cage armor was not used much in the Twilight War, but a few MAOVs were equipped with it.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Warrior MAOV	$552,315	D, A	500 kg	24 tons	4	18	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (C), FLIR (G), Artillery Counterbattery/GSR Radar	Shielded
Warrior MAOV w/Appliqué	$610,610	D, A	450 kg	25 tons	4	18	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (C), FLIR (G), Artillery Counterbattery/GSR Radar	Shielded
Warrior MAOV w/Cage Armor		D, A	450 kg	25.4 kg	4	19	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (C), FLIR (G), Artillery Counterbattery/GSR Radar	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Warrior MAOV	154/108	39/23	770	234	Trtd	T4	TF12 TS8 TR5 HF11 HS7 HR5*
Warrior MAOV w/Appliqué	149/103	37/22	770	251	Trtd	T4	TF12 TS8 TR5 HF17Sp HS10Sp HR5**
Warrior MAOV w/Cage Armor	152/106	38/23	770	238	Trtd	T4	TF12 TS10Sp TR7Sp HF13Sp HS7Sp HR7Sp*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Warrior MAOV	+1	Fair	EX-34	1500x7.62mm

*Hull floor armor for this version is 5.

**Hull floor armor for this version is 7Sp.

GDLS LAV III OPV

Notes: The LAV III OPV (Observation Post Vehicle) is designed for a FIST team, and is essentially a standard Kodiak externally, except for an additional laser rangefinder and a laser designator which are on the turret; they can move independently of it, and are controlled by the commander/forward observer. Externally, the OPV can be identified by the plethora of antennas on the roof. It is internally where the OPV has the greatest differences; in addition to the independently trainable extra laser rangefinder and laser designator, the commander/forward observer has his own thermal imager and image intensifier (though they are not in a hunter/killer arrangement with the gunner). Down in the hull lies the greatest difference; the OPV has a computer to compute fire solutions and coordinate airstrikes and naval fires, and a total of two long-range data-capable radios, one radio for communication with aircraft (with data capability), one very long range radio which is used to communicate with ships (and has data-capability), and two short-range radios. The OPV also carries the equipment to hand-plot fire solutions as well. The OPV has GPS with an inertial navigation backup, as well as extensive interactive mapping software. A total of three LCD screens provide information to the hull crew, and two to the commander/forward observer; the driver has one with navigational information and vehicle state.

Being a variant of the LAV III, the OPV has many features in common with the LAV III. The driver is in his customary place in the front left, and has standard driving controls. The LAV III OPV is powered by a Caterpillar 3126 turbocharged diesel developing 350 horsepower, coupled to an automatic transmission. The 8x8 suspension can be switched to 4x8 (with the rear set of wheels providing the power) to improve on-road performance; it is also beefed up to improve off-road performance. All wheels have antilock brakes and run-flat tires, as well as a traction control system. In the front of the hull is a winch with a capacity of 6804 kg and 100 meters of cable. The LAV III is not amphibious. The rear ramp is retained, though it is a tight squeeze to get to that ramp. The crew and passengers also have the protection of a collective NBC system, and OPV has a chemical agent detector and a radiation meter. The OPV is radiologically protected. Armor is still of steel, though it is improved over that of the LAV-25. The OPV has a laser/radar warning receiver to alert the crew when they are being targeted. The crew and troops have air conditioning. each side of the turret are a cluster of four smoke grenade launchers. The OPV can use the MEXAS appliqué armor kit. It can also be fitted with bar/slat armor around its hull to further foil HE-type rounds (Including HEAT); this acts as spaced armor, and from some angles, gives a sort of “double spaced” effect (the 2D6 normally added to a hit are not added on, and then the hit is reduced by a further 2D6). The ramp is not covered by the bar/slat armor though the area immediately to the right and left of the ramp are – 25% of all rear-quarter hits will hit the bar/slat armor. The OPV employs thermal dampening technology which presents a -2 penalty to those trying to detect it by IR/thermal-based vision devices or when an IR-guided weapon tries to lock on.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
LAV III OPV	$316,719	D, A	500 kg	17.1 tons	5	10	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded
LAV III OPV (MEXAS)	$320,256	D, A	300 kg	17.6 tons	5	11	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded
LAV III OPV (Bar/Slat)	$320,168	D, A	400 kg	17.4 tons	5	11	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C)	Shielded
LAV III 6.0 OPV	$946,031	D, A	514 kg	19.15 tons	5	12	Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G,	Shielded

LAV III 6.0 OPV w/Trophy Light	$946,031	D, A	414 kg	19.55 tons	5	15	C), 8xDay/Night CCD Cameras Passive IR (D, G, C), Image Intensification (G, C), Thermal Imaging (G, C), 8xDay/Night CCD Cameras	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
LAV III OPV	143/82	33/19	400	148	Trtd	W(6)	TF7Sp TS6Sp TR4 HF9Sp HS6Sp HR5*
LAV III OPV (MEXAS)	139/79	32/18	400	152	Trtd	W(6)	TF10Cp TS8Sp TR4 HF12Cp HS9Sp HR5*
LAV III OPV (Bar/Slat)	143/82	33/19	400	148	Trtd	W(6)	TF7Sp TS8Sp TR11Sp HF11Sp HS11Sp HR7Sp**
LAV III 6.0 OPV	163/93	38/22	400	175	Trtd	W(8)	TF14Cp TS12Cp TR6 HF16Cp HS13Cp HR7***
LAV III 6.0 OPV w/Trophy Light	160/91	37/22	400	179	Trtd	W(8)	TF14Cp TS12Cp TR6 HF16Cp HS13Cp HR7***

Vehicle	Fire Control	Stabilization	Armament	Ammunition
LAV III OPV	+4	Good	25mm M-242 ChainGun, L-6, L-6 (C)	675x25mm, 1750x7.62mm
LAV III 6.0 OPV	+4	Good	25mm M-242 ChainGun, L-6, M-249 (C)	675x25mm, 1750x7.62mm, 2400x5.56mm
LAV III 6.0 OPV w/Trophy Light	+4	Good	25mm M-242 ChainGun, L-6, M-249 (C)	675x25mm, 1750x7.62mm, 2400x5.56mm, 10 Trophy Rounds

*Hull and Turret Roof AV is 3; Hull Floor AV is 5Sp.

**Hull and Turret Roof AV is 3; Hull Floor AV is 5Sp. See Glossary for Ground Vehicles for special effects of the bar/slat armor, and what is in effect double spaced armor.

***Hull and Turret Roof AV is 5; Hull Floor is 8Sp and has a V-type hull. (See Glossary for Ground Vehicles for the effects of a V-hull.)

Montreal Locomotive Works Sexton GPO

Notes: The Sexton GPO (General Purpose Observation) was designed as an FDC vehicle for Sexton batteries, and for use as what we would today call a FISTV, though in World War 2 it was simply called a mobile artillery observation post. The FDC version was generally deployed one per Sexton battery of eight; the FISTV was deployed at one per artillery battalion and was usually deployed forward with the troops, much like a modern FISTV. The FDCs stayed in the Canadian and British Armies as long as the Sexton artillery guns remained; the FISTVs were largely replaced by 1944 by crews mounted in jeeps, small trucks, or half-tracks, all of whom made a less-inviting target for the enemy.

The GPO FDC carried a crew of driver, FDC chief (who manned a Bren during movement or defense), and four “computers” – not computers in the modern sense, but troops specially trained to quickly crunch the numbers, use plotting gear and maps, and come up with firing solutions for the guns. For this role the FDC has two long-range, one medium-range, and one short-range radios, along with eight field telephones and external and internal hookups for commo wire for the phones. The FDC has a liberal collection of

maps for the combat area at various scales, four plotting boards, and two pairs of standard binoculars. A map table was provided at the center of the rear area. (The time of service of the GPO FDC was a time when most of the fire solution work was done manually, though the GPO FDC also had two slide rules to help out the math work.) The FDC has a pintle-mounted Bren at the front, firing over the driver, and one hand-held gun.

The GPO MAOP is likewise equipped with extra radios, two long-range, one medium range, and one short-range. It also has a field telephone mounted on the rear right side, allowing troops outside to communicate directly with the MAOP crew. The MAOP is equipped with an extra Bren machinegun on a pintle mount on the right side, as well as a pintle-mounted gun in front firing over the driver, and one hand-held Bren. Like the FDC, it has a good selection of maps of the battle area, usually at smaller scales to allow for more detailed coordinates to be transmitted to the FDC. It has one set of artillery plotting gear, including a slide rule; *in extremis*, it could transmit fire solutions directly to the FDC. The MAOP has several pairs of standard binoculars, two scissors types of high-powered binoculars, and an optico-mechanical rangefinder.

Like the Sexton artillery guns, the Sexton GPO is open-topped, though they came with tarps which could be mounted on small bows. The Sexton GPO was based on the Sexton I chassis, and is equipped with a British (later Canadian)-built engine, a Continental RG-75-C1 gasoline engine developing 400 horsepower, and with a manual transmission and with tillers for steering. The engine is at the rear on an extended chassis deck. The Sexton used the VVSS suspension pioneered on the M-3 Grant and Lee and made famous by the M-4 Sherman. There are no shock absorbers, as shock absorption is included in the VVSS suspension. Most of the 5-man crew is in the open back; however, the driver was in the front of the superstructure on the right side, and had an open window in front of him, with an armored shutter which had a vision slit in it.

The Australians did not make a Yeremba version of the GPO.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Sexton GPO FDC	$36,917	G, A	2.43 tons	23 tons	6	18	Headlights	Open
Sexton GPO MAOP	$138,975	G, A	2.24 tons	23.76 tons	5	19	Headlights	Open

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Sexton GPO FDC	140/98	39/27	682	210	Stnd	T5	HF8 HS3 HR3
Sexton GPO MAOP	137/96	38/27	682	217	Stnd	T5	HF8 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Sexton GPO FDC	Nil	None	2xBren	1500x.303 (in 50-Round Magazines)
Sexton GPO MAOP	Nil	None	3xBren	1500x.303 (in 50-Round Magazines)

PCZ-45 Ammunition Resupply Vehicle

Notes: The PLZ-05 is, as the name suggests, a vehicle designed for support of the PLZ-05 in long bombardments or when the howitzer is low on ammunition. It also carries special ammunition not normally carried by a PLZ-05, such as CLGP-type rounds. It is similar in concept to the American M-992 FAASV, being based on the PLZ-05, but having a large closed hull filled with racks for ammunition, fuzes, and charge bags. The front is the glacis from the PLZ-05 howitzer, but about one third of the way back, the hull is substantially raised, being a little over 3 meters high for the rear two-thirds of the vehicle. Armor for the Resupply Vehicle is about the same strength as for the SP Howitzer. The PCZ-45 is also one of the designs that the Chinese stole from the US, then reverse-engineered.

On the front center of the vehicle is the driver's position; the driver has limited vision even with his head outside his hatch. On the left side, the mechanism for the crane projects into the driver's view; on the right side, his vision is totally blocked by the exterior of an internal equipment box. When viewing through his vision blocks, the driver only has about half of the normal field of vision though the left block and no vision through the right block. The hatchway opens to the rear, and has the room to open enough for driver entry and exit. The driver can mount a night vision device in place of the center vision block.

The engine is on the right side of the driver. This is the same 520-horsepower turbocharged diesel engine as on the PLZ-05; the transmission is also the same. A crane is to the left and to the rear of the driver, it is a large crane used primarily for lifting pallets of ammunition into the large hatch on the roof of the right front of the vehicle. The roof also has several attachment points for radio antennas if needed, as well as three armored, short antennas of surprising power, able to service even a long-range data-capable vehicular radio. On the right center of the hull is a vaguely pulpit-like non-rotating cupola. This is the commander's station; he has all-around vision blocks and one night vision channel on the forward vision block. Though the cupola does not rotate, his weapon is on a ring-type mount and can be rotated as necessary, with the hatch opening to the left and almost flat to the hull. On the right side of the vehicle is a small armored window for use by the commander. Below that is a large hatchway for loading various items of for the crew to enter; on the left side in the same position is a hatch of the same dimensions.

In the rear are large hatches, and the PCZ-45 has a tent it can pitch between the PLZ-05 and itself, giving more covered room to work. A conveyor system can also be rigged between the PCZ-45 and PLZ-05. Standard load for the PCZ-45 includes 3 CLGP-type rounds, 80 of various 155mm rounds, 66 charge bags, 11 boxes of two dozen fuzes, and 1 box of 40 primers. This can vary or be modified by mission requirements or ammunition available. The PLC-45 comes with a conveyor belt and arm, which is to be put into the gun at the other end, which can pass projectiles at a rate of 6-8 projectiles per minute. The conveyor and crane may be used with the engine off, as the PCZ-45 has a 20kW APU on the roof. Also on the roof is a large hatchway to allow the crane to resupply the vehicle.

I have been unable to discover whether similar vehicles exist for other SP howitzers. If you know, let me know.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PCZ-45	$1,137,644	D, A	500 kg	23.9 tons	5	14	Passive IR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
PCZ-45	136/95	37/25	500	159	Trtd	T4	HF10Sp HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
PCZ-45	None	None	NSVT (C)	850x12.7mm

VOP-26 Sternberk BVP-1PPK Snezka

Also known as the PZpK, the Snezka artillery reconnaissance version is based on the BVP-1 chassis (the Czech license-produced version of the Russian BMP-1), but for the most part, that's where the similarity ends. It is specially outfitted for its role, and is greatly modified from their BVP-1 roots. The BVP-1PPK Snezka (sometimes referred to as the PzPK) was introduced just before the split-up of Czechoslovakia into the Czech Republic and Slovakia, and is currently used by the Czech Republic only, entering service with 1997.

Being a BVP-1 chassis, it has a number of components in common with that vehicle. The driver is located in the left front of the hull, with the engine to his right. He is seated behind a sharply-raked glacis plate which allows the Snezka to have much better frontal armor protection than the thin metal of the armor would otherwise provide. The driver has three vision blocks to his front; the center block can be removed and replaced by a night vision block. The first version used an active IR block; later improvements gave the driver a passive IR block to be used in conjunction with IR headlights or an IR searchlight. The driver's controls are remarkably simple for APCs and IFVs of the period: the driver has a steering yoke and a conventional gas and brake pedal. To the rear of the driver is the commander's position, which has a manually-rotating cupola with a machinegun. The commander has control of a conventional day vision periscope. The day periscope has a magnification of x5. The commander's vision blocks have heating devices to help remove fogging due to weather as well as wipers to remove moisture due to rain or mud.

The UTD-20 300-horsepower diesel engine is mounted in the front to the right of the driver, and is coupled to a manual transmission. The Snezka's engine has a limited multi-fuel capability – it can burn almost any grade of diesel fuel, and it can also burn kerosene. The Snezka may lay a thick, oily smoke screen by injecting diesel fuel into its exhaust. The ground pressure is relatively low, and the Snezka can cross fairly deep snow without getting bogged down; it can also traverse some swampy terrain with a reasonable chance of success. The Snezka is also amphibious with minimal preparation; a trim vane must be erected at the front and bilge pumps turned on. The hull is airtight once the rear doors are closed, and buoyancy is assisted by hollow roadwheels and roadwheel arms with air chambers in them. The amphibious capability is rather limited – a current as little as 1.2 meters per second (4.3 kilometers per hour) can swamp a Snezka. Cross-country travel has been smoothed out considerably from the standard BVP-1.

The modifications start with the stretching of the chassis from one with six roadwheels into one with seven roadwheels; however, the engine is not changed and the Snezka is much heavier than the BVP-1, so performance suffers. The Snezka is an advanced fire direction vehicle to spot and designate targets for artillery; it has a secondary role of more general reconnaissance. The Snezka features a sensor pack on a 14-meter folding lifting arm, containing a laser designator, a laser warning detector, counterbattery (mortar and artillery) radar with a range of 9 kilometers for personnel, 22 kilometers for a tank, and 15 kilometers for artillery or mortar fire, a thermal imager and a FLIR camera, an image intensifier, several TV cameras (Day/Night CCD, thermal imager, and image intensification), and a wind velocity indicator. A second laser rangefinder is on the front right side, and a second laser rangefinder on the front left side. The TV cameras include one slaved to the FLIR, another slaved to the image intensifier (which is an advanced model with a range of 5000 meters), and a day camera with a telescopic lens and a range of 2000 meters. The driver has a day/night backup camera. The laser rangefinder and laser designators are also advanced models, with the laser rangefinder having a range of 20 kilometers and the laser designator having a range of 5 kilometers. The counterbattery radar and the ground surveillance radar sets are standard, except that they have a greatly increased response time when tracking moving targets; the ground surveillance radar can almost track moving vehicles in real time, with just a slight delay. Inside the Snezka is a sophisticated computer setup able to collate all the data from the sensors and analyze it. The computer has a 50% chance of being able to identify vehicular and static military targets by type, based on sensor and computer data. The computer also computes fire solutions for up to five artillery, MRL, and/or mortar batteries working with it. All this data can be passed to higher/other friendly units by three data-capable radios, and the Snezka also has a medium-range and short-range radio and hookups for two field telephones (not included). The Snezka has a GPS navigation system with an inertial navigation backup, with navigation data being passed to the driver via a small LCD screen and to the commander by a larger LCD screen. The commander's station has two screens for displaying the navigation information and a distillation of the sensor data.

The Snezka has an NBC Overpressure with a Vehicular NBC backup. The Snezka has a 24kW APU on the roof to power the systems while the engine is off. The Snezka does not have an air conditioner, but does have an adequate crew compartment heater. Crew includes a driver, a vehicle commander, one radar operator, and one member who operates the other sensors and cameras (except the backup cameras). It does not have a full BMS, but can transmit digital information, photographs, and text to another similarly-equipped radio at a range of 14 kilometers. It has a GLONASS receiver, but with an inertial navigation backup.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$979,465	D, A	400 kg	17.4 tons	5	16	Passive IR (D), 2nd Generation Image Intensification (Mast, C), Thermal Imaging (Mast, C), FLIR (Mast), Counterbattery Radar, Ground Surveillance Radar, Vehicular /Radar	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
112/78	27/17/3	462	174	Trtd	T3	TF3 TS3 TR3 HF8 HS4 HR4*

Fire Control	Stabilization	Armament	Ammunition

None	None	NSVT (C)	1200x12.7mm

*The “Turret” of the Snezka actually refers to the sensor mast. This “Turret” has no crew inside and no crew casualties are possible from a “Turret” hit on the Snezka. All crew casualties for the “Turret” are converted to electronics/equipment damage. A damage point hit of 24 on the “turret” or higher has a 25% of severing the sensor arm, essentially crippling the Snezka as a artillery support or or observation vehicle.

VOP-26 Sternberk BVP-2 LOS

While the Snezka is a very capable FIST vehicle, it is considered to be a vehicle that is to be operated at a longer range from enemy positions, both because of its capabilities and because commanders want to risk as little as possible such a valuable vehicle as the Snezka. Therefore, the Czechs came up with another FIST vehicle based on the BMP-2 chassis, the BVP-2 LOS (Light Observation Vehicle; both the acronym and name here are the English equivalents, and I do not know the Czech versions). The LOS, like the Snezka uses the chassis and hull of the BMP-2, but the similarity ends there. Both the Snezka and the LOS are part of the Czech ASPRO artillery fire control system, along with other components. The LOS has been in service since about 2006. The LOS has been offered for export, without any sales, since mid-2007; Sternberk, the makers of the LOS, is willing to mount the FIST-specific equipment onto other tracked or wheeled vehicles of appropriate size, but there have been no requests for the LOS FIST system on any other chassis. Currently, the Czech Republic is the only nation to use the LOS.

Like the Snezka, the LOS uses an extended chassis, with seven roadwheels instead of six, and about a meter longer than the BMP-2. Externally, the LOS looks quite similar to the BMP-2, but has a number of externally-visible components that are specific to the LOS. The turret of the LOS is the same as used on the BMP-2, but the “autocannon” and “ATGM launcher” are dummies, non-functioning mockups of the actual weapons. This is done because a FIST vehicle is a much higher-priority target than a troop carrier; it is a form of camouflage. Inside the turret, there are no gun parts, and no ammunition feed or storage components, nor ATGM control components or missiles. The turret is instead packed with mission-specific equipment, as is the hull. The turret retains the PKT machinegun as well as the commander’s cupola. There are three smoke grenade launchers on each side of the turret. The turret retains the fire control laser rangefinder in the turret. The turret can take the same *kovriki* appliqué armor as the BMP-2.

The LOS’s sensors are largely contained in a mast-mounted sensor package behind the turret. The sensor package is raised when the LOS is fulfilling its FIST vehicle role; when the package is not needed or the vehicle is in more than slow movement, the sensor package is lowered completely into the vehicle and the package is protected by automatic armored doors which have the same AV as the rest of the hull roof. The mast raises to a height of 4.3 meters; it can be traversed 200 degrees right or left and elevate or depress up to 40 degrees. The sensor package includes a low-grade night vision channel, a FLIR, an image intensifier, a laser rangefinder, a laser designator, and a gyrocompass. (Sternberk has indicated that it is willing to change or add equipment and features in the sensor package.) The LOS has two TV cameras; one is slaved to the image intensifier and is primarily used for day observation, and one is slaved to the FLIR and used primarily for night observation. The image intensifier is an advanced model with a range of 5 kilometers, while the FLIR is also an advanced version with a range of 10 kilometers. The laser rangefinder is a high-powered version with a range of 20 kilometers, while the laser designator has a range of 15 kilometers. A second laser rangefinder and laser designator is mounted in the turret; these have normal ranges.

The hull houses two more FIST members, who are equipped with computers to collate the sensor information and keep track of up to five targets at once. The LOS is equipped with a computer which can help the FIST in their job, including keeping track of the sensor information, giving them a 50% chance if identifying the vehicle or building which is a potential target, and computing fire solutions. All crew members have access to LCD screens which give them relevant information (for the driver, this is only navigation and vehicle state information). The commander and “gunner” have two such screens, while the FIST members in the hull have two such screens as well as a BW monitor. They can also control the sensor package using a keyboard with a mouse and joystick. The LOS is equipped with GLONASS navigation with inertial navigation backup equipment; in extremis, the driver can also navigate using the gyrocompass in the sensor package. Part of the rear space is taken up by a 5kW generator. Part of the LOS’s equipment are two data-capable long-range radios, a medium-range radio, and a short-range radio. Some of these radios are mounted in the turret, which is actually quite cramped despite the deletion of the weapons and ammunition. The data-capable radios can communicate digitally with other friendly units so equipped, including providing a video feed. The LOS has an air conditioner installed.

Of course, being a BMP-2 variant, the BVP-2 LOS shares a number of features with the BMP-2. The driver of the BMP-2 is in the front left hull with the engine to his right. He has three vision blocks to his front, and the center block can be removed and replaced with a night vision block. The engine has the same power has the BMP-1 – 300 horsepower – but is an improved supercharged diesel engine called the UTD-20/3 that has greater reliability and acceleration than that of the BMP-1. The transmission is semiautomatic instead of manual and easier on the driver than that of the BMP-1. The driver (and commander) have access to a gyrocompass to help them navigate. The LOS is amphibious with a little preparation, requiring the extension of a trim vane at the front and the switching on of bilge pumps, and requiring 5 minutes. Some sources say the LOS is propelled in the water by its tracks, and others say that propulsion when swimming is switched to waterjets; I have not been able to determine which is correct. Amphibious operations can be dangerous in the LOS, particularly in a strong current; and the suspension’s bearings are not airtight, and freeboard is not great. Also in recognition of this possibility, the shallow side skirts are hollow and filled with foam to increase buoyancy. The suspension is improved over the BVP-2/BMP-2.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
	D, A	400 kg	16.2 tons	4	9	Passive IR (D, Mast, G), Image Intensification (Mast), FLIR (Mast)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
124/87	30/18/3	462	177	Trtd	T3	TF11 TS7 TR6 HF9 HS5 HR4*

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

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

GIAT AMX VCA

Notes: This version of the AMX VCI armored personnel carrier is a support vehicle for the Mk F3 self-propelled howitzer. As such, it carries ammunition, fuses, and gun crewmembers for the howitzer. The vehicle normally tows a trailer with further ammunition. The vehicle has racks for 25 155mm shells, plus 25 charges and 49 fuses, and the gun crewmembers. Additional crates of ammunition may be carried as cargo. The AMX VCA has an extra-wide rear door to facilitate off-loading as well as a roller-equipped conveyor strip (which is carried on the outside of the vehicle while moving). The roof hatches are likewise oversized. The AMX VCA retains the small turret of the AMX VCI. Firing ports are deleted and plated over. Many AMX VCAs are, in fact, converted AMX VCIs.

As a variant of the AMX VCI, the AMX VCA retains a number of commonalities with the AMX VCI. The commander is to the right and rear of the gunner and has his own hatch with vision blocks to the front and right, but no weapon mount. The AMX VCA has a separate gunner. The original engine of the AMX VCI was a SOFAM 8Gxb 250-horsepower gasoline engine, with a manual transmission. In the 1980s, this was replaced by 280-horsepower Baudouin 6F11SRY turbocharged engine and a semiautomatic transmission. Some export versions had their engine and transmission replaced with one based on the Detroit Diesel 6V-53T 280-horsepower turbocharged engine and an automatic transmission to form a unitary powerpack that is easier to maintain. (These diesel-powered versions are sometimes referred to as AMX VCI 1987s.) The suspension is unusual in that it the line of the tracks is not level; it is noticeably lower at the rear of the vehicle. It is based on conventional torsion bars with shock absorbers at the front and rear of the five roadwheels. Early examples have four return rollers, but later production reduced this to three return rollers. Most tracks for the AMX VCI are steel, but rubber track pads can be retrofitted. The AMX VCI is not amphibious, though fording of up to 1 meter is possible. Note that the collective NBC system of the AMX VCI was not fitted to the AMX VCA, unless the AMX VCA in question is a converted AMX VCI that already had a collective NBC system.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
(Gas)	$60,130	G, A	1.5 tons	15.2 tons	8	6	Passive IR	Enclosed
(Diesel)	$27,556	D, A	1.5 tons	15.3 tons	8	6	Passive IR	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
(Gas)	117/82	26/19	410	141	CiH	T3	TF2 TS2 TR2 HF8 HS4 HR4
(Diesel)	128/90	28/21	410	149	CiH	T3	TF2 TS2 TR2 HF8 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
(Both)	+1	Basic	AAT-F1 or M-2HB	2000x7.62mm or .50

GIAT AMX-10 VOA

Notes: This is a FISTV version of the AMX-10P armored personnel carrier. The turret is removed and replaced with one mounting enhanced observation equipment (including enhanced night vision and telescopic day vision), a laser designator, and a machinegun. The vehicle also features a defense system similar to that mounted on the US M-1A2P31 tank, with a laser jamming system (laser-guided weapons are one level harder to hit the vehicle with) and an IR system jammer (fire-and forget missiles are one level harder to hit with, and the vehicle is one level harder to see with IR vision devices). The turret is also equipped with a laser rangefinder that can be slaved to the machinegun if necessary, but is primarily used to find ranges to targets. The AMX-10 VOA is normally equipped with no less than 4 radios: two long-range data-capable radios and two short-range radios. The AMX VOA's rear is taken up with the radios and a computerized fire solution and targeting system, which takes information from the vision devices and laser rangefinder and computes fire solutions, then passes it on to artillery or mortar batteries in digital form to their fire control computers (if they are so equipped), or shows the fire solution to allow the operator to transmit the fire coordinates via radio. The AMX-10 VOA initially used an inertial navigation system; later upgrades gave it a GPS system. The crew has a collective NBC system, but the AMX-10 VOA does not have radiation shielding.

Being a variant of the AMX-10P, it has a number of features in common with that vehicle. Layout is basically conventional, with a driver's hatch on the front right that has three vision blocks to the front, the center of which can be replaced by a night vision block. The engine is to the left of the driver, and the engine and transmission form a complete power pack. Main entrance to the rear compartment is by a power-operated ramp, which also has a pair of doors in it. Firing ports are deleted and plated over. The side vision blocks and periscopes are likewise deleted. The locking points on the deck for a Milan ATGM launcher are also deleted, though the overhead hatches remain. Power is provided by a Hispano-Suiza HS-115 supercharged diesel engine providing 280 horsepower, coupled to a semiautomatic transmission. The suspension is of the torsion-bar type, with three track return rollers and five roadwheels. The first and last roadwheel on each side have shock absorbers. The steel tracks have replaceable rubber tracks. The AMX-10 VOA is amphibious with little preparation; a trim vane must be erected at the front, a bilge pump switched on, and waterjets for propulsion turned on. The AMX-10 VOA can take the appliqué armor of the upgraded AMX-10P.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
AMX-10 VOA	$229,046	D, A	700 kg	13 tons	4	9	Passive IR (D), Image Intensification (C), Thermal	Enclosed

AMX-10 VOA w/GPS	$239,046	D, A	700 kg	13 tons	4	9	Imaging (C) Passive IR (D), Image Intensification (C), Thermal Imaging (C)	Enclosed
AMX-10 VOA w/Appliqué	$231,413	D, A	600 kg	13.7 tons	4	11	Passive IR (D), Image Intensification (C), Thermal Imaging (C)	Enclosed
AMX-10 VOA w/GPS w/Appliqué	$241,413	D, A	600 kg	13.7 tons	4	11	Passive IR (D), Image Intensification (C), Thermal Imaging (C)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
AMX-10 VOA	139/97	30/22/3	528	122	Trtd	T2	TF3 TS3 TR2 HF8 HS3 HR3
AMX-10 VOA w/Appliqué	131/92	29/21/3	528	127	Trtd	T2	TF4 TS4 TR3 HF14 HS5 HS4*

Vehicle	Fire Control**	Stabilization	Armament	Ammunition
AMX-10 VOA	+2	Fair	AAT-F1	800x7.62mm

*Belly armor is 3.

**The laser rangefinder and laser designator share duties – one cannot range-find for the gun, range-find for targets, and/or designate targets at the same time. Backup fire control for the machinegun is at +1.

FMC/Rheinmetall M-113G1 BeobPzArt

Notes: The M-113G1 AOPV (in German, the M-113G1 Beobachtungspanzer) sort of takes a middle road between a bunch of artillery spotters with hand-held equipment and a fully specialized M-113-based FISTV such as the American M-971. The M-113G1 AOPV has a mission equipment set on an extendible mast that projects the sights and equipment above the vehicle, but only just enough to give the equipment and sights free play. The mast and the equipment set is raised through the standard M-113-type rear hatch. The equipment pod has a thermal imager, image intensifier, a laser rangefinder, and a laser designator. The standard commander's cupola is retained and has a pintle mount, though normally for a smaller machinegun than is normally fitted to an M-113. The fourth crewmember has a small computer that is good for producing fire solutions, but only one at a time; it is not a particularly high-powered computer. The M-113G1 AOPV has one long-range data-capable radio, one other long-range radio, and one short-range radio. Much of the internal and external upgrades are similar to the US M-577A1.

As an M-113 variant (specifically, an M-113A1 variant), the M-113G1 AOPV has many things in common with an M-113A1. The driver is on the front left, and steers and brakes using tillers. He has three vision blocks to his front; the center one can be replaced with a night vision block. The M-113G1 has a hydraulic ramp at the rear with another hatch set into it on the left side. The ramp can be quickly opened by simply dropping it, or lowered more slowly by using engine power to help control the speed at which the ramp lowers. There is a large, rear-opening hatch on the rear deck; the equipment mast and pod is raised through this. On the left front; somewhat to the rear of the driver's position, is the commander's cupola; he has no night vision gear, but has all-around vision blocks and the cupola manually turns. The handle to operate the ramp it to the rear of the driver, and it is the driver that is responsible for opening and closing the ramp under most circumstances. The M-113G1 uses the engine of the M-113A2, which is a General Motors 6V53T turbocharged diesel developing 212 horsepower and has an improved cooling system. The M-113G1 also has smoke grenade launchers – a cluster of four on each fender, like that of the M-113A2, but of German make.

The M-113G1 AOPV is later upgraded to the M-113G3 AOPV, which had the same mechanical, automotive, and fuel tank upgrades of the M-113G3G. This includes uses the Mercedes-Benz MTU 6V183 TC 22 turbocharged diesel engine with a fully-automatic ZF LSG 1000 transmission. The engine develops 335 horsepower, and the driver has standard controls and can use alternate controls to make a pivot steer. The M-113G3 AOPV has vastly-upgraded fire control and calculation computers, able to control up to two batteries, survey sites (and give an emergency, lower-accuracy survey by use of a hand-held laser rangefinder), and feed through radio precise coordinates to the guns, even if he cannot see them; he can also relay commands like traversing fire, elevating or depressing fire, or bracketing. The elevating pod has FLIR instead of thermal imaging, independently-moving double-range image intensification, and a longer-range laser rangefinder and laser designator (6000 meters). The M-113G3 is equipped with a mapping computer. The fuel tanks are moved to the rear, on either side of the ramp on the upper hull (like the M-113A3 in use by the US).

Twilight 2000 Notes: About 10% of M-113 AOPVs are M-113G3 AOPVs. However, half of the M-113G1s are equipped with the computers, radios, and elevating pod of the M-113G3 AOPV instead of their standard equipment, and have had their fuel tanks moved to the rear. They do not, however, have the GPS and mapping computer; they do retain their inertial navigation hardware. About 25% of these partially-upgraded are armed with M-2HBs instead of MG-3s at the commander's positions. (One picture featured in *Der Spiegel* in January of 1997 showed an upgraded M-113G1 AOPV armed with an MG-3/HK GMG in a double mount at the commander's position, and cases of machinegun and 40mm ammunition hung outside of the vehicle.)

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-113G1 AOPV	$445,359	D, A	930 kg	11.14 tons	4	9	Passive IR (D), Image Intensifier (Pod), Thermal Imaging (Pod)	Shielded
M-113G3 AOPV	$428,441	D, A	835 kg	11.33 tons	4	10	Passive IR (D), Advanced Image Intensifier (Pod), FLIR (Pod)	Shielded
M-113G1 AOPV (T2K Type 1)	$419,264	D, A	820 kg	11.36 tons	4	10	Passive IR (D), Advanced Image Intensifier (Pod), FLIR (Pod)	Shielded
M113G1 AOPV (T2K Type 2)	$324,938	D, A	750 kg	11.5 tons	4	10	Passive IR (D), Advanced Image Intensifier (Pod), FLIR (Pod)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor*
M-113G1 AOPV	150/105	38/26/3	360	62	CiH	T2	TF3 TS3 TR3 HF6 HS4 HR4
M-113G3 AOPV	175/122	44/31/3	360	78	CiH	T2	TF3 TS3 TR3 HF6 HS4 HR4
M-113G1	147/103	37/26/3	360	63	CiH	T2	TF3 TS3 TR3 HF6

AOPV (T2K Type 1)							HS4 HR4
M-113G1 AOPV (T2K Type 2)	145/102	36/26/3	360	64	CiH	T2	TF3 TS3 TR3 HF6 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-113G1/M-113G3 AOPV	None	None	MG-3 (C)	2000x7.62mm
M-113G1 AOPV (T2K Type 1)	None	None	MG-3 (C)	4000x7.62mm
M-113G1 AOPV (T2K Type 1)	None	None	M-2HB (C)	3000x.50 BMG

*The mast's armor is an abstraction based on it's true mass and the difficulty for an enemy to hit such a small target. In addition, hits on the mast which result in a crewmember being hit are instead treated as misses.

Rheinmetall Leopard AOPV

Notes: This is a vehicle where I have not been able to determine whether or not it ever entered service; I have given stats here on this page as if it did enter service. Some 333 conversions were scheduled to take place by 1995, but they may have fallen victim to the budget axe. The Leopard AOPV, last I heard, was to replace Jagdpanzer AOPV and most M-113G AOPV vehicles.

The Leopard AOPV (in German, the Leopard Beobachtungspanzer) is a FIST version based on the Leopard 1A5 tank. The result is a highly-survivable FIST platform. Broadly, the Leopard AOPV is similar to the Leopard 1A5, to the inclusion of a dummy cannon on the turret to hide the fact that it is a higher-priority-target FIST vehicle rather than an average tank. The turret is heavily modified; the internal main gun components are not installed, and the turret carries part of the extra radio gear, part of the mission-specific computers, and enhanced day and night vision gear. The turret also has an advanced laser rangefinder with a range of 15 kilometers, and a laser designator with a range of 10 kilometers. The turret also has an advanced image intensifier for day and night use with a range of 15 kilometers during the day and 8 kilometers during the night, and an advanced FLIR. The commander also has a second laser rangefinder and image intensifier (of normal capability) at his position, and he can access all vision devices on his vehicle. The Leopard AOPV has two data-capable long-range radios, a medium-range radio, and a short-range radio. A 5kW APU is also carried. The Leopard AOPV has the maps and equipment to do manual fire solutions if necessary, but the Leopard AOPV is designed to primarily do its calculations on a special computer built and programmed for that purpose, and similar to that on the later versions of Jagdpanzer AOPV. The Leopard AOPV was at last check equipped with in inertial navigation; I would imagine that GPS would equip them now; with GPS, add $10000. The crew is protected by an NBC Overpressure system and an automatic fire detection and suppression system for the turret, driver's compartment, engine, and fuel tanks.

Like the Leopard 1, the Leopard AOPV has a conventional crew layout, with the driver to the front left side, the commander on the right of the turret below and to the right of him, and the loader's hatch on the left side of the turret. The loader and gunner actually are part of the FIST, and help find targets, designate targets, and computer fire solutions. The only weapon remaining in the turret is the former coaxial machinegun, which does not have any ballistic computer, laser rangefinder, or stabilization. The ammunition ready bin to the right of the driver houses equipment on the Leopard AOPV. The driver has three vision blocks allowing vision to the front and partially to each side. The Leopard AOPV has a rare feature among military vehicles – the commander has auxiliary driving controls, and can drive the Leopard 1 from his cupola, if in a somewhat awkward fashion. He also has auxiliary controls for the main gun. The commander's cupola has seven vision blocks giving him a 360-degree view, and he has a 1x/6x/20x periscope on the turret roof itself that can be rotated independently of the cupola and allows day/night vision. The commander's hatch can be fully open, fully closed, or locked into a position that allows the commander to peek out at his surroundings, but is only open a little. The periscope has an aiming reticule for use when firing his machinegun from under armor. (In the latter case, an image of the gunner's aiming reticule is projected onto the periscope.)

The turret of the Leopard 1 is all-welded. The Leopard 1 has a fully automatic transmission. The engine is a Daimler-Benz DB-838 830-horsepower supercharged diesel which can also run on JP8 jet fuel. The engine and transmission is combined into one powerpack that can be removed as a unit. The suspension is optimized for some of the roughest terrain around. The tracks are US-designed, but can be replaced with German-designed anti-skid tracks. In either case, the tracks have rubber track pads.

Twilight 2000 Notes: 33 of these conversions had been accomplished before the start of the war, to replace M-113 based observation vehicles.

Merc 2000 Notes: These conversions were never done.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$406,618	D, G, A	700 kg	38.9 tons	4	21	Passive IR (D, C), Image Intensification (C), Advanced Image Intensification (Turret), 2nd Generation FLIR (Turret)	Shielded

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
145/102	37/29	985	413	Trtd	T6	TF44Sp TS19Sp TR13 HF49Sp HS13Sp HR8

Fire Control	Stabilization	Armament	Ammunition
None	None	MG-3, MG-3 (C)	5500x7.62mm

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Rheinmetall Wiesel 2 FDC

Notes: Wiesel 2 FDC is similar to the Wiesel Battalion Command Post Vehicle, but internally it is modified specifically to serve its role within units made up of Wiesel 2 120mm mortar units. These modifications include a GPS set with an attached mapping computer, a surveying set to set positions for the guns of the unit, a small laser rangefinder on a small pod atop the vehicle, used primarily if the FDC is unable to survey firing positions first. The FDC has a small but powerful computer which ties together all functions, as well as being able to generate firing solutions for eight guns and transmit them wirelessly to the gun vehicles. (The Wiesel 2 FDC can also be used with other types of guns, but has problems with generating fire coordinates outside the maximum range of the Wiesel 2 120mm's mortar.) The vehicle also has a secondary computer can generate fire solutions for four additional guns or take over the GPS/mapping functions, surveying features, and laser rangefinder functions so that the main computer can generate the four extra solutions. The FDC can also communicate with and coordinate with up to four other FDC vehicles, and these do not need to be of the Wiesel 2 type; this allows coordination between a wide variety of indirect fire vehicles, howitzers, and mortar units. To communicate fire solutions and other data and communicate them to other FDCs, as well as to transmit this information to other units (including mapping coordinates), the Wiesel 2 FDC has a pair of long-range radios which are data-capable, plus a pair of short-range radios for more mundane communications between units. The Wiesel 2 FDC can likewise receive fire solutions from other FDCs or mortar ballistic computers; 20 fire solutions from FDCs/mortar units can be received and stored, as well as 10 fire solutions or requests from other units, including FIST units. (Old-style maps, protractors, pens, and fire solution tables and circles are carried just in case.)

Note that the Wiesel 2 FDC is not a FIST or reconnaissance vehicle and does not have the equipment to be one.

The Wiesel 2 FDC is essentially a standard Wiesel 2 with only slightly raised sides (about 100mm); these raised sides allow for the housing of equipment and to allow the crew to move about easier. Automotively, the Wiesel 2 FDC is the same as other Wiesel 2s, having a 1.9-liter Volkswagen 109-horsepower turbocharged diesel engine and a ZF fully automatic transmission. Despite what seems to be inadequate power for an armored tracked vehicle, the low weight makes the Wiesel 2 FDC, like other Wiesel 2s, fast and nimble. The driver's controls are standard, with a steering wheel, and a pedal for the gas and brake. The driver can also use auxiliary controls to perform pivot steering. The driver is in the front left, just behind the glacis plate; the commander has a ring mount on the right. The engine and transmission are to the right of the driver and in front of the commander; on the glacis is a hatch which gives access to oil, transmission fluid, and radiator fill points, as well as the engine air filter. Since the crew may have to operate in a chemical environment, and the crew also needs freedom of movement, the Wiesel 2 FDC is equipped with an NBC overpressure system. (The Wiesel 2 does not have a backup NBC scrubber system for the crew's protective masks, as the hoses would actually get in the way of the small confines of the vehicle.) In addition, the MG-3 of the Wiesel 2 FDC can be aimed and fired (though not reloaded) from inside the vehicle. The commander also has a small degree of night vision capability through his front vision block.

Twilight 2000 Notes: Like the Wiesel 2 Mortar Carrier, the Wiesel 2 FDC was also a rare vehicle in the Twilight 2000 timeline; perhaps slightly more than one Wiesel 2 FDC present for every Wiesel 2 Mortar Carrier. However, a Twilight 2000 FDC vehicle uses primarily inertial navigation integrated with its mapping computer. The computer are also take up more space, and interior space for the crew is more cramped.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Wiesel 2 FDC (Current)	$169,947	D, A	200 kg	4.67 tons	4	7	Passive IR (D), Passive IR (C)	Shielded
Wiesel 2 FDC (T2K)	$132,697	D, A	180 kg	4.69 tons	4	7	Passive IR (D), Passive IR (C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Wiesel 2 FDC (Current)	160/112	40/28/3	80	17	Stnd	T2	HF4 HS2 HR2
Wiesel 2 FDC (T2K)	159/111	40/28/3	80	17	Stnd	T2	HF4 HS2 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Wiesel 2 FDC	None	None	MG-3 (C)	2000x7.62mm

Thyssen Henchel Jagdpanzer AOPV

Notes: The Jagdpanzer Rakete was an early Cold War tank destroyer that persisted into service into the mid-1980s. (It is covered in German Self-Propelled Guns.) Though 333 Jagdpanzer Raketes were later converted into Jaguar 2 ATGM carriers, 165 were converted into FISTVs called Jagdpanzer AOPV (Artillery Observation Post Vehicle) or Jagdpanzer Beobachtungspazer. I have not been able to discover whether these vehicles are still in service, or when they served if they are no longer in service. Germany appears to be the only country that used them.

The hull of the Jagdpanzer AOPV (called in German the Jagdpanzer Beobachtungspanzer) is broadly similar to the Jagdpanzer Kanone (minus the gun, of course). The driver is on the front left side, with an overhead hatch that opens to the right and three forward vision blocks. One of these blocks can be removed and replaced with a night vision block. The commander has a cupola near the center right of the vehicle, with all-around vision blocks; a pintle mount for a weapon is mounted. The commander also has a periscope which can be rotated through 270 degrees, and has magnifications of 1x, 6x, and 20x; this is mounted in front of the cupola. The hatch for the loader remains (including its all-around vision blocks), but the gunner's and loader's positions themselves have been deleted and replaced with mission-specific equipment. The Jagdpanzer Kanone's coaxial machinegun has also been deleted. The main gun and all its associated equipment is removed, and the opening for the gun and mantlet plated over. The crew is protected with an NBC overpressure system. On each front corner of the roof is a quadruple cluster of smoke grenade launchers.

The Jagdpanzer AOPV is powered by the original Daimler Benz MB-837 diesel developing 500 horsepower, coupled to a manual transmission. The driver has a steering yoke and appropriate foot pedals. Behind the driver is the mission compartment, which houses two crewmembers. The crewmembers man radios, including two data-capable long-range radios, a medium-range radio, and a short-range radio. The Jagdpanzer AOPV has a ruggedized computer appropriate to its tasks of assisting the crew in producing fire solutions, navigating, and coordinating supporting fires. The radios and computer can interface with artillery/mortar/MRL fire control computers with ground-mounted units as well as transmit coordinates to higher headquarters. On the deck next to the commander's cupola is an armored hatch which automatically opens upon command; this hatch protects an elevating pod containing sensors, including telescopic sights, an image intensifier, a thermal imager, a laser rangefinder, and a laser designator. The sensors in the pod are accessible by the crew (except for the driver) and can be interfaced with the computer. Storage is provided for maps, especially in early models, as well as codebooks. The crew uses and maps and manual equipment to plot supporting fire *in extremis.*

Originally, the Jagdpanzer AOPV was equipped with a gyrocompass for navigation, which was later upgraded to inertial navigation. Rumors state that the inertial navigation was to be supplemented with GPS, but I have not been able to discover whether or not this upgrade was ever made. (I have included stats for all three versions below.) Computers were also supposed to be upgraded at the same time as the installation of GPS, and sensors were supposed to be upgraded, but I have not been able to confirm this either, though I included it in the stats below.

Twilight 2000 Notes: About 80 of these conversions had been completed before the Twilight War.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Jagdpanzer AOPV (w/Gyrocompass)	$419,441	D, G, AvG, A	500 kg	27.5 tons	4	11	Passive IR (D), Image Intensifier (Pod), Thermal Imaging (Pod)	Shielded
Jagdpanzer AOPV (w/Inertial Navigation)	$428,441	D, G, AvG, A	500 kg	27.5 tons	4	11	Passive IR (D), Image Intensifier (Pod), Thermal Imaging (Pod)	Shielded
Jadgpanzer AOPV (w/GPS & Upgrades)	$446,133	D, G, AvG, A	500 kg	27.5 tons	4	11	Passive IR (D), Image Intensifier (Pod), FLIR (Pod)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Jagdpanzer AOPV	129/91	30/21	470	270	Stnd	T6	HF14 HS7 HR5

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Jagdpanzer AOPV	None	None	MG-3 (C)	4000x7.62mm

MOWAG Eagle AOPV

Notes: The Eagle AOPV is used by the Swiss Army (and designated by them the *Artillerie Schiesskommdant Fahrzeug* 2000, or ASF-2000). Switzerland uses versions based on the Eagle I and Eagle III versions, with the later version having slightly heavier armor and carrying improved equipment.

For the Eagle AOPV, the rear area has a raised superstructure, underneath which is a sensor pod on a two-meter extendible mast. When retracted, armored panels close over the pod. The driver and commander are in the front of the vehicle in a cab, behind a large, bullet-resistant windshield. On the ASF-2000 I, this is a double windshield; on the ASF-2000 III, it is a single-piece windshield. There are bullet-resistant windows on either side of them, in their doors; behind those doors, there is another door on each side with a bullet-resistant window in it. In the rear of the vehicle is a reduced-size (from the normal Eagle) door with a bullet-resistant window in it. Above the commander is a hatch with a pintle mount for a weapon.

The sensor pod of the ASF-2000 I has a thermal imager, image intensifier, and laser rangefinder, as well as a telescopic day optic. The optics are downlinked to the crewmember inside the vehicle. In the rear is a simple artillery computer, but this is used more for generating coordinates and has limited mapping software for that purpose; supplying fire solutions is not normally its job and its computer has limited capability in that department. The ASF-2000 I has a long-range data-capable radio and a short-range radio.

The ASF-2000 III came into service in 2003 and has enhanced capability in its sensors, including the replacement of the image intensifier with an enhanced model with a range of 8 kilometers and replacement of the thermal imager with a FLIR with a range of 6 kilometers. The computer of the ASF-2000 III is fully capable of generating fire solutions as well as coordinates and can communicate directly with the fire solution computers of artillery, MRL, and mortar units. The ASF-2000 III carries an additional data-capable long-range radio. The sensor pod carries a laser designator as well as a laser rangefinder. The ASF-2000 III has a GPS receiver.

The ASF-2000 has a 4x4 off-road suspension and is powered by a 250-horsepower Cummins ISBe 5.9L turbocharged horsepower engine, coupled to an automatic transmission. The relatively high power output of the engine leads to a large fuel consumption, unfortunately. The ASF-2000 III uses the same engine as the ASF-2000 I, but the performance does suffer considerably due to the higher weight of the ASF-2000 III. Armor is decent for such a vehicle, but primarily effective against small arms and shell fragments. The tires of the ASF-2000 I are run-flat tires; the tires of the ASF-2000 III are puncture-resistant as well.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ASF-2000 I	$115,116	D, A	800 kg	5.3 tons	3	4	Image Intensification (Pod), Thermal Imaging (Pod)	Enclosed
ASF-2000 III	$291,531	D, A	700 kg	8.7 tons	3	7	Advanced Image Intensification (Pod), FLIR (Pod)	Enclosed

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
ASF-2000 I	323/163	75/38	95	131	Stnd	W(2)	HF4 HS3 HR3
ASF-2000 III	225/114	52/26	95	215	Stnd	W(3)	HF5 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
ASF-2000	None	None	MG-51/71 (C)	400x7.62mm

ROMARM TAB-77 PCOMA

Notes: This is both a FISTV designed for use in motorized infantry and scout units and reflects an earlier design than the TABC-79A, though it too has been updated over the years. So far, only the Romanians use the TAB-77 PCMOA. The TAB-77 PCMOA first appeared in the late 1970s, soon after the TAB-77 APC, and is still in use in its updated form.

For the most part, the TAB-77 PCMOA appears externally similar to the TAB-77 APC. However, the turret has been replaced with a different small turret; this is larger and rounder, and mounts primarily an enhanced vision suite including day and night vision gear, and a laser rangefinder. The turret itself is unarmed; above the turret, in front of the "gunner's" hatch, is a pintle-mounted machinegun. At the center of the vehicle is a large hatch, which opens to the rear. This allows the PCOMA's crew to utilize hand-held instruments. Internally, the TAB-77 PCMOA has two data-capable radios, a medium-range radio, a radio teletype, a short-range radio, a gyrocompass-based land-navigation system with a small amount of inertial navigation capability, and a large but relatively weak computer which can generate fire coordinates, but not solutions, and transmit them to two batteries at once.

The mid-1980s brought improvements to the computers, radios, and night vision gear, as well as a more powerful day telescope. The computers were also improved, primarily in the area of miniaturization, but also in power; the computer could now generate fire solutions for up to two batteries at once. This update also brought true inertial navigation to the TAB-77 PCMOA. Crew was also reduced. The radio teletype was retained, though by then it had become for the most part obsolete. A laser designator was added to the turret.

The late 1990s brought more improvements. Crew was further reduced. The radio teletype was removed, replaced by improvements in computer technology that allowed the operator of the TAB-77 PCMOA's fire control suite to directly feed target information to battery computers (if so equipped). The day and night vision are fully integrated with the computer. The TAB-77 PCMOA retained the inertial navigation capability, but only as a backup; the primary navigation method is by GLONASS and later, GPS.

As a variant of the TAB-77, the TAB-77 PCMOA as some features in common with the TAB-77. The TAB-77 PCMOA is powered by a pair of 132-horsepower Savia 797-05M1 diesel engines. The manual rotation of the TAB-77's turret is replaced by electric rotation. The TAB-77 PCMOA retains the "suicide hatches" of the TAB-71M; not being an infantry carrier, these are not used in combat except in emergencies. The crew in the rear still use the pair of roof hatches, and the "suicide hatches" are used for equipment loading more than anything else. The driver and commander are in the front of the vehicle, with the driver on the right and commander on the left; they have bullet-resistant windshields to the front with armored shutters which may be lowered and have vision slits in them. To their sides are small windows over which armor plates may be slid. The commander has a hatch over his position; the driver does not have a hatch, but the roof does have an opening for a night vision block. The gunner's position is more a FIST member and not really a gunner. Suspension is 8x8 off-road-type; the front four wheels are the steerable wheels. The TAB-77 is still difficult to drive due to the manual transmission and twin engines. The driver has a central tire pressure regulation system. The crew has a collective NBC system. Armor is all-welded steel, but is relatively light. The vehicle is amphibious, with a trim vane requiring erection from inside the driver's compartment and bilge pumps turned on, as well as a waterjet once the vehicle is floating. The crew is protected by an automatic fire detection and suppression system. The same front-mounted winch as on the TAB-71 is on the TAB-77 PCMOA, with a capacity of 5.5 tons and 60 meters of cable.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
TAB-77 PCMOA	$168,856	D, A	800 kg	13.5 tons	6	9	Passive IR (D, G), Image Intensifier (G)	Shielded
TAB-77 PCMOA 1st Upgrade	$335,061	D, A	800 kg	13.5 tons	5	9	Passive IR (D, G), Image Intensifier (G), Thermal Imaging (G)	Shielded
TAB-77 PCMOA 2nd Upgrade	$405,061	D, A	800 kg	13.5 tons	4	10	Passive IR (D, G), Image Intensifier (G), Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
TAB-77 PCMOA	147/74	33/17/4	290	141	CiH	W(4)	TF4 TS4 TR3 HF4 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
TAB-77	None	None	PK (C)	2500x7.62mm

ROMARM TABC-79A PCMOA

Notes: Based on the TABC-79 light APC, the TABC-79A PCMOA is a FIST vehicle with enhanced observation and rangefinding equipment in its turret, and an extra laser rangefinder as well as a laser designator. Its turret is wider but lower in profile, and is armed only with a PKT machinegun. The commander's cupola has an artillery plotting circle inscribed on it. Inside, the rear area is largely taken up by extra communications gear and fire solution computers, as well as the equipment necessary to directly transmit their

findings to artillery, MRL, or mortar batteries. The computer is limited in scope, designed only to perform its duties in fire control. The PCMOA has a long-range data-capable radio, an extra-long-range data-capable radio, one medium-range radio, and one short-range radio. The enhanced observation gear includes day telescopic sights as well as an image intensifier and a thermal imager; these are mounted in the turret, but accessible by the commander. The PCMOA originally had a radio teletype, but this was replaced in the mid-1990s by a ruggedized laptop computer. The PCMOA originally had inertial navigation, but this was supplemented in the 1990s by GLONASS and later GPS.

Being a variant of the TABC-79, the basic facts about the TABC-79 also apply to the PCMOA. The driver is at the front left of the vehicle with a windshield to the front and supplemental vision blocks for when the tactical situation dictates that the windshield be covered by its armored shutter. The commander's position is still there, though it is normally unoccupied or used to store equipment; both positions have a hatch above them; the commander's position has been shifted to the turret. The side hatches are retained, as is the rear door and the roof hatch. The firing ports are plated over. The PCMOA has a collective NBC system for the crew and troops. Protection also includes an automatic fire detection and suppression system. The passengers have firing ports, two to a side and two in the rear. The PCMOA has a 5.5-ton winch on the front with 50 meters of cable. The PCMOA is powered by a single Savia 798.05N2 turbocharged diesel engine, with an automatic transmission. The driver has conventional controls. The engine is relatively compact, allowing for that small hatch in the rear, though it is mounted at the rear of the vehicle. The PCMOA is amphibious without preparation, requiring only that a waterjet be switched on when the vehicle begins floating. Suspension is 4x4 and of the off-road-type.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
TABC-79A PCMOA	$165,822	D, A	350 kg	9.5 tons	4	8	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded
TABC-79A PCMOA (Upgraded)	$295,822	D, A	350 kg	9.5 tons	4	9	Passive IR (D, G), Image Intensification (G), Thermal Imaging (G)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
TABC-79A PCMOA	124/62	28/15/3	200	82	CiH	W(4)	TF4 TS4 TR3 HF5 HS3 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
TABC-79A PCMOA	+2	Fair	PKT	2500x7.62mm

Arzamas 1V18/1V19

Notes: The BTR-60 1V18 Klyon-1 is a standard BTR-60PB that has been converted into a FIST vehicle. Its turret has been replaced with one of a different shape and unarmed, often called a "Darth Vader" turret due to its superficial resemblance to his helmet. The turret houses extra day and night observation gear as well as a laser rangefinder and laser designator. The turret has a hatch. The vehicle also has a 4kW internal generator, a fire direction computer, three long-range radios and one medium-range radio, and an aiming circle inside the turret. Later versions replace the radio teletype with a ruggedized laptop computer and one of the long-range radios with a data-capable version, and add more vision equipment and GLONASS. The BTR-60R-975 is similar, but for use by Tactical Air Control Parties (TACPs); the difference is primarily in the radios carried. The top of the vehicle has a collapsible AZI frame antenna and an extendible 10-meter radio mast. The 1V19 carries manual plotting equipment and hand-held calculators in its early version, and still carries them as a backup in its later version. The rear of the vehicle is suitably modified for the role.

The 1V19 is a fire direction center variant of the BTR-60PB. It is equipped with two long-range radios, one medium-range radio, a radio teletype, and one short-range radio and the APPK computer system to compute and calculate artillery and mortar firing solutions. It turret is of the same shape as the 1V18 and it has a hatch atop it, but it does not have the enhanced observation year or the laser rangefinder or designator. The original 1V19 had two long-range radios, one medium-range radio, a short-range radio, and a radio teletype, along with an extendible 10-meter antenna and a collapsible AZI frame antenna; later versions replace the radio teletype and the APPK with a more-capable computer and both of the long-range radios with data-capable versions, and add a GLONASS system and a hand-held laser rangefinder (to help place guns). The 1V19 has a 4kW generator on its roof. The later versions also delete the AZI antenna in favor of a more capable 10-meter antenna and whip antenna/radio combinations.

As with other such vehicles, the 1V18 and 1V19 have many features in common with their parent vehicle. The 1V18 and 1V19 are powered by a pair of GAZ-49B 90-horsepower gasoline engines, each developing 90 horsepower. One engine propels the second and fourth axles, and the second engine propels the first and third axles. Each engine has its own gear box and clutch, and the driver has a dual manual transmission to contend with, making driving challenging to say the least. The dual engine format means that if one engine goes out, the vehicle can still drive at half speed, but causes the driving difficulties as stated. The transmission layout is also quite complicated and prone to breakdown. The suspension, as stated, is 8x8 and of the off-road-type, and shock absorption is surprisingly effective. The BTR-60 is fully amphibious with preparation (a trim vane must be erected in front from the driver's compartment, bilge pumps turned on, and a waterjet turned on when the vehicle is floating; this takes four minutes). The turret's traverse and elevation are manual, and thus are slower than on newer vehicles. The rear deck hatch is smaller than on the BTR-60PB, and the firing ports are deleted. There is a small hatch on the right side the hull for the gunner, and a full-sized hatch on the left side of the hull. In the front of the vehicle is a winch with a capacity of 4.5 tons. The 1V18 and 1V19 have a collective NBC system. The driver and commander of the BTR-60 are in the front of the vehicle, behind bullet-resistant windshields. The positions have vision blocks to their fronts and on their outer sides. The driver and commander also have small bullet-resistant windows to their right and left. They have hatches over their positions which open to the front, with a space for a night vision block.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
1V18 (Early)	$211,621	G, A	550 kg	10.6 tons	5	7	Passive IR (D, C, Turret), Image Intensification (Turret)	Shielded
1V18 (Late)	$177,451	G, A	550 kg	10.6 tons	5	8	Passive IR (D, C, Turret), Image Intensification (Turret), Thermal Imaging (Turret)	Shielded
1V19 (Early)	$152,901	G, A	550 kg	10.6 tons	5	8	Passive IR (D, C)	Shielded
1V19 (Late)	$187,115	G, A	550 kg	10.6 tons	5	8	Passive IR (D, C)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
1V18/1V19	135/68	32/16/4	290	72	CiH	W(4)	TF2 TS2 TR2 HF5 HS2 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
1V18/1V19	None	None	KPV, PKT	500x14.5mm, 2000x7.62mm

Arzamas 1V152

Notes: The 1V152 is called a "unified command vehicle;" of somewhat modular interior design, there are two versions of the 1V152, a FIST vehicle and an FDC vehicle. Both carry the same designation, but have different equipment and different capabilities. Both were introduced in the early-to-mid 1980s. Both carry special equipment for their roles; though they may appear externally like a standard BTR-80 at first, closer examination will reveal their true natures – for example, they use a version of the BTR-80's hull called by NATO "Fat Body" and by the Russians the BTR-80UNsh chassis. There are special, folding or retractable antennas on the front left of the passenger compartment, on the right rear of the same compartment, and on the front left of the bow roof. So far, the 1V152

vehicles have not been exported outside of Russia and the former Soviet republics. The 1V152 may be regarded in some sense as a more advanced 1V18/1V19, being based on the BTR-80 and using more advanced electronics and systems. Along with the 1V153 Ural-4320-based truck (carrying an MLRS), these three vehicles belong to the KSAUO Kapustnik-B set of artillery vehicles.

The 1V152 FIST

The FIST version uses a wider and somewhat taller turret which not only houses the gunner/observer, but a large array of vision equipment, including extensive night vision equipment and day vision equipment along with a laser rangefinder. The original 1V152 had a relatively simple control computer to tie together the inertial navigation system and the sensors and provide targeting information to artillery, mortar, or MRL batteries. This computer does not compute fire solutions, though it can calculate corrections to observed fire. The 1V152 FIST has three long-range radios (two of them data capable), one medium-range radio, and one short-range radio. The 1V152 has an internal 4kW generator to power electronics and sensors when the vehicle's engine is off. The 1V152 has a 10-meter extendible antenna for extended-range communications and more advanced whip antennas. The 1V152 also carries an assortment of maps and map markers, manual plotting devices, and hand-held calculators as a backup for the computers. The 1V152 carries not only a turret-mounted laser rangefinder, but also a hand-held laser rangefinder for use away from the vehicle; this laser rangefinder can be connected by a cable to the vehicle's artillery fire control computer to feed information directly to it. The vehicle also carries a hand-held image intensifier and several pairs of binoculars.

Later versions increase the capabilities and reliability of the main computer to allow it to tie into the new GLONASS system or the inertial navigation system, and give recommendations on what round might be the most effective. This computer can produce limited fire solutions, though they will not be as accurate as those produced by a dedicated FDC. The improved version has an advanced active/passive IR viewer with a range of 1500 meters in the passive mode and 3000 meters in the active mode; the 1V152 FIST has a small IR searchlight for use when the IR is in the active mode. The improved version adds a thermal imager and a laser designator.

The 1V152 FDC

The 1V152 FDC is the fire control component of the 1V152 system. In its original iteration, the 1V152 FDC carries two data-capable long-range radios, a medium-range radio, and a short-range radio. The 1V152 FDC has a limited computer able to compute fire solutions (though only two at a time), and use the data transmitted by FIST vehicles (manual input must be used). The 1V152 FDC uses the same turret as the BTR-80 from which it derived, but that turret does not have the PKT coaxial machinegun. On the roof is a 10-meter collapsible antenna, and several advanced whip antennas which are longer than normal whip antennas. The original 1V152 FDC is equipped with an inertial navigation system with gyroscopic backup. It has a survey system to help lay out firing positions for the guns, mortars, or MRLs. Newer 1V152 FDCs add a third long-range radio, a more capable computer able to calculate multiple fire solutions at once as well as fully and semi-automatically integrate information from FIST vehicles with much reduced user input. The newer 1V152 FDC also adds a GLONASS system and a hand-held laser rangefinder to help determine proper firing positions for its guns, mortars, or MRLs; this laser rangefinder can be connected to the computer by a cable, and directly input its information. The 1V152 also carries an assortment of manual aids to producing fire positions and determining firing positions, in case of equipment failure. The 1V152 FDC carries an internal 4kW generator to power its electronics while the engine is turned off.

Common Features

The BTR-80 and the two 1V152 vehicle have a number of common features. The 1V152 vehicles have bullet-resistant windshields and small windows to the sides which are very resistant to gunshots. The commander and driver have vision blocks to the front and to their respective sides to supplement this, and each have a night vision block. The driver's controls are conventional and easy to use. The turret is stepped up and, based on experiences in Afghanistan, the weapons are capable of very high elevation (almost straight up) and depression of -12 degrees. The new mantlet bulges outwards from the front of the turret, and the turret is a little taller, giving the gunner a better field of view. The turret has electric traverse and elevation. The turret has a cluster of four smoke grenade launchers on either side of the turret. Firing ports are deleted, and the roof hatches are smaller than on the BTR-80. The crew enter and exit through enlarged side hatches, which are clamshell hatches opening upwards and downwards. The 1V152s are powered by a single KamAZ-7403 260-horsepower turbocharged diesel engine, which, though the they have a manual transmission, greatly decreases the difficulty of the driver's task as well as greatly simplifying the transmission and drive train, and increasing reliability. Suspension is 8x8 and of the off-road-type, with run-flat tires. The 1V152s are amphibious with preparation; when floating, a waterjet at the rear is turned on. The 1V152s have an NBC overpressure system with collective NBC backup, and radiological shielding. The 1V152s have a winch in the front with a capacity of 4.5 tons and 60 meters of cable.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
1V152 FIST (Early)	$352,902	D, A	900 kg	14 tons	4	10	Passive IR (D, C, Turret), Image Intensification (C, Turret)	Shielded
1V152 FIST (Late)	$279,882	D, A	900 kg	14 tons	4	10	Passive IR (D, C), Advanced Active/Passive IR (Turret), Image Intensification (C,	Shielded

							Turret), Thermal Imaging (Turret)	
1V152 FDC (Early)	$194,793	D, A	900 kg	14 tons	4	10	Passive IR (D, C, Turret)	Shielded
1V152 FDC (Late)	$256,723	D, A	900 kg	14 tons	4	10	Passive IR (D, C, Turret)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
1V152 FIST/FDC	141/71	33/16/4	300	140	CiH	W(6)	TF4 TS4 TR4 HF5Sp HS3 HR3*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
1V152 FIST	+1	Basic	KPV, PKT	500x14.5mm, 2000x7.62mm
1V152 FDC	+1	Basic	KPV	500x14.5mm

*This vehicle has a floor AV of 4Sp.

Kharkov 1V12 Mashina System

Notes: This is a blanket designation referring to a family of vehicles that are used for artillery fire control purposes. These vehicles are based upon the MT-LBu chassis, with a raised superstructure in the rear of the vehicle. There are four vehicles in the 1V12 system. So far, the 1V12 system has not been exported, and the Russians and some former Soviet republics continue to use the system. These vehicles are a part of the Russian KSAUO system of vehicles, designed for support of artillery, MLRS, and SAM units.

1V13 Battery Command/FDC Vehicle

The 1V13 is the deputy battery commander's vehicle, which is also used as the battery fire direction center (FDC); it has two long-range data-capable radios and one short-range vehicle. Early versions also had a radio teletype, later replaced by the computer listed next. Later versions have a ruggedized laptop computer, which can communicate directly with battery fire control computers (if so equipped). The computer can send and receive target coordinates, use internal maps to synthesize target coordinates (if enough information is known), and produce fire solutions particular to each gun, mortar, or MRL in the battery. The 1V13 can receive visual information from the 1V14's sensors if both the 1V14 and 1V13 are so equipped. The 1V13 can also survey battery locations, and locations to place each gun, and feed that information into the fire control computers of the guns (again, if so equipped; otherwise, it must be done manually). The 1V13 also includes a hand-held laser rangefinder to manually input the gun locations into the 1V13's computer. (Before the computer, the laser rangefinder was still available, but fire plotting had to be done mostly manually, with only a small computer of very limited capabilities.) The early versions were equipped with inertial navigation, but newer versions replaced this with GLONASS (but retained the inertial navigation equipment as a backup). The 1V13 has a manually-rotating commander's cupola with a pintle-mounted weapon; this cupola has an aiming circle inscribed on the ring of the cupola, for quick fire solutions or pre-set bracketed or surveyed targets.

These vehicles were upgrades in the 1980s, producing the 1V13-3 Mashina-M. The upgrades are in most cases minor system upgrades, but include upgraded radios, the DShK replaced by an NSVT in a larger cupola, and an 8kW APU on the right rear roof.

1V14 Faltset FISTV

The 1V14 serves as the observation post for the battery commander; and is essentially a light FISTV. The 1V14 has one long-range data-capable computer and three medium-range radios. Early versions were equipped with a radio teletype, but this was replaced by a computer (not as comprehensive as the 1V13's computer). It can also survey gun locations as a secondary feature. The primary equipment, of course, is its observation gear – it has enhanced day and night vision gear, a laser rangefinder, and a laser designator, contained in a turret enlarged from that of the MT-LB and also armed with a light machinegun. To facilitate long-range communication, the 1V14 has a 10-meter telescoping antenna which extends from the rear right roof. The computer-equipped version can transmit its sensor information to higher headquarters, target coordinates, and preliminary fire solutions for the battery (not the individual guns). Early versions used inertial navigation, but later versions use GLONASS for navigation, with an inertial navigation backup. Later versions also upgraded the day and night vision, including a 1x/6x/20x day telescope, an advanced image intensifier which gives a +4 to observation, and an advanced FLIR with a range of 8 kilometers. Later versions are identified by the 1V14-3 Faltset-M appellation.

1V15 Command Vehicle

The 1V15 is for use by the battalion commander; as such, it is more a command post than a strict artillery support vehicle, though it can function as an FDC *in extremis.* It has one short-range, two medium range, and two long-range radios; the long-range radios are data-capable. The 1V15 has the same sort of 10-meter extendable antenna as the 1V14 to extend radio range. The 1V15 also originally included a radio teletype, but it was one of the first of the 1V12 series to receive a ruggedized laptop computer in the late 1980s, and a second one was added in the mid-1990s. The 1V15 can also survey gun positions, has a laser rangefinder linked to the

computers(s) to help establish firing positions for the guns, and some night vision gear. These items are contained, along with a light machinegun, in a small, flattened turret similar to that of the 1V14. Initial navigation gear for the 1V15 was inertial navigation, but this has since been supplanted with GLONASS, with the inertial navigation gear being retained as a backup. Vehicles that have been though the same electrical and mechanical upgrades and life extension programs as the 1V13 are designated 1V15-3.

1V16 Battalion Command/FDC Vehicle

The 1V16 is the deputy battalion commander's vehicle that also serves as the battalion FDC; as such it can control the component batteries in the battalion (especially with later updates) and has as a part of its primary responsibility maintaining communications with the 1V14s in the battalion. The 1V16 has two long-range data-capable radios and three medium-range radios, as well as a 10-meter extendable antenna. Early versions also had a radio teletype, though this was later replaced by a ruggedized laptop computer which can not only receive orders and information, but also generate fire solutions. (Backup manual plotting gear is carried, as well as items such as calculators.) The 1V16 can do gun surveys, and also has a set of meteorological instruments to measure local weather conditions that may affect the battalion's guns and their fire. Early 1V16's had simple computers which helped do calculations and analyze the weather information. As with the rest of this series, early 1V16s had inertial navigation equipment; this was later supplanted with GLONASS equipment, with the inertial navigation retained as a backup. The 1V16 has the same commander's cupola as on the 1V13 – however, an upgraded version carries an 8kW APU in place of the turret, and has only a small, rotating cupola with a PKM on the front right side. Vehicles that have been though the same electrical and mechanical upgrades and life extension programs as the 1V13 are designated 1V16-3.

Common Features

Other than the mission-specific equipment and outfitting, the 1V12 series is similar to the MT-LBu. The 1V12 series do not have dedicated gunner's positions, as on much of the MT-LBu-based vehicles; the commander mans a cupola or small turret, and the normal MT-LBu commander's space is used for equipment storage instead. The driver is in the front left of the 1V12, with the commander's former position to the right, and a small aisle between their positions that links to the rear of the vehicle. The driver has a hatch on the front face of the vehicle; the hatch in front of the former commander's position is still there. These are not normally used for ingress and egress from the vehicle, as they open only part way (so that they are standing just slightly above straight out from the front face), and both the commander's former position and driver's position have normal hatches above their positions. The front hatches are square, while those above their positions are oval. (It should be noted that the normal commander's seat is still there, so potentially a passenger could sit there.) Other than the cupola or a hatch on the turret roof, there are no hatches atop the 1V12. The engine is a YaMZ-238N 300-horsepower diesel which is actually an adapted heavy truck engine. The engine gives the 1V12 a 5.5-ton towing capacity. The 1V12 has an automatic transmission, and the driver has conventional driving controls – a steering yoke, a gas pedal, and a brake pedal. Like other MT-LBu-series vehicles, the 1V12 series is amphibious with a minimal amount of preparation (a trim vane must be erected and bilge pumps turned on), though on the 1V12 a crewmember must leave the vehicle to erect the trim vane instead of simply climbing out onto the front of the vehicle, so 7 minutes are required for preparation instead of five. The 1V12 variants are equipped with an NBC overpressure system.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
1V13 (Early)	$151,536	D, A	375 kg	16.5 tons	6	13	Passive IR (D)	Shielded
1V13 (Late)	$250,586	D, A	375 kg	16.5 tons	6	14	Passive IR (D)	Shielded
1V13-3	$252,586	D, A	367 kg	16.82 tons	6	16	Passive IR (D)	Shielded
1V14 (Early)	$360,730	D, A	375 kg	16.5 tons	6	13	Passive IR (D, C), Image Intensification (C), Thermal Imaging (C)	Shielded
1V14 (Late)	$382,280	D, A	375 kg	16.5 tons	6	14	Passive IR (D, C), Advanced Image Intensification (C), Advanced FLIR (C)	Shielded
1V15 (Early)	$181,280	D, A	400 kg	16.4 tons	7	13	Passive IR (D, C), Image Intensification (C)	Shielded
1V15 (Mid)	$221,280	D, A	400 kg	16.4 tons	7	13	Passive IR (D, C), Image Intensification (C)	Shielded
1V15 (Late)	$332,330	D, A	400 kg	16.4 tons	7	14	Passive IR (D, C), Image Intensification (C)	Shielded
1V16 (Early)	$101,936	D, A	375 kg	16.5 tons	7	13	Passive IR (D)	Shielded
1V16 (Late)	$256,136	D, A	375 kg	16.5 tons	7	14	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor

1V13/1V16	125/87	30/20/3	540	135	Stnd	T3	HF5 HS2 HR2
1V13-3	124/86	30/20/3	540	136	Stnd	T3	HF5 HS2 HR2
1V14	125/87	30/20/3	540	135	CiH	T3	TF4 TS2 TR2 HF5 HS2 HR2
1V15	126/88	30/20/3	540	135	CiH	T3	TF4 TS2 TR2 HF5 HS2 HR2

Vehicle	Fire Control	Stabilization	Armament	Ammunition
1V13/1V16	None	None	DShK (C)	500x12.7mm
1V13-3	None	None	NSVT (C)	500x12.7mm
1V14/1V15	None	None	PKT	1000x7.62mm

Volgograd JSC 1V118 Reostat/1V119 Spektr

Notes: These two vehicles are based on the BMD-1 chassis and have a number of features in common (other than the mechanics and hull of their base chassis). The Reostat and Spektr are used by Russian Airborne and Naval Infantry units, depending on the vehicle, as FDCs and FISTVs for their units' mortars and artillery (whether self-propelled or ground-mounted). So far, only the Russians use them. Both are based on BMD-1 chassis, but have their turrets removed; externally, they look very much like BTR-Ds, but can be identified apart from the BTR-D by the lesser amount of roadwheels, greater amount of antennas, and generally smaller size. Both have s simple commander's cupola, but this cupola is not armed, and is primarily used for observation. Armament is restricted to one machinegun in the right bow; this weapon may be aimed and fired from the commander's position or by the driver. Internally, they are far different from the BMD-1, however; the crampness of the interior is, if anything, exacerbated.

1V118 Reostat FISTV

The 1V118 Reostat is the FISTV component of the system. Much of the rear area is taken up by the sensor package, which elevates on a 10-meter extendible mast. The Reostat's sensor package is equipped with several day and night vision devices and telescopic sights. It also has both a long-range laser rangefinder and long-range laser designator, both with a range of 8 kilometers; the commander and one of the crewmembers in the rear has controls to elevate and lower this mast and down/over links to their position from the sensor package. The commander has a special sight which has an aiming reticle for the laser designator and range information projected on it; one of the crewmembers in the rear also has this information downlinked to him, though the aiming reticle and range information is projected by his equipment instead of a special direct-view sight like the commander has. Behind the sensor package is a combination ground surveillance/artillery/mortar counterbattery radar with a range of 14 kilometers; the sensor package is on the right and the radar on the left and slightly ahead of the sensor package/mast, so both can be used at once. When the sensor package is lowered, armored panels close over it; the radar dish does not lower and is always on the roof. Other equipment in the rear includes two long-range data-capable radios and a short-range radio. Early versions had a small, low-capability computer to coordinate the sensor package and the radar and help the crewmembers digest the information for transmission to artillery or mortar batteries, and to send target coordinates. This computer had little ability to actually come up with fire solutions, however. Since the early 1990s, a full ruggedized computer was installed, along with two decent-sized LCD screens supplying target information, range, target status, and information from the sensor package and the radar. This computer also has a number of maps stored in its memory, and can match them to the target coordinates and information. This computer has been upgraded a number of times since its introduction. The Reostat was introduced with inertial navigation, but this was replaced by GLONASS in the mid-1990s and the inertial navigation unit became a backup.

1V119 Spektr FDC

The 1V119 Spektr is the FDC component of the system. This vehicle has two long-range data-capable computers, a medium-range radio, and short-range radio. Initial versions had a computer capable of taking the information received from the Reostat and generating fire solutions from it, as well as giving the proper fire solution for each gun in the battery (assuming the battery location information given it by the crew is accurate). The vehicle has a hand-held laser rangefinder, primarily to help it get proper coordinates for each gun or mortar. The Spektr also has the ability to survey gun and mortar sites. This early Spektr has inertial navigation. Later versions have a more comprehensive computer, capable of being connected by cable to the laser rangefinder and more fully use the information transmitted to it by the Reostat. It quickly generates fire solutions for the battery, and can also keep up with the locations of enemy and friendly units (manual input), to help reduce friendly fire. The later Spektr has a GLONASS navigation system, complete with computer storage for scores of maps, with the inertial navigation system being kept as a backup.

Common Features

Features in common with the BMD-1 are as follows: The driver is in the center front hull, but the engine is in the rear. One rear deck hatch is retained and is the entry and exit point for the crew in the hull. The left bow position of the BMD-1 hull is not used except for equipment storage. The gunner's seat of the right bow is also not present, and there is another small space for equipment storage instead. Like the BMD-1, the bow machinegun of the Reostat and Spektr has a narrow field of fire – depending on the source, 20-30 degrees. The hull side firing ports are deleted in the Reostat and Spektr. The commander's periscope is also deleted. The engine is 270-horsepower 5D-20 diesel engine, giving the Reostat and Spektr good power for its light weight; the transmission is manual. Armor protection is surprisingly good given the light weight; however, to save weight, the Soviets used magnesium alloy for the armor, which could go up like a Roman candle when hit. The suspension is specially-designed for the Reostat and Spektr's role; it is a variable-

height hydropneumatic suspension that allows the Reostat and Spektr 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 Reostat and Spektr is amphibious with a little preparation – a trim vane must be erected, bilge pumps turned on, and a periscope must be inserted into a socket and extended by the driver. The bilge pump has a manual backup. This takes 10 minutes. Propulsion in the water is by hydrojets. The hydrojets have shutters which allow for surprising maneuverability when swimming – the Reostat and Spektr 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.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
1V118 Reostat (Early)	$453,382	D, A	200 kg	13.4 tons	4	11	Passive IR (D, Mast), Image Intensification (Mast), Thermal Imaging (Mast), Radar (Roof)	Shielded
1V118 Reostat (Late)	$297,594	D, A	200 kg	13.4 tons	4	12	Passive IR (D, Mast), Image Intensification (Mast), Thermal Imaging (Mast), Radar (Roof)	Shielded
1V119 Spektr (Early)	$223,586	D, A	200 kg	13.3 tons	4	11	Passive IR (D)	Shielded
1V119 Spektr (Late)	$207,096	D, A	200 kg	13.3 tons	4	11	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
1V118 Reostat	147/103	36/22/9	300	113	CiH	T3	TF2 TS2 TR2 HF8 HS4 HR4*
1V119 Spektr	148/104	36/22/9	300	112	Trtd	T3	TF2 TS2 TR2 HF8 HS4 HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
1V118/1V119	None	None	PKT (Right Bow)	2000x7.62mm

*The “turret” refers to the radar dish or the mast-mounted sensor package (when extended). As such, no crew casualties are possible when hitting the dish, and all such results are treated as electronics damage instead. When firing at the Reostat, the chance of hitting the radar dish or mast is 50/50, unless the mast is not raised, in which case all such hits are on the radar dish.

KMZ PRP-3 Bal/PRP-4 Nard

Notes: The PRP-3 was the initial FIST version of the BMP-1, entering service in the early 1970s. When first spotted by NATO, it was given the temporary NATO reporting designation of BMP M-1975, and some sources refer to it as the BMP-SON. In the Russian Army, the PRP-3 is normally attached to 122mm or 152mm-equipped artillery units, though it can spot for mortar or MRL units as well. The PRP-3 served with Russian and some Warsaw Pact units into the late 1980s, by which time it was almost totally replaced by the PRP-4. Numbers of them, however, are still kept in reserve in Russia. Though I have not been able to substantiate it, some sources say that some PRP-3s are still used by Romania and Bulgaria. Other than some Warsaw Pact country use, the PRP-3 was not exported. The PRP-4 is a modernized version of the PRP-3, with virtually all electronic systems and sensor equipment upgraded.

The PRP-3

The basic hull of the PRP-3 is virtually identical to the BMP-1’s, though all firing ports have been deleted and the hatch arrangement has been changed a great deal. The driver is still on the right front side and the commander is in the turret with a hatch above him, but on the hull roof, there are only two small hatches just behind the turret. The turret has a second hatch for another observer; the turret is a two-man turret. The rear doors remain. One of the largest changes and recognition features are in the turret; the turret is wider than the BMP-1’s and is armed with only a single machinegun. This turret has a number of projections and boxes on it, which are the heads for the PRP-3’s sensors and telescopic day and night vision equipment. The passive IR scope on the PRP-3 has somewhat extended range – it has a 500-meter base range. The turret’s image intensifier likewise is a bit more effective than most image intensifiers, adding 3 to the user’s observation. (The driver’s image intensifier is standard.) Most of the night vision equipment is in a large box with a hinged cover on the right side. The machinegun is aimed and fired using of these boxes on the roof of the turret; it is a periscopic vision block with an aiming reticle on it. The aiming reticle includes a small ballistic computer. Other boxes on the turret include a laser rangefinder and a separate commander’s telescopic scope and IR scope. The laser rangefinder may double as a laser designator, for both aircraft and ground-launched laser-guided missiles, or laser-guided artillery projectiles. The PRP-3 has an inertial navigation system, with a gyro course indicator and gyrocompass as a backup. The PRP-3 has three smoke grenade launchers on each side of the turret, and 90mm folding illumination shell launcher, for which 20 rounds are carried; the smoke grenade launchers are on either side of the turret, and the illumination shell launcher is just behind the turret.

Though some of the radios are in the turret, they are generally routed through the equipment of the two men in the back of the

vehicle. This includes one long-range radio, one medium-range radio, and one short-range radio. The PRP-3 has a 10-meter extendible antenna to extend radio range. They also have access to a simple computer to help calculate ranging and use information from the inertial navigation equipment and gyrocompass, though it has no capability to calculate fire solutions. The troops in the rear also have manual plotting gear, maps, and hand-held calculators. The crew in the rear control perhaps the most obvious of the recognition features: a combination ground surveillance and mortar/artillery counterbattery radar called “Small Fred” by NATO and the 1RL126 by Russia. The antenna folds flat against the vehicle when not in use. The Small Fred has a detection range of 20 kilometers, and can track large moving objects such as vehicles at 10 kilometers or personnel at 1 kilometer. (Sources are contradictory as to whether the Small Fred operates in the J-band or K-band.)

The PRP-4

The PRP-4 is a development of the PRP-3, essentially a PRP-3 with updated sensors, vision devices, and electronics. The PRP-4 retains inertial navigation with a gyroscopic backup/supplement, though the system is updated, more accurate, and more compact. Both the fire direction computer and the ballistic computer are likewise updated and are more compact and more reliable. The night vision has been improved – the passive IR has a base range of 1500 meters in passive mode or a range of 3000 meters when used in the active mode, and the image intensifier (except for the driver’s) adds 4 to the user’s observation. The PRP-4 has a small IR searchlight for use in conjunction with the IR viewer when it is in the active mode. The PRP-4 has two large shuttered boxes, one on each side of the turret; the one on the left side houses the thermal imager and the laser rangefinder, and the one on the right houses the passive IR, image intensifier, and day vision equipment. On the turret roof on the left side is the head for the laser rangefinder, which is likewise improved in reliability and more compact, in addition to acting also as a laser designator. The PRP-4 also carries a hand-held laser rangefinder for use when away from the vehicle, and this can be attached by a cable to the vehicle’s computer. The commander’s rotating periscopic vision block has been given its own night vision device, which is a standard passive IR device and not the enhanced one which is on the side of the turret. The radar has been replaced with the more advanced 1RL133 (“Tall Mike”) radar, which has a detection range of 25 kilometers, and a tracking range of 12 kilometers against vehicles and 2 kilometers against personnel. It can also track low-flying helicopters (those flying at not more 3000 meters) at a range of 7 kilometers. As the Tall Mike is more compact and technology had advanced, the radar dish can be folded and pulled into the vehicle under armored doors when it is not in use. The PRP-4 has one data-capable long-range radio, one other long-range radio, one medium-range radio, and one short-range radio. The computer on the PRP-4 is more capable and gives results quicker, as well as able to take data directly from the vehicle’s sensors and couple it with the inertial navigation and mapping equipment.

The PRP-4M Deyteriy and PRP-4MU Deyteriy have much of the same improvements as the improved BMP-1 (Ob’yekt 765Sp2), including incremental reliability improvements to the electronics, and suspension. The PRP-4M and PRP-MU have a higher hull and changes to nose section for better flotation that increased length by 200mm, making the PRP-4M and MU a better swimming platform. The exhaust port behind the turret was fitted with an extendible snorkel for amphibious operations and deep fording. A small air intake to the left of and in front of the driver was removed, again to increase swimming integrity. Improvements were made to the NBC (overpressure and backup collective) system and engine to improve reliability. The PRP-MU also has an increased-capability computer, which can do fire solutions if required, and adds a laser designator. For game purposes, the PRP-4M is identical to the PRP-4, except that players will find that many of the electronic parts are different when their characters attempt to fix the electronics; the PRP-4MU is a little different in game terms as listed below. The PRP-4M and PRP-4MU have a fake turret build, including a faux 30mm autocannon barrel re that of the BMP-2. The machinegun is retained as the “coaxial.” No other VISMODs have been made to the vehicle.

Common Features

The PRP-3 and PRP-4 have a UTD-20 300-horsepower diesel engine is mounted in the front to the right of the driver, and is coupled to a manual transmission. The BMP-1’s engine has a limited multi-fuel capability – it can burn almost any grade of diesel fuel, and it can also burn kerosene. The PRP-3 and PRP-4 may lay a thick, oily smoke screen by injecting diesel fuel into its exhaust. The ground pressure is relatively low, and the PRP-3 and PRP-4 can cross fairly deep snow without getting bogged down; it can also traverse some swampy terrain with a reasonable chance of success. The PRP-3 and PRP-4 are also amphibious with minimal preparation; a trim vane must be erected at the front and bilge pumps turned on. The hull is airtight once the rear doors are closed, and buoyancy is assisted by hollow roadwheels and roadwheel arms with air chambers in them. The amphibious capability is rather limited – a current as little as 1.2 meters per second (4.3 kilometers per hour) can swamp a PRP-3 or PRP-4. Cross-country travel, however, is unpleasant for the crew and passengers, particularly on a long trip or at high speeds, as even on the improved versions, the shock absorbers suck and the ride is bouncy, sometimes to the point of being violently bouncy. As with the BMP-1, crews often fill the PRP-3’s and PRP-4’s rear tanks with sand or water to help address the vulnerabilities of the vehicle to rear-quarter shots, and add on *ad hoc* appliqué armor.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
PRP-3	$948,268	D, A	425 kg	13.2 tons	5	10	Enhanced Passive IR (Turret), Image Intensification (D), Enhanced Image Intensification (Turret),	Shielded

PRP-4	$860,974	D, A	425 kg	13.2 tons	5	10	Radar Enhanced Active/Passive IR (Turret), Image Intensification (D), Enhanced Image Intensification (Turret), Thermal Imaging (Turret) Radar	Shielded
PRP-4MU	$652,389	G, A	425 kg	13.2 tons	5	10	Radar Enhanced Active/Passive IR (Turret), Image Intensification (D), Enhanced Image Intensification (Turret), Thermal Imaging (Turret) Radar	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
PRP-3/PRP-4	148/104	36/22/4	462	132	Trtd*	T3	TF10 TS6 TR6 HF8 HS4 HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
PRP-3/PRP-4	+1	Basic	PKT	2000x7.62mm

*On the PRP-3 and the PRP-4 (if the dish is deployed), a “Turret” hit is 25% likely to hit the radar dish instead. If so, use the Crew-in-Hull tables to find the vehicle damage, and any result which indicates crew casualties results in electronics damage instead. The radar dish is considered to have an all-around AV of 2 for this purpose. If the dish is not deployed, use the standard damage table for a turreted vehicle.

BAE South Africa Ratel EAOS

Notes: The Ratel EAOS (Enhanced Artillery Observation System) is a highly modified Ratel Mk 1 APC designed as a FIST vehicle. The primary feature of the EAOS is its hydraulically operated mast, which raises a sensor package up to 30 meters above intervening terrain without exposing the vehicle itself. The sensor package consists of a video camera (day or night operable), a long-range zoom lens, a FLIR viewer, a laser designator, and a laser rangefinder with a video channel. This system provides accurate observation during the day to 20 km and during the night to 3.5 km. In the vehicle itself is mounted a computer system to manage the data and to provide firing solutions, an integrated vehicle inertial land navigation system (later replaced by GPS), and a pointing control. Extra radios to transmit new target locations to artillery and mortar batteries are provided (typically, three long-range data-capable radios, one medium-range radio, and one short-range radio).

The Ratel EAOS has no turret, and during travel the mast is folded on top of the raised superstructure. A machinegun mount is provided next to the commander's hatch.

The Ratel EAOS has a roomy driver's compartment at the center front of the vehicle with good visibility through ballistic-glass windows to the front and sides of his position. He can enter and exit through a roof hatch, or though the rear of his position through the troop compartment. The driver can cover his windows with armored shutters for high-threat environments. With the shutters in position, the driver views the area around him though three vision blocks (to the front and sides); the front vision block can be replaced by a night vision block. The driver's controls are conventional, and the seat and steering column are adjustable. On either side of the front of the hull are two smoke grenade launchers. The commander has a cupola with all-around vision blocks. The top hatches are deleted except for one, and all firing ports are deleted. The primary method of entry and exit for troops is via that rear door, which is on the right side of the rear face opposite the engine compartment and is a clamshell-type door opening up and down. There is also a clamshell door in either side of the vehicle near the center of the hull.

The Ratel EAOS is powered by a Bussing D-3256 BTXF turbocharged diesel produced in South Africa which has an output of 282 horsepower, coupled to a manual transmission. The suspension is 6x6, and is of the off-road type. The suspension is rather high (ground clearance is 35 centimeters). The armor is of all-welded steel; though the Ratel does not have an MRAP hull, additional attention has been paid to the survivability of the suspension, wheels, and tires, which are run-flat and especially puncture-resistant. The floor has additional armor protection, and the troops and crew have shock-absorbing seats/positions and take 10% less damage if the Ratel EAOS hits a mine or IED.

Twilight 2000 Notes: Fewer than 10 of these vehicles were completed in time for the Twilight War.

Merc 2000 Notes: This project was abandoned as being too expensive.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$263,815	D, A	300 kg	20.7 tons	5	14	Passive IR (D), Image Intensification (Mast), FLIR (Mast)	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
122/61	28/14	430	165	Trtd	W(6)	TF2* TS2* TR2* HF11 HS6 HR4**

Fire Control	Stabilization	Armament	Ammunition
None	None	MG-4 (C)	2000x7.62mm

*Turret hits are on the mast-mounted sight; no crew hits are possible (weapon hits are on the mast, and ammo hits are on the sensors). If the mast is not raised, hits are resolved as normal for a Standard-configuration vehicle.

**Floor AV is 4Sp.

CSIR Casspir FISTV

Notes: This is a FIST vehicle version of the Casspir APC. It has the same level of mine protection as the APC version. The Casspir FISTV is sort of a basic form of a FISTV; it has basic equipment necessary for its role. The Casspir FISTV is fitted with limited computers for artillery and mortar firing solutions, inertial land navigation equipment, and a laser designator, as well as extra radios – three data-capable long-range radios, one medium-range radio, and one short-range radio. The Casspir FISTV carries an additional hand-held laser rangefinder, image intensifier, and thermal imager. The Casspir FISTV can be distinguished from the normal Casspir with overhead protection by its extra, longer radios antennae, additional external stowage boxes, and extra fairings.

The Casspir FISTV has an MRAP-type hull and suspension, along with the appropriate seating. This includes 4-point harnesses for the crew and troops to help protect them in the case that a mine or IEDs turns the Casspir FISTV on its side or roof, or causes it to roll over. The Casspir FISTV has a water tank for crew and troop consumption, in this case holding 200 liters; set in the floor, this also provides some incidental protection against mines and IEDs. It is based on the Mk 2 version, and is enclosed. It also has a limited-slip differential, a roof with four hatches in it, and a double door at the rear. The commander has a mount for a weapon under his windshield with limited traverse, elevation, and virtually no depression; this is normally an MG-4. At the front of the troop compartment is a mount (or double mount) for a weapon, which may be of several different types but is normally another MG-4; this is manned by one of the troops in the rear. The interior is rearranged to suit its mission, and the firing ports are deleted, though there are two ballistic-glass windows, one in each side, and one in each rear door. The Casspir FISTV is powered by 166-horsepower Mercedes-

Benz OM-352 turbocharged diesel engine, which unfortunately still leaves it a bit underpowered. The suspension, however, is more suited for off-road use, though a fairly stiff leaf-spring-type suspension is used and the ride can be a bit rough. The transmission is manual, and the driver has conventional controls.

Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
$268,067	D, A	500 kg	11.3 tons	5	6	Headlights	Enclosed

Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
126/64	29/15	220	95	Stnd	W(4)	HF5 HS3 HR3*

Fire Control	Stabilization	Armament	Ammunition
None	None	MG-4 (C), MG-4	1500x7.62mm

*Floor AV is 6Sp.

Daewoo K-10 FAASV

Notes: The Daewoo FAASV Field Artillery Ammunition Support Vehicle) uses the chassis of a Korean self-propelled AA gun called the Biho to produce an armored ammunition support vehicle for field howitzers and self-propelled howitzers. In concept, it is very much like the US M-992 FAASV, though in design and external appearance it is quite different. It is of cabover design, with armored shutters on the front windows and a hatch over the commander's position for a heavy machinegun. The driver and commander have three vision blocks to the front; in addition. The driver has vision blocks to the right side and the commander to the left side. One of the driver's forward vision blocks can be removed and replaced by a night vision block. There are large doors in the rear for the unloading and loading of ammunition, and particularly for the passing of ammunition to guns. These are also the primary entrance and exit to the vehicle for the crew. There is a small hatch on the roof. On each side, there is a small hatch from which a roller way can be extended to speed up the ammo replenishment rate for the FAASV. The internal ammunition stowage racks have room for 139 155mm shells, 146 charges, and 167 fuses. Ammunition is passed to a field gun crew or self-propelled howitzer via a conveyor belt at the rate of eight rounds per minute. The vehicle passes ammunition and is resupplied through large rear doors. Four smoke grenade dischargers are mounted at the front of the hull on each side.

Like the Biho, the FAASV is powered by a MAN-Doosan D2840L 520-horsepower diesel engine, coupled to an automatic transmission. The engine is actually a development of the engine of the K-200 series of fighting vehicles, though only about 50% of the parts of the engines are in common. The transmission is totally replaced from the K-200 to handle to the increased weight and engine power. The rest of the drive train, and electrical system have virtually nothing in common, though the roadwheels are the same and the tracks are the same (but longer). Despite the modifications, the FAASV remains amphibious, even with a full load.

The Daewoo FAASV is also able to work with the M-109 SP howitzer; the South Koreans use a number of those, calling them the K-55.

Modifications done in the late 1990s and early 2000s gave the K-10 a few new features. These include a GPS and mapping module with an inertial navigation backup, incremental fixes and upgrades to the running gear, engine, transmission, and electrical system, a BMS, and extra data-capable radios. The driver has an image intensifier for forward vision and a day/night CCD camera for backup. There are three day/night CCD cameras around the back to monitor the ammo transference and the use of other items. The BMS can also monitor the amount of replenishment items carried and used. The commander has a night channel for his front vision block and has a reticule to help him aim; he can also aim and fire from within the vehicle.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
K-10 FAASV	$819,580	D, A	500 kg	26.4 tons	4	16	Passive IR (D)	Shielded
K-10 FAASV (Late)	$1,135,530	D, A	462 kg	26.55 tons	4		Image Intensification (D, C), Day/Night CCD Cameras (D, 3xRear)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
K-10 FAASV	159/105	35/25/3	500	281	Stnd	T3	HF8 HS4 HR4
K-10 FAASV (Late)	158/104	35/25/3	500	283	Stnd	T3	HF8 HS4 HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
K-10 FAASV	None	None	M-2HB (C)	1000x.50
K-10 FAASV (Late)	+1	Basic	M-2HB (C)	1000x.50

*This vehicle has a Roof AV of 4; the floor AV is 4Sp.

Hagglunds Bplpbv-3023 Fire Direction Center Vehicle

Notes: The Bplpbv-3023 is a version of the Pbv-302 modified and kited out to serve as an FDC vehicle to direct artillery, mortar, or MRL batteries. When the Bplpbv-3023 came into service in the early 1960s, the idea of a dedicated and specially-equipped FDC vehicle (as opposed to a bunch of guys in the back of somewhat-modified APC with some plotting boards and pocket calculators) was relatively new, and the Swedes were one of the first to put such a vehicle into service. The concept has proven successful and Bplpbv-3023s remain in service, after several upgrades, to this day. To simplify matters of simulating upgrades, I will use the tack I took for the Epbv-3022 (below), and lump them into sets of upgrades. Note that the Bplpbv-3023 works primarily with Bandkanon batteries.

The Bplpbv-3023 is similar in concept to the US M-577 series in that the base chassis and drive train remain virtually identical to that of the base Pbv-302, but the rear section of the vehicle has the roofline raised nearly a meter. On the Bplpbv-3023, however, the raised area is not merely a place allowing the crew to stand inside the vehicle; instead, the raised area is sort of an equipment storage area/equipment bay to hold additional equipment and some of the specialist FDC equipment. In the initial Bplpbv-3023 iterations, a collection of two long-range radios, one medium-range radio, and one short-range radio is carried, as well as a radio teletype. Though manual plotting boards, equipment, calculators, and maps are carried, the primary tool of the FDC crew is what was for the time a rather sophisticated computer for calculating fire solutions, helping to lay gun or mortar firing positions, and coordinating fire support requests. Like the Epbv-3022, the Bplpbv-3023 has primitive inertial navigation gear (sort of a gyroscopic system with computer assistance). The Bplpbv-3023 also carries eight field telephones and 200 meters of commo wire to connect it to the firing batteries. Like the Epbv-3022, the Bplpbv-3023 is a little more bulbous and rounded due to the insertion of additional flotation aids inside an outer metal skin to retain the amphibious capability of the Pbv-302 series. This version is listed below as the “Early” version.

Mid-Life Overhauls and Upgrades

The “Mid” version has automotive, electrical, and suspension overhauls to keep the vehicle functioning despite the fact that the base chassis was aging. Internally, the Bplpbv-3023 has a more capable and nimble fire computer, similar in capabilities to the US TACFIRE artillery fire direction system of the period. This computer can calculate fire solutions for up to half a battery at a time, or an entire battery if the positions of the guns, mortars, or MRLs is known. The “Mid” iteration of the Bplpbv-3023 has some firing position surveying equipment to help accurately place firing positions for its guns, mortars, or MRLs. Like the “Early” version, it can coordinate with other FDCs (whether they are in Bplpbv-3023s or other similarly-equipped units), to help allow for maximum effectiveness of the fire from multiple batteries of support fire weapons, though it can accomplish this task more quickly and more accurately. It can also communicate and receive data directly from other similarly-equipped FDCs and FIST-type and other units able to transmit data digitally. This version of the Bplpbv-3023 has a full inertial navigation setup, with the system having a minor computerized relay to feed information to the fire control computer. The radio teletype has been removed, and in its place a data-capable long-range radio has been installed. One of the other long-range radios is also data capable. A third long-range (non-data-capable) radio is carried, along with a medium range and a short-range radio; the field telephones and commo wire are still carried, though the field telephones carried are normally more advanced digital telephones.

Late-Life Overhauls and Upgrades

The “Late” version upgrades consisted primarily of more overhauls, but also gave the Bplpbv-3023 an even more advanced fire control computer setup. The equipment requires less crewmembers to operate. The “Late” version of the Bplpbv-3023 is also equipped with GPS, though it retains its inertial navigation gear as a backup, as well as the link to the fire control computer.

Hull armor is of steel; it is a bit on the thin side, and an appliqué armor kit was quickly devised as a result. The engine and transmission are combined in a unitary powerpack, something which was unusual at the time of its development. The engine used is a Volvo-Penta THD-100B diesel with an output of an amazing 280 horsepower. The engine is coupled to a manual transmission which is also designed by Volvo. The suspension uses conventional torsion bars with shock absorbers on the first and last set of roadwheels, so it may be surmised that the ride can be a bit rough sometimes. Tracks are wide and help the Bplpbv-3023 stay mobile in snowy or swampy terrain. The Bplpbv-3023 is amphibious; preparation consists only of switching on bilge pumps and extending a trim vane, requiring only 4 minutes. The double-skinned nature of the lower hull above the tracks aids in floatation, as does the additional flotation aids built into to the sides, front, and rear faces. It should be noted that the raised rear section of the Bplpbv-3023 limited the traverse of the autocannon turret to 90 degrees right and 135 degrees left.

Twilight 2000 Notes: The “Late” modifications would have been only starting and most Bplpbv-3023s would not have them. In particular, GPS would not be installed on them in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Bplpbv-3023 (Early)	$120,841	D, A	500 kg	13.6 tons	3+4	12	Passive IR (D)	Shielded
Bplpbv-3023 (Mid)	$149,416	D, A	500 kg	13.6 tons	3+4	12	Passive IR (D)	Shielded
Bplpbv-3023 (Mid) w/Appliqué	$152,706	D, A	325 kg	14.4 tons	3+4	12	Passive IR (D)	Shielded
Bplpbv-3023 (Late)	$223,499	D, A	600 kg	13.5 tons	3+3	12	Passive IR (D)	Shielded
Epbv-3022 (Late) w/Appliqué	$226,789	D, A	425 kg	14.3 tons	3+3	12	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
Bplpbv-3023	151/106	38/23/4	285	109	CiH	T2	TF2 TS2 TR2 HF6 HS3 HR3

(Early/Mid) Bplpbv-3023 (Mid) w/Appliqué	142/100	36/22/4	285	116	CiH	T2	TF2 TS2 TR2 HF7 HS4 HR3*
Bplpbv-3023 (Late)	153/107	38/23/4	285	108	CiH	T2	TF2 TS2 TR2 HF6 HS3 HR3
Bplpbv-3023 (Late) w/Appliqué	143/101	36/22/4	285	115	CiH	T2	TF2 TS2 TR2 HF7 HS4 HR3*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Bplpbv-3023	+2	None	20mm m/47D Autocannon	505x20mm

*With the appliqué armor kit, the Bplpbv-3023 has a hull deck, turret deck, and hull floor AV of 3.

Hagglunds EpBv-90

Notes: This vehicle is the FISTV version of the CV-9040. In this role, the turret is replaced with one mounting advanced electronics. 4 extra radios are added, making for a long-range radio, two data-capable long-range radios, a medium-range radio, and two short-range radios. A laser designator is added to the turret, along with a long-range laser rangefinder (2x range) and computers for fire solutions are inside the vehicle. The EpBv-90 can spot for artillery even while moving, and can instantly relay fire solutions to linked artillery and mortar units. The thermal imaging on this vehicle is 2nd generation, 150% normal range. Map and plotting boards complete the package, along with hand calculators and computers for use if manual fire solutions have to be calculated. Long-range day observation gear is also provided, including an image intensifier. The EpBv-90 has an inertial navigation system; later improvements include a GPS system with the inertial navigation being retained as a backup along with a gyroscope, along with improved computers.

The EpBv-90 includes the Defensive Aids Suite, a system normally mounted on tanks. This includes a laser warning system, along with a radar warner and missile approach sensors. The system includes 10 smoke grenade launchers on each side of the turret; this smoke obscures into the IR spectrum. The entire vehicle has a IR-absorbent feature, especially the engine, electronics, and exhaust (IR systems observe at one level more difficult, and IR and laser-guided munitions are -3 to hit). The EpBv-90 also has a minor stealth shape (especially in the turret); radar systems observe at one level more difficult, and radar-guided munitions are at -2 to hit). The EpBv-90 has a full NBC overpressure system with a collective NBC backup. The turret is armed only with a single machinegun, though this is linked to a ballistic computer and laser rangefinder of its own.

The hull of the EpBv-90 is similar to that of the CV-9040, though it is more rounded in appearance. It has the same high level of base armor protection as the CV-9040, including the turret (except across the frontal arc). The Lyran mortar system is not fitted to the EpBv-90. The EpBv-90 has the same Scania DSI 14 550-horsepower engine of the CV-9040. Upgrades started in 2001 gave the EpBv-90 a Scania DI-16 600-horsepower engine and matching transmission, general suspension and drive train improvements, and electrical system updates. As noted above, a GPS system was added as well as improved artillery computers. Upgrades were made to both the day and night vision suite. The EpBv-90 was given the ability to take add-on appliqué armor as well as a bar/slat cage (not normally mounted, and not noted below). Armor improvements included hull floor, hull deck, and turret deck armor. I have not been able to discover whether such upgraded versions have an official designation, so I have simply called the two versions below “Early” and “Late.”

Twilight 2000 Notes: the EpBv-90C is not available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
EpBv-90 (Early)	$424,007	D, A	500 kg	22.3 tons	3+3	12	Passive IR (D, Turret), 2nd Generation Thermal Imaging (Turret), Image Intensification (Turret)	Shielded
EpBv-90 (Late)	$543,877	D, A	400 kg	22.8 tons	3+3	14	Passive IR (D, Turret), FLIR (Turret), Improved Image Intensification (Turret)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
EpBv-90 (Early)	144/100	36/21	525	244	Trtd	T4	TF10 TS8 TR6 HF18 HS7 HR4
EpBv-90 (Late)	163/114	41/24	525	300	Trtd	T4	TF10 TS8 TR6 HF18 HS7 HR4*

Vehicle	Fire Control	Stabilization	Armament	Ammunition

EpBv-90	+3	Good	Ksp m/39	3800x7.62mm

*Hull deck, turret deck, and hull floor armor on this version is AV 3.

Hagglunds Epbv-3022 Armored Observation Post Vehicle

Notes: The Epbv-3022 is a version of the Pbv-302 APC modified to serve as a FIST vehicle. Though the Epbv-3022 was to have been eventually totally replaced by the CV-90E, budgetary problems mean that it may be a very long time before total replacement occurs; in the meantime, the Epbv-3022 will continue to soldier on, probably with periodic upgrades and improvements. (Several have already taken place, though I have lumped them together somewhat below.) The Epbv-3022 was one of the first such specific FISTVs built, with service beginning shortly after the Pbv-302 APC came into service in 1966.

For the most part, the Epbv-3022 externally looks the same as the Pbv-302. It's most telling recognition feature is the extra cupola on the opposite side of the hull roof from the gun turret (which is retained). On the original Epbv-3022, this cupola houses an image intensifier, additional day vision equipment, a laser designator, and electronics to overlay reticules on the user's sights to help them accurately determine the positions of targets and thus help give the artillery or mortar batteries accurate information. Unlike the gun turret, this cupola rotates manually instead of electrically. The Epbv-3022 is also a little more bulbous and rounded, due to the inclusion of extra floatation aids under a layer of thin metal on the exterior to allow the Epbv-3022 to remain amphibious despite the added weight. Inside the hull, the interior is greatly rearranged, with primitive inertial navigation gear (sort of a gyroscopic system with computer assistance), manual plotting gear, hand-held calculators and maps, and a primitive computer which can store small amounts of information and help perform some calculations to determine fire coordinates. This original Epbv-3022 is equipped with one long-range radio, one medium-range radio, and one short-range radio, along with a compact radio teletype. This leads to another recognition feature: three radio antennas on the roof of the Epbv-3022. (This version has been designated "Early" below.)

Mid-Life Overhauls and Upgrades

In the late 1970s to mid-1980s, several improvements were made to the Epbv-3022. Some consisted of general drive train, electrical, and suspension overhauls, just to keep the Epbv-3022s in service and to prevent breakdowns that would have inevitably occurred without such overhauls. However, the FIST-specific cupola was also augmented with an IR viewer, more robust day optics, a more compact laser designator, and a laser rangefinder. The cupola's rotation and the aiming of its optics was still manual, but was given more fine control. Inside the Epbv-3022, the computer was given more power, with the ability to more quickly and accurately process targeting information, as well as a limited capability to produce its own fire solutions if necessary. The computer was also given a datalink (though a data-capable radio) to allow it to directly transmit its information to FDCs in the rear. This meant that the radio teletype was no longer necessary. Radios had also since become more compact. Radio complement became two data-capable long-range radios, two medium-range radios, and one short-range radio. This upgrade gave the Epbv-3022 true inertial navigation gear, and a limited-capability computer allowed the inertial navigation unit to communicate and combine its information with the fire control computer. This version of the Epbv-3022 is able to take a thin appliqué armor kit to supplement its base armor. (This version has been designated "Mid" below.)

Late-Life Overhauls and Upgrades

From the mid-1990s to early 2000s, more overhauls were made to continue the Epbv-3022s ability to remain in service. However most of the improvements were in the form of FISTV-specific equipment, such as a thermal imager mounted on a rotatable head behind the FIST cupola (though downlinked into the operator inside the cupola). The cupola controls are also now electric instead of manual. The computer is also a bit more capable; it can function as an ad hoc FDC, though it cannot come up with fire solutions as quickly or through as many channels as a dedicated FDC. This version of the Epbv-3022 is equipped with a GPS receiver linked by computer to the fire control computer of the rest of the Epbv-3022. Crew requirements have been decreased. (This version is designated "Late" below.)

Hull armor is of steel; it is a bit on the thin side, and an appliqué armor kit was quickly devised as a result. The engine and transmission are combined in a unitary powerpack, something which was unusual at the time of its development. The engine used is a Volvo-Penta THD-100B diesel with an output of an amazing 280 horsepower. The engine is coupled to a manual transmission which is also designed by Volvo. The suspension uses conventional torsion bars with shock absorbers on the first and last set of roadwheels, so it may be surmised that the ride can be a bit rough sometimes. Tracks are wide and help the Epbv-3022 stay mobile in snowy or swampy terrain. The Epbv-3022 is amphibious; preparation consists only of switching on bilge pumps and extending a trim vane, requiring only 4 minutes. The double-skinned nature of the lower hull above the tracks aids in floatation, as does the additional flotation aids built into to the sides, front, and rear faces.

Twilight 2000 Notes: The "Late" modifications would have been only starting and most Epbv-3022s would not have them. In particular, GPS would not be installed on them in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
Epbv-3022 (Early)	$212,341	D, A	500 kg	13.8 tons	3+3	12	Passive IR (D), Image Intensification (Cupola)	Shielded
Epbv-3022	$393,341	D, A	500	13.9	3+3	12	Passive IR (D, Cupola), Image	Shielded

(Mid)			kg	tons			Intensification (Cupola)	
Epbv-3022 (Mid) w/Appliqué	$396,631	D, A	325 kg	14.6 tons	3+3	12	Passive IR (D, Cupola), Image Intensification (Cupola)	Shielded
Epbv-3022 (Late)	$261,424	D, A	600 kg	13.7 tons	3+2	12	Passive IR (D, Cupola), Image Intensification (Cupola), Thermal Imager (Roof)	Shielded
Epbv-3022 (Late) w/Appliqué	$264,714	D, A	425 kg	14.4 tons	3+2	12	Passive IR (D, Cupola), Image Intensification (Cupola), Thermal Imager (Roof)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config*	Susp	Armor
Epbv-3022 (Early)	147/105	37/23/4	285	120	CiH	T2	TF2 TS2 TR2 HF6 HS3 HR3
Epbv-3022 (Mid)	147/104	37/22/4	285	122	CiH	T2	TF2 TS2 TR2 HF6 HS3 HR3
Epbv-3022 (Mid) w/Appliqué	140/99	35/21/4	285	128	CiH	T2	TF2 TS2 TR2 HF7 HS4 HR3**
Epbv-3022 (Late)	148/106	37/23/4	285	119	CiH	T2	TF2 TS2 TR2 HF6 HS3 HR3
Epbv-3022 (Late) w/Appliqué	141/101	36/22/4	285	125	CiH	T2	TF2 TS2 TR2 HF7 HS4 HR3**

Vehicle	Fire Control	Stabilization	Armament	Ammunition
Epbv-3022	+2	None	20mm m/47D Autocannon	505x20mm

*The Epbv-3022 has sort of a “double Crew-in-Hull” configuration, in that if a turret hit is indicated from the front or rear, it is 50% likely that the gun turret or the FIST turret will be hit. From the left side, 75% of turret hits will be on the FIST turret, and 25% on the gun turret; from the right side, 90% of all turret hits will be on the gun turret, and 10% on the FIST turret. Other odd angles can be extrapolated from this.

**With the appliqué armor kit, the Epbv-3022 has a hull deck, turret deck, and hull floor AV of 3.

ACV-15 AFOV

Notes: This version of the ACV-15 is meant for the artillery observation post (ie, FIST) role. The turret is removed and an extendible 3-meter mast with sensors is on the roof of the vehicle. This mast has night vision equipment, day vision equipment, a laser rangefinder, and a laser designator. Inside the vehicle is a system similar to the US Army's TACFIRE (where fire solutions are produced and transmitted directly to fire support units by secure radio). This system was upgraded in the early 2000s, installing better, more capable computers and improved vision equipment, as well as the ability to transmit TV transmissions using the input from its vision equipment and a counterbattery radar on the mast. The ACV-15 AFOV is equipped with a GPS system and a surveying system to help properly locate the gun or mortar positions of a battery. The radio suite includes two long-range data-capable radios, one other long-range radio, one medium-range radio, and a short-range radio. The ACV-15 AFOV also carries four digital field telephones and 200 meters of commo wire. Some, but not all, of these vehicles are equipped with air conditioning, but all have a heater.

The ACV-15 AFOV, in general, uses a hull similar to the AIFV, though the armor is a bit better than the AIFV, and some additional attention is paid to belly armor. The hull front and sides incorporate spaced armament with ceramic sandwich panels. The engine remains a Detroit Diesel 6V-53T developing 300 horsepower, along with a fully automatic transmission along with a conventional driver's station. The ACV-15 is fully amphibious, propelled in water by its tracks. The rear of the vehicle has a powered ramp with a door in it. The interior is extensively reconfigured for the FIST role, carrying the artillery fire direction computers along the right side and some of the radios on the right, some forward, and some on the left. The three operators sit facing the computers to the right. The firing points have been deleted and plated over. Roof hatches have been deleted, with the exception of a manually-rotating cupola with a pintle-mounted machinegun.

Twilight 2000 Notes: In the Twilight 2000 timeline, perhaps one in ten are of the "Late" variety.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
ACV-15 AFOV (Early)	$314,553	D, A	710 kg	12.9 tons	2+3	9	Passive IR (D), Image Intensification (Mast), Thermal Imager (Mast)	Shielded
ACV-15 AFOV (Late)	$416,578	D, A	710 kg	12.9 tons	2+3	9	Passive IR (D), Improved Image Intensification (Mast), FLIR (Mast), Counterbattery Radar (Mast)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
ACV-15 AFOV	154/108	33/24/3	416	134	Stnd	T2	HF10Sp HS7Sp HR6*

Vehicle	Fire Control	Stabilization	Armament	Ammunition
ACV-15 AFOV	None	None	M-2HB (C)	1000x.50

*Belly armor is 4.

FMC/GDLS M-981 FISTV

Notes: The M-981 FISTV is a modification of the M-901A1 ITV (Improved TOW Vehicle), and externally resembles the ITV to a high degree. This resemblance is intentional; an ATGM vehicle like the M-901A1 is a much lower priority target than a FISTV that is spotting for and partially controlling what could massive amounts of indirect fire. The resemblance is so uncanny that the hammerhead mount that contains the M-981's spotting gear is virtually identical to the M-901A1's hammerhead mount (except for some inconspicuous lens openings in the center of the mount where the M-901A1 has its sights for its TOW missiles), and the place where the openings for the TOW normally on the M-901A1 are covered with black paint that is hardened against wear. The M-981 is used in numbers by Egypt and Israel; though the US still uses the M-981, it is quickly being supplanted by the M-7 BFIST and the M-1131 Stryker FISTV. In the US military, the M-981 had a severe weakness once the M-1 Abrams and Bradley came into service – it could not keep up with the faster Abrams and Bradley, and it could not match the Bradley's armor. In addition, the M-981 has a top-heavy design (the M-981's hammerhead is much heavier than that of an M-901), and it is therefore prone to rollovers and is unbalanced to the point that large Styrofoam flotation panels much be attached to the sides to keep it afloat when swimming. (It should be noted that in the countries using them, swimming the M-981 is to be done only in emergencies and for certain tactical situations, and the Styrofoam panels are almost never carried or mounted.) It is lightly armed, even more so than its M-113 base vehicle. It cannot move with the hammerhead deployed (which would make the sights useless and the vehicle even more top-heavy). The sights and vehicle navigation equipment in early versions included gyroscopes; these took about 10 minutes to spin up enough to provide proper targeting. The M-981, however, was the first designated FIST vehicle, and was a novel concept at the time of its introduction.

The Base M-981

Internally, however, the M-981 is very different from the M-901A1. The hammerhead mount contains the sights and targeting gear, called the Ground/Vehicular Laser Locator Designator (commonly called a "GLID"), which includes a laser designator. The hammerhead mount also contains day and night vision equipment. The M-981's hammerhead mount also uses the vehicle's sights to transmit a target picture to the vehicle's computer and identifies the target, if it is a vehicle. The chance of the vehicle being able to properly identify the target vehicle is 13 in 20. The hammerhead mount allows the M-981 to take up a hull-down position and raise the sights above the terrain, thus protecting the M-981. Internally, the M-981 has an inertial navigation system, and early versions had two long range radios (one data-capable), a medium-range radio, and a short-range radio. It also has downlink equipment to allow the crew to view through the sights in the hammerhead mount and use its laser rangefinder. The M-981's computer is primarily used for identifying targets, providing information about the targets, and calculating targeting information. The computer can provide firing solutions, but this is a secondary if not a tertiary solution, is very limited, and rarely used.

Common Features with the Base M-113 Chassis

The M-981 is based on the M-901A1 ITV, which is itself based on the M-113A2 APC. The M-981 retains the M-113A2's rear ramp with a door in it, but the roof hatch is deleted. The commander's cupola is smaller than that of the M-113A2 and is situated further forward than that of the M-113A2; in addition, the hatch opens to the right. This keeps the cupola clear of the hammerhead mount whether it is in the up or down position. The M-981's cupola has a pintle mount, but it is armed with a smaller weapon, since the M-2HB is too big for the cupola's position, and because the M-901A1 also uses a smaller weapon. The commander's weapon is normally an M-240D (originally, an M-60), but later, many M-981's traded the heavier machinegun for an M-249 SAW. M-981's also commonly carry an M-249 in a storage rack, in addition to the crew's personal M-16s or M-4s. Like the M-113A2, the fuel tanks are in the side walls of the M-981. The driver's position is in the left front, and has three vision blocks to the front and one somewhat to the left. The center front block can be removed and replaced by a night vision block. The original M-981 uses a tiller system for controlling the vehicle and for braking. The M-981 uses the M-113A2's superior torsion bars, which give superior off-road performance and a smoother off-road ride. The M-981 uses the M-113A2's engine, transmission, and drive train. The engine of the M-981 is a turbocharged General Motors 6V53T diesel engine developing 212 horsepower. Like the M-113A2, the M-981 has pivot steer capability, but in the US Army, the pivot steering capability was usually disabled because it often led to thrown tracks. On the front fenders are a cluster of four smoke grenade launchers each.

The M-981A3

The M-981A3 is the designation for a later iteration of the M-981 that first appeared in the mid-1990s, and is the form that most M-981s used by Egypt and Israel, as well as the US, take. It consists of several modifications, including drive train modifications, an automatic transmission, and the use of the RISE version of the 6V53T engine which develops 275 horsepower. The M-981 is controlled using a conventional steering yoke, a brake pedal, and a gas pedal, instead of the physically tiring tiller control system. The pivot steer system was made much more reliable and is normally enabled on the M-981A3. The driver's passive IR night vision was replaced with a thermal imager. The fuel cells in the walls of the M-981 were moved to the rear on the M-981A3. The drive train, transmission, engine, and suspension improvements in the M-981A3 render the M-981A3 unable to swim "officially," though if the Styrofoam flotation panels are added, the M-981A3 can actually swim. The vehicle is slow in the water, has almost no freeboard, and is almost constantly in danger of sinking. If you want to swim your M-981A3, you do so at your own risk.

Internally, the M-981A3 carries two data-capable long-range radios, one medium-range radio, one short-range radio, one radio designed specifically for communicating with fixed-wing aircraft, and one radio specifically designed for communicating with naval assets. The M-981A3 has a laser designator and the computers are far more adept at providing fire solutions. The computer and the

communications gear automatically categorize requests for information by necessity and can provide information to up to four receiving FDCs, assuming the sights in the hammerhead mount and the crew can keep up. The M-981A3 has upgraded batteries and there are more of them to give the M-981A3 additional capability of running its electronics with the engine off. The hammerhead mound can be retracted much faster than on the M-981. Day and night vision equipment has been improved, including the inclusion of an advanced image intensifier and a FLIR instead of a thermal imager. A GPS and map module has been added. Steps have been taken to automatically protect a crewmember directly using the sights from blinding lasers. A minor piece of added kit is a water/ration heater hotplate.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-981	$405,899	D, A	525 kg	12.7 tons	4	10	Passive IR (D), Image Intensifier (Head), Thermal Imager (Head)	Shielded
M-981A3	$368,772	D, A	490 kg	14 tons	4	10	Passive IR (D), Advanced Image Intensifier (Head), FLIR (Head)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-981	121/85	27/18/3	360	139	CiH	T2	TF2 TS2 TR2 HF6 HS4 HR4
M-981A3	133/94	30/20/3	360	150	CiH	T2	TF2 TS2 TR2 HF6 HS4 HR4

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-981	None	None	M-60 or M-240D or M-249 (C)	800x7.62mm or 1100x5.56mm

GDLS M-7 BFIST

Notes: Often called simply the BFIST or sometimes referred to as a BFSV, the M-7 BFIST shares much in common with the M-7 ACP, and both are modifications of the M-2 Bradley IFV. BFISTS first appeared in the mid-1990s in the wake of Desert Storm, where the M-981 showed its inability to keep up with the fast-moving Bradleys and Abrams. (Ironically, the BFIST had its own problems keeping up with the standard Bradley and the Abrams, though tactical employment doctrine was much different by then.) The original BFIST was based on the M-2A2ODS variant of the M-2 Bradley, and has the upgrades and improvements of that version. The BFIST's performance during Operation Iraqi Freedom was impressive, able to provide highly mobile spotting elements for artillery, mortar, and MLRS units, and greatly improving the commanders' situational awareness, as it can be used to an extent as a reconnaissance vehicle (though it was not designed for that purpose). As of the time I write this (early June 2011), no sales of the M-7 BFIST have been made to other countries. The BFIST also offers much better firepower than that of the M-981, as well as much superior mobility and protection for its crew.

The Current BFIST – The M-7 BFIST

The current BFIST is, as stated above, based on the M-2A2ODS, and externally resembles that vehicle to a high degree. A telling point, however, is the box on the left side of the turret; it is wider and longer than the TOW launcher of the M-2A2ODS, because it carries the bulk of the BFIST's mission equipment and sensors, including night vision gear, day vision gear, and a laser rangefinder and laser designator. Another telling feature is the extra radio antennas. The turret and the rest of its armament is retained, though ammunition load is reduced. Internal stowage is rearranged to take into account the much altered mission, though often there is stowage for one or two AT-4 rocket launchers. The gunner's and commander's positions are retained, along with their associated sighting equipment and sensors. Internally, however, the layout is much different; in the space where the dismount crew and their equipment is normally carried, there is a single crewman who is virtually surrounded by his computer, radios, and other mission equipment and stowage. The computer of the M-7 BFIST is sort of an intermediate step up from that of the M-981A3, somewhat improved in capability, but primarily improved in the areas of speed, storage, ruggedness, and the ability to go quickly into action, gather information from the sensors, and begin to provide information on targets. The amount of targets the M-7 BFIST's computer is capable of keeping track of is classified, but I have heard numbers ranging from four to seven. The computer's accuracy in identifying enemy vehicles is improved in capability and speed from the M-981A3. Though it reduces accuracy somewhat, the M-7 BFIST is capable of spotting for fire units and designating targets while the M-7 BFIST is moving at half-speed. The turret crew also act as spotters for the vehicle, and they can feed the information from their sights to the computer, as well as provide some limited positional

information. Information from the primary sensors are automatically downlinked to the hull crewman. The radio suite includes two data-capable long-range radios, one long-range radio (not data-capable), and two short-range radios, as well as a radio for communicating with fixed-wing air assets and one for communicating with naval assets.

Features retained from the basic M-2A2ODS include the armor improvements, lugs for ERA on the sides, the redesign of the turret armament, and provisions for the mounting of appliqué armor or bar/slat armor. The engine is an improved version of the M-2 and M-2A1's VTA-903T engine, developing 600 horsepower, and able to diesel, alcohol, or the military's current standard, JP-8. Retractable metal covers are mounted to protect the driver's vision blocks, and a wire guard has been mounted to protect the driver from low-hanging wires. Two others were also mounted, on the turret to protect the commander and gunner. The commander and gunner have seats inside the hull for use when the vehicle is not in action. Excess internal space, however, is at a premium, and those seats are usually folded and the space used to stow gear. The M-7 BFIST has an eye-safe laser rangefinder and designator, an IFF system, thermal imaging for the driver, and a system to jam radio-guided and IR-guided missiles (regarded as only partially-effective; on a roll of 12 in 20 against radio-guided missiles and 10 in 20 for IR-guided missiles they are decoyed away from the M-7 BFIST). Part of the system involves the emission of low-grade radio-jamming signals, and the launch of flares (eight carried) and IR-obscurant smoke. Like many vehicles in Iraq and Afghanistan, the BFIST also has special panels on the sides, front, and roof; though they may look like appliqué armor, they in fact look a certain way (again classified) to observation devices to help cut down on fratricide. M-7 BFISTs are equipped with an NBC overpressure system with a collective NBC backup.

The BFIST's successor – The M-7 BFIST A3

The M-7 BFIST is currently undergoing upgrades which will are based on the M-2A3, along with improvements to the internal computer, the day and night sensors in the external pod, and extended-range laser rangefinder and laser designator (effectively doubling the range of both). The largest change in the M-7 BFIST A3 (also called the Bradley FIST A3, Bradley A3 FIST, or the M-7A3 BFIST) is the addition of a Battlefield Management System, similar to that on the M-1A2 Abrams and M-2A3 Bradley, which is managed by the crewmember in the hull. The computer improvements also extend to the rest of the crewmembers; the commander and gunner in particular have more direct input of targets they spot into the computer system, which is much more flexible and capable with increased storage. The crewmember in the hull has at least two large displays and one small one to monitor the tactical situation and the vehicle situation. The inertial guidance of the M-7 BFIST has been upgraded to GPS, though the inertial guidance system has been retained as a backup/secondary system.

Like the M-2A3, the M-7 BFIST A3 has a CIS which gives it a hunter-killer capability, aiding in its defense. The day night vision of the commander and the gunner was upgraded, and the M-7 BFIST A3 also received the IBAS system allowing for automatic boresighting of the ChainGun on the move and calling for an improved fire control computer. Likewise, the gunner's sights have received the stabilization upgrades of the M-2A3. The day and night vision equipment now has a magnification of 1x of 4-48x and twice the field of view of the M-7 BFIST. And like the M-2A3, the turret of M-7 BFIST A3 has a thin layer of titanium armor added to the turret roof, and a low-power air conditioner. In short, the M-7 BFIST A3 has been upgraded to M-2A3 standards, and now has virtually all of the M-2A3's improvements as well as improvements to the mission equipment package.

Though I haven't been able to find any specific information on the subject, I can see no reason why the M-7 BFIST and BFIST A3 could not be fitted with the BUSK kit. This, however, is simply my guess and **should not be taken as any sort of fact.**

Twilight 2000 Notes: The M-7 BFIST made an appearance in the Twilight War, though it was a rare asset, with perhaps 40 making it overseas and another 40 being kept in the US. The M-7 BFIST A3 was not available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-7 BFIST	$647,624	D, A	550 kg	29.9 tons	4	14	Thermal Imaging (D, G+C, Pod), Image Intensification (Pod)	Shielded
M-7 BFIST A3	$969,324	D, A	490 kg	30.8 tons	4	14	Thermal Imaging (D), FLIR (C), 2nd Gen FLIR (G, Pod), Image Intensification (G), Advanced Image Intensification (Pod)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor

M-7 BFIST	110/83	23/18	662	156	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp
M-7 BFIST A3	108/82	23/18	662	162	Trtd	T4	TF11 TS8 TR6Sp HF13 HS8Sp HR6Sp

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-7 BFIST	+3	Fair	M-242 25mm ChainGun, M-240C	250x25mm, 1100x7.62mm
M-7 BFIST A3	+3	Good	M-242 25mm ChainGun, M-240C	250x25mm, 1100x7.62mm

*Floor armor for the M-7 BFIST and M-7 BFIST A3 is 7; the M-7 BFIST A3 also has a turret roof AV of 7.

GDLS M-1131 Stryker Fire Support Vehicle (FSV)

The FSV is what was once known as a FIST-V (Fire Support Team Vehicle). It's purpose is to provide fire direction and reconnaissance for artillery and mortar elements of an attacking army. In this role, the FSV is equipped with the M-707 Stryker Mission Equipment Package, which includes all the electronics, computers, software, and hardware needed to direct and control indirect fires. This includes a BMS, the ability to directly input fire coordinates into artillery and mortar fire computers equipped with a radio data link, and extra information on the state of indirect fire assets, including what ammunition they have and their state as far as whether they are moving, setting up, or ready to fire. The FSV carries a raised module on the rear of its hull which carries enhanced sensors, including day telescopes, an advanced image intensifier (with a range of 15 kilometers), and an advanced FLIR (range 10 kilometers), as well as a laser and GPS rangefinder and a laser designator. The laser rangefinder and laser designator have enhanced range (6 kilometers). The FSV does not normally have an RWS – the raised turret would interfere with the sensor package. It does normally have a single cupola with an M-2HB, or rarely, an M-3M or Mk 19. The interior includes the BMS and tactical fire control system with multiple screens and fire solution and direction computers, as well as two data-capable long-range radios, another long-range radio, and a short-range radio. The FSV does not carry a dismount team, but a FIST (Fire Support Team), which consists of 3 men; the FSV also carries a vehicle commander who mans the cupola and the driver. The FSV normally has a priority radio frequency or digital link to the Stryker Command Vehicle.

As a variant of the Stryker, the FSV has most of its automotive, electrical, and hull components in common with the base Stryker. The FSV is equipped with a 350-horsepower turbocharged diesel engine coupled to an automatic transmission. Some of the automotive components have redundancies. The engine used is unusually quiet, and when burning JP8 fuel, also has a reduced exhaust plume. The FSV has ABS and traction control for more positive braking and traction, especially off-road, and it has a locking differential. The ABS is on the last three axles, and those wheels also have power brakes. The tires are run-flat and puncture-resistant. The FSV is normally 8x8, but can be switched to 8x4 for road use; in this case, the four rear wheels become the drive wheels. The FSV has central tire pressure regulation. The crew and troop compartments have air conditioning and heating, as well as an automatic fire detection and suppression system. The engine compartment and fuel tanks also have an automatic fire detection and suppression system. Boxes are mounted on the rear third of the sides of the FSV to store vehicle, crew, and troop equipment; nonetheless, like virtually all military vehicles in the field or combat, crew and troop equipment is often carried strapped to the top, sides, or glacis. (Incidentally, this strapped-on equipment can provide some minor "armor.")

The base armor of the FSV is a steel/ceramic sandwich, giving it the equivalent of spaced armor over much of its hull. The floor and suspension are also reinforced to give it enhanced mine and IED protection. However, the FSV is almost never seen in combat with its cage of bar/slat armor, which surrounds the vehicle except for the area of the rear where the ramp opens and closes (shots at the rear of the FSV are 20% likely to hit the cage before they hit the vehicle). This protection extends to about 30 centimeters above the deck of the vehicle. The FSV can also take a MEXAS composite appliqué armor kit, which can be applied to every face of the vehicle, to varying degrees. The bar/slat armor and the MEXAS appliqué armor can be used in conjunction with each other to provide superior protection to the vehicle, but this does substantially increase the weight and mobility of the FSV. IR suppression is also employed on the FSV; detection by IR devices, thermal imagers, and FLIRs is one level more difficult, as is targeting with IR-guided missiles. When not equipped with the bar/slat armor, the rounded shape gives it some stealth characteristics; detection by radar in this case is at -3 and targeting by radar-guided weapons is one level more difficult. (The use of bar/slat armor negates this advantage.)

Twilight 2000 Notes: Like other Stryker variants, the FSV is not available in the Twilight 2000 timeline.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-1131 FSV	$555,315	D, A	1 ton	17.4 tons	3	9	Passive IR (D Rear), Image Intensification (D), Advanced Image Intensifier (Pod), FLIR (Pod)	Shielded

M-1131 FSV w/Bar/Slat	$557,461	D, A	900 kg	17.9 tons	3	9	Passive IR (D Rear), Image Intensification (D), Advanced Image Intensifier (Pod), FLIR (Pod)	Shielded
M-1131 FSV w/MEXAS	$559,973	D, A	425 kg	19.7 tons	3	11	Passive IR (D Rear), Image Intensification (D), Advanced Image Intensifier (Pod), FLIR (Pod)	Shielded
M-1131 FSV w/MEXAS & Bar/Slat	$562,119	D, A	300 kg	20.2 tons	3	11	Passive IR (D Rear), Image Intensification (D), Advanced Image Intensifier (Pod), FLIR (Pod)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-1131 FSV	147/74	34/18	201	179	Stnd	W(8)	HF9Sp HS6Sp HR6 (1)
M-1131 FSV w/Bar/Slat	143/73	33/17	201	183	Stnd	W(8)	HF11Sp HS8Sp HR8Sp (2)
M-1131 FSV w/MEXAS	129/64	30/16	201	202	Stnd	W(8)	HF15Cp HS10Cp HR7Sp (3)
M-1131 FSV w/MEXAS & Bar/Slat	126/63	29/15	201	206	Stnd	W(8)	HF17Cp HS12Cp HR8Sp (4)

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-1131 FSV	None	None	M-2HB or M-3M or Mk 19 or M-240D (C)	2000x.50 or 430x40mm Grenades or 3200x7.62mm

(1) Roof AV is 3; Floor AV is 4Sp.
(2) The bar/slat armor provides a sort of “double spaced armor” effect depending upon the face it hits – if the front or sides are hit, 4D6 damage is removed from the hit’s penetration if the Stryker is hit by HE-type rounds. The rear face’s bar/slat armor protects the rear face only on 20% of hits – the rest of rear face hits have only an AV of 6. Roof AV is 3, Floor AV is 4Sp.
(3) Roof AV is 4, Floor AV is 5Sp. Hits from certain angles (front and sides) will have a “composite-spaced” armor effect – divide incoming hits by two for HE-type warhead hits, then subtract 2D6.
(4) Roof AV is 4, Floor AV is 5Sp. Hits from certain angles (front and sides) will have a “spaced-composite-spaced” effect – divide incoming hits by two for HE-type warhead hits, then subtract 4D6.

United Defense M-992 FAASV

Notes: The FAASV (Field Artillery Ammunition Support Vehicle) began as a private venture by BMY (later merged with FMC to become United Defense). The idea was to produce a mechanized supply vehicle that automated or nearly-automated almost every facet of resupplying the M-109 series of self-propelled howitzers, and/or keep them supplied during a long fire mission, and would be a superior resupply vehicle to M-548s in service at the time. Though the M-992 was originally designed to be matched specifically to the M-109A2 howitzers in US service at the time, they have been progressively modified and upgraded for other M-109 versions, as well as for use with the M-107, M-108, and M-110, and several countries produce near-clones of the M-992 based on their own indigenous chassis or have vehicles with similar functions. Other countries have found that with a little modification (sometimes “field-expedient” in nature) that the M-992 can also be used with some of their other SP artillery pieces, and even with heavy mortars or ground-mounted guns. In the US military and in the militaries of several countries worldwide, the M-992 has replaced earlier, less capable vehicles. Initial date into US Army service was 1985. Crews often refer to the M-992 as the CAT (Carrier, Ammunition, Tracked).

The Basic M-992

The chassis of the M-992 is in its lower half virtually identical to that of the M-109A2, and automotively and suspension-wise it uses the same components, as well as the same driver’s station. However, the turret is replaced by a large semicircular domed

superstructure which is flattened on top. The driver's compartment is in the same place as on an M-109, but on the M-992 this places him just in front of the raised superstructure. On the center part of the raised superstructure is a manually-operated cupola for the commander which has a pintle mount. Within this superstructure is what makes the M-992 a FAASV. Racks are installed which, on the base M-992, carry a total of 90 standard 155mm projectiles, three Copperhead 155mm CLGPs, 99 propelling charge canisters, 13 boxes of various fuzes, and one primer box. When in use, the M-992 is backed up to the rear of the M-109 (or vehicle in question), and a conveyor belt is extended into the open doors of the rear of the M-109's turret. Six rounds per minute can be fed to the gun vehicle. A second conveyor can be extended to the ground on the either side of the vehicle to load and/or pass ammunition from stacks or piles on the ground. A crew of three are required to man each conveyor, and two soldiers oversee the process and quickly fix any problems which might arise during the loading or passing process. They are assisted by an electro-hydraulic automatic stacker. The interior of the M-992 leaves little room for anything else (especially crew equipment or anything else extra), but the M-992 does have a 5kW APU to allow it to continue to function at full speed with the engine switched off, as well as another 5kW APU dedicated to charging the vehicle's batteries and running other electronics such as radios.

The M-992 is equipped with a heater and an automatic fire detection and suppression system. The rear door of the M-992, when opened, opens upwards hydraulically and fits to the rear doors of the M-109 to form a protective shell. The M-992 is equipped with an NBC overpressure system, with a collective NBC backup; in addition, the roof of the superstructure has a passive automatic chemical detection sensor. Vehicle armor is largely of aluminum, and provides only limited protection, primarily against shell fragments and small arms. The suspension consists of torsion bars connected to seven roadwheels on each side, and the front and rear sets of roadwheels have shock absorbers; the ride is reasonable, but not great. The M-992 is powered by a Detroit Diesel 8V71T 405-horsepower turbocharged engine, coupled to an automatic transmission. In addition to the side hatches for ammunition loading (found on the lower hull at the rear of either side), there is a large hatch on the right side at the front of the superstructure to crew entry and exit. This hatch has a vision block, but no sort of firing port.

Egyptian M-992s have a slight modification not found on other M-992s: Attached to the front of the superstructure is a light crane with a capacity of 626 kilograms, which can move ammunition pallets or cargo around and onto the M-992.

The M-992A1

The primary modification to the M-992A1 is an upgraded version of 8V71T engine, developing 440 horsepower for more speed. The engine was also modified for more reliability in cold weather and in hot and dusty conditions. Operating crew requirements have been reduced, with only two men being required to man the conveyor belts. Ammunition storage is slightly modified; the M-992A1 carries only 11 boxes of fuzes, as some newer rounds have unitary fuzes. A GPS navigation system was added. The M-992A1 was regarded as an interim upgrade, prior to the introduction of the M-992A2, which would be designed specifically to operate with the M-109A6 Paladin. The M-992A1 was to allow operations with the Paladin to begin. There are slight differences in length and some armor improvements.

The M-992A2

The primary modifications to the M-992A2 were to the rear door, propellant charge racks, and conveyor system to make it more compatible with the M-109A6 Paladin. Other upgrades were largely incremental, including improvements to the engine, transmission, electrical system, and drive train, as well as a slight suspension height adjustment. Relocations of the engine fuel heater and the internal crew heater were carried out. Propelling charge bags carried was reduced to 96. Improvements in components have actually lightened the vehicle.

In 2005, the M-992A2 MACS (Materiel Change System) upgrade was carried out. This upgrade was aimed primarily at supporting the new types of ammunition available, including RAP rounds, base-bleed rounds, and the soon-to-be-coming Excalibur CLGP. A minor change under the MACS program is the addition of a third APU – a 10kW APU, which can be used to power the M-992A2, another M-992A2, or gun vehicle. The number of standard projectiles carried is increased to 95, and the number of CLGP's to four, but since some of these projectiles are unitary and some of the propelling charge bags are more powerful, their number has been reduced so that 73-80 are carried depending upon the ammunition load carried. The main conveyor system has been replaced with the MACS conveyor system, which primarily helps in the assembly or rounds and charges, but also increases round passing to seven rounds per minute. Improvements in components have actually lightened the vehicle (in relation to the M-992A1), despite the addition of the extra APU and an upgrade in armor.

The M-1050

When the M-110 203mm SP Howitzer was still in service in the mid-1980s and early 1990s, a version of the M-992 was designed for use with the M-110. This is largely the same as the M-992, but as the rounds and charges are larger, the M-1050 carries 48 203mm projectiles, 53 propelling charges, 7 boxes of fuzes, and one primer box. The main conveyor belt is also slightly modified, as is the rear hatch. These vehicles have since been converted, some to M-992A2 FDCV vehicles, and some to M-992A1 and M-992A2 FAASVs.

The M-992A2 FDCV

The M-992A2 FDCV (Fire Direction Center Vehicle) takes an M-992A2 base and greatly modifies the interior to make into a sort of super-FDC vehicle. The FDCV can function as both an FDC and a more general battery command post; one M-992A2 FDCV can replace four M-1068's in the FDC/battery command post role. The M-992A2 FDCV is equipped with a full Battle Management System

(BMS), with the associated computers and storage, and LCD screens and storage for maps and suchlike. The computers also collate and produce fire solutions for an entire battery if necessary. The M-992A2 FDCV is equipped with GPS that ties into the BMS, and the computers can also directly receive information from appropriately-equipped FISTVs and fire control parties. The M-992A2 has a survey system to help place the guns, mortars, or MLRS accurately, and it can directly input its computer information to fire control computers used by batteries' guns if they are so equipped. The FDCV can therefore give the batteries nearly instantaneous firing information, as well as keep aware of the general tactical situation. The radio suite includes three data-capable long-range radios, two short-range radios, a radio for communicating with fixed-wing assets, and a radio for communications with naval assets. In addition, the FDCV has a very-long-range VHF radio; in a passive role, its listening range can reach many thousands of kilometers, while in the active transmitting role, one can expect up to 500 kilometers range. The M-992A2 FDCV also has a switchboard and carries 20 field telephones and 500 meters of commo wire. The M-992A2 FDCV has a 60kW APU, which can power the FDCV's electronics as well as those of another vehicle.

Twilight 2000 Notes: The M-992A2 FDCV does not exist in the Twilight 2000 timeline. Most M-992s in the Twilight 2000 timeline are M-992A1s, though a few are M-992A2s; the M-1050 is also still in common use, and has produced a further **Twilight-only** variant: the M-1050A1, with the improvements of the M-992A1.

Vehicle	Price	Fuel Type	Load	Veh Wt	Crew	Mnt	Night Vision	Radiological
M-992	$604,063	D, A	400 kg	28.8 tons	8	20	Passive IR (D)	Shielded
Egyptian M-992	$604,859	D, A	325 kg	28.9 tons	8	20	Passive IR (D)	Shielded
M-992A1	$631,524	D, A	500 kg	28.8 tons	6	20	Passive IR (D)	Shielded
M-992A2	$630,581	D, A	840 kg	26.1 tons	6	20	Passive IR (D)	Shielded
M-992A2 MACS	$672,497	D, A	740 kg	26.6 tons	6	20	Passive IR (D)	Shielded
M-992A2 FDCV	$462,069	D, A	640 kg	26.8 tons	5+4	22	Passive IR (D)	Shielded
M-1050	$428,940	D, A	500 kg	28 tons	8	20	Passive IR (D)	Shielded
M-1050A1	$429,900	D, A	600 kg	28 tons	8	20	Passive IR (D)	Shielded

Vehicle	Tr Mov	Com Mov	Fuel Cap	Fuel Cons	Config	Susp	Armor
M-992	105/73	25/17	511	213	Stnd	T4	HF6 HS3 HR3
Egyptian M-992	104/73	25/17	511	215	Stnd	T4	HF6 HS3 HR3
M-992A1	113/79	26/19	511	228	Stnd	T4	HF7 HS4 HR3
M-992A2	124/87	29/21	511	205	Stnd	T4	HF7 HS4 HR3
M-992A2 MACS	122/85	28/21	511	209	Stnd	T4	HF9 HS4 HR4
M-992A2 FDCV	120/84	28/21	511	211	Stnd	T4	HF7 HS4 HR3
M-1050	108/75	26/18	511	207	Stnd	T4	HF6 HS3 HR3
M-1050A1	116/81	27/20	511	221	Stnd	T4	HF7 HS4 HR3

Vehicle	Fire Control	Stabilization	Armament	Ammunition
M-992/M-1050	None	None	M-2HB (C)	840x.50