

Designing the Future Infantry Vehicle

Do We Want a Tank with Dismounts?

Or a Close Assault Vehicle for Mounted Infantry?

by Stanley C. Crist

What is the optimum configuration for the future infantry vehicle? The assumption expressed in most essays on the subject is that it will be an evolution of the Bradley Fighting Vehicle, but is that really the best choice? Or might there be other options that would be better suited to the challenges that lie ahead? Answering those questions will require an examination of the alternatives, from existing hardware to theoretical concepts.

The Armored Personnel Carrier

Although tanks were invented and employed by some of the combatants in World War I, armored transport for foot soldiers was not made reality until the eve of the Second World War. At that time, the German Wehrmacht and the U.S. Army simultaneously developed the concept of mechanized infantry, and created the armored personnel carrier (APC) to equip their high-mobility units.¹ Like its German counterpart, the M3 “half-track” was a thinly-armored, open-topped vehicle that provided some protection from small arms fire and shrapnel, but left the infantry squad vulnerable to air-bursts of artillery shells.

Because of the limitations inherent to its design, doctrine intended that the APC would be employed as a “battle taxi”; that is, it would give the troops a degree of protection en route to the objective, but the infantry would dismount to make the attack while the vehicle remained at a safe distance. In actual use, half-tracks were often driven right onto the objective, thereby enabling the onboard infantrymen to fight while mounted, firing their individual weapons over the sides of the squad compartment.² When the half-track was employed in this manner, the vehicle’s armament — typically a single, pintle-mounted, M2 .50-caliber heavy machine gun (HMG) — added greatly to the firepower of the squad.

After World War II, there was a succession of full-tracked, armored personnel carriers — the M39, M44, M75, and M59

— none of which satisfactorily met Army requirements.³ Finally, in 1960, the M113 APC arrived on the scene. With a hull made of a special aluminum alloy, the “one-one-three” was light enough for parachute delivery, buoyant enough to swim without preparation, yet tough enough to protect the occupants from artillery fragments and rifle bullets.⁴ Also, the troops inside are shielded from artillery air-bursts (a significant weakness of the WWII half-track) when the cargo hatch is shut on the fully-enclosed design, but they are unable to use their weapons until after they exit the vehicle. This is in keeping with the “battle taxi” concept, but — once again — wartime practice overturned peacetime doctrine when the M113 was used in the Vietnam War.

In that conflict, it did not take long for mechanized soldiers to realize that the APC was quite usable for mounted warfare; with the cargo hatch locked open, as many as four men can stand up in the opening to fire their rifles during a mounted attack. Although they were then partially exposed to enemy fire, the risk proved to be well worth the benefits, and the idea was soon taken a step further. By installing a pintle-mounted, 7.62mm machine gun on each side of the cargo hatch, the fightability of the vehicle was essentially triple that of an issue M113, which only had the standard APC armament of a single .50-caliber HMG. With armor shields added to each of the three machine guns, the gunners were fairly well protected from small arms fire, and the configuration became known as the armored cavalry assault vehicle (ACAV).⁵

While the ACAV performed capably in Southeast Asia, there was doubt in the minds of many planners that it would have been adequate for the high-intensity conflict that could have resulted if the Cold War had turned hot. Clearly, the ACAV conclusively proved the validity and usefulness of mounted combat by the infantry,⁶ but it was also apparent that the exposed gunners would be extremely vulnerable to the nuclear, biological, or

chemical (NBC) hazards that might have been encountered in a war against Warsaw Pact forces. After the Vietnam War, a few combat-savvy veterans continued to employ the “A-kit” shield and hatch armor⁷ made for the commander’s cupola, but the “B-kit” shields for the side-mounted M60 machine guns disappeared from use. In contrast, the Israeli Defense Force (IDF) apparently found the ACAV concept worthwhile, and adopted a variation of it that they continue to use to this day. Perhaps because their primary opponents are light infantry, IDF armored personnel carriers are typically armed with three 7.62mm medium machine guns rather than the .50-caliber and two “seven-six-deuces” of the ACAV. Oddly, the Israelis rejected the use of ACAV-type gun shields until about 1996, when gun shields of a more sophisticated design were seen on some IDF M113s operating in Lebanon.⁸

The M113’s minimal level of armor protection is easily defeated not only by the shaped-charge projectiles fired from recoilless rifles and hand-held antiarmor weapons like the RPG-7, but also by the bullets from 12.7mm and 14.5mm heavy machine guns.⁹ This happened numerous times in Vietnam, and to Israeli mechanized units in the Middle East. The IDF has attempted to cope with this by attaching additional armor to many of their M113s, but this effort has only reduced the severity of the problem, not eliminated it.¹⁰ The latest version of the APC to be adopted by the U.S. Army — the M113A3 — is also capable of accepting add-on armor, but such armor has yet to be fielded.

The Infantry Fighting Vehicle

As early as 1963, U.S. Army leaders recognized the limitations of the M113, and initiated a quest for a replacement.¹¹ Nearly two decades later, after some false starts, budgetary difficulties, and program delays, the M2 Bradley infantry fighting vehicle (IFV) was born. In its original incarnation, the Bradley offered four ma-

for improvements over the armored personnel carrier: increased armor protection, superior cross-country mobility, greater vehicle firepower, and *the capability for mounted combat by all of the onboard infantrymen*.¹² This last characteristic was fundamental to the IFV concept as developed by Russia, Germany, and the United States, for it allowed the infantrymen in the M2 (and M2A1) to fight from within the vehicle, under armor.

Although the M2 was made primarily with aluminum alloy of the same type and similar thickness as that of the M113, effectiveness of the armor was increased by the shapes and angles incorporated into the construction, and side skirts of thin steel functioned as spaced armor, providing some additional resistance to penetration. To improve the survivability of the track commander (TC), the open cupola of the APC was discarded in favor of a fully-enclosed, armored turret. Vehicle firepower was made several orders of magnitude greater, as the solitary .50-caliber machine gun of the M113 was superseded by a high-velocity 25mm cannon, a coaxial 7.62mm machine gun, a twin-tube TOW missile launcher, and six 5.56mm firing port weapons (FPWs).¹³

In a move that is both curious and interesting, the Army later abandoned the concept of fighting mounted when it added, on the newer M2A2 and M3A2 vehicles, steel applique armor on the turret and hull, with extended side skirts that block the firing ports on the left and right sides.¹⁴ Apparently, the increased level of protection was deemed more important than the infantryman's ability to fight from within the vehicle. This course of action seems to actually reduce survivability, particularly in the close terrain of jungles, forests, and cities, because the mounted soldiers can no longer neutralize any RPG gunners who attempt to ambush the vehicle from the sides.

In a further note of irony, the steel/aluminum armor combination provided only a negligible increase in protection against the RPG-7, which is able to penetrate an RHA (rolled homogeneous armor) equivalent of up to 600mm¹⁵ — more than 10 times the RHA equivalent of M2A2 armor! This vulnerability was tragically illustrated on 27 February 1991, when a Bradley of 4-66 Armor was struck by an Iraqi RPG round that punched through the crew compartment, instantly killing the driver, severely wounding the TC, and inflicting minor wounds on the gunner.¹⁶ Unquestionably, the armor does offer enhanced protection

from heavy machine gun and autocannon projectiles, but, even so, there were reports from Operation Desert Storm of Bradleys being "holed" by HMG fire.¹⁷

Since the armor configuration of the M2A2 mandates that the infantry team must dismount in order to engage the enemy, it certainly seems that we have come full circle — from battle taxi (the M113), to infantry fighting vehicle (the M2/M2A1), and back to battle taxi (the M2A2). Actually, it might be more accurate to label the M2A2 a light tank — one that carries a small number of infantry, but a light tank nevertheless. As such, it is inferior to the M113 (especially the ACAV version) as a vehicle for mounted combat by the infantry, and it is grossly inferior to the M1 Abrams for tank combat.

The Combined Arms Tank

Although it definitely has a more potent weapon system than the standard APC, the M2A2 has neither the armament nor the armor to allow it to go "head-to-head" with enemy main battle tanks (MBTs). The notion that IFVs only need sufficient gun and armor to do battle with enemy infantry vehicles seems to ignore the lessons of history. As long as they have enough ammunition and time available, tankers have a strong tendency to shoot anything that can be considered a legitimate target, and that certainly includes IFVs. During Desert Storm, for example, 1st Armored Division tankers readily destroyed the many Iraqi BMPs that came into their sights,¹⁸ and there was at least one Bradley gunner who was forced by circumstances to use his 25mm gun to engage a T-55 tank.¹⁹

Rather than continuing to field an infantry-carrying light tank with thin armor and a small-caliber gun, wouldn't it make more sense to produce an infantry vehicle that has the survivability and combat power of a main battle tank? After all, the time is long past when it was acceptable to consider the infantry as expendable "cannon fodder"; the emphasis on keeping friendly casualties to an absolute minimum, as seen in operations conducted since 1990, clearly calls for vast improvements in IFV protection levels. Also, a large-caliber, high-velocity main gun would enable more effective and versatile supporting fires from the vehicle. The trend to increasing the bore size of the main armament of the infantry vehicle is paralleling that of the tank: the M113 has a .50-caliber HMG; the German Marder is armed with a 20mm auto-

cannon; the Bradley has a 25mm weapon; the British Warrior has a 30mm cannon; and Sweden has adopted the CV90, which is equipped with a 40mm gun. It's a safe bet that calibers will continue to increase in the future, so why not skip the intermediate steps and go directly to the 120mm tank gun?

The combined arms tank (CAT)²⁰ is the logical successor to the Bradley series. Like the M2A2, the CAT would carry an infantry fire team, but with the combat capability and survivability of the Abrams main battle tank. So far, the closest thing to a CAT in the real world is the Israeli Merkava, an MBT that has sufficient internal space to transport a few foot soldiers, and a rear hatch that makes ingress/egress practical when under fire. While the Merkava was not designed expressly to be an infantry-carrying tank, it has been pressed into service in that role during some of the fiercest battles in Lebanon.²¹ Some Merkavas have taken multiple hits from antiarmor weapons, but because the shaped charge warheads were unable to penetrate to the interior of the vehicles, in most cases the tank crews (and any onboard infantrymen) were uninjured and able to complete their assigned tasks. In one instance, a Merkava Mk3 survived an astounding 20 hits from antitank guided missiles (ATGMs), with the sole casualty being one crewman who had his head outside the turret!²² It takes little imagination to envision what would happen to a Bradley — and the soldiers inside — if struck by even half that many ATGMs.

Adoption of a CAT would have other advantages beyond greatly magnifying combat power and survivability. Logistics would be simplified and, since there would be only one vehicle type for both Infantry and Armor units, there would no longer need to be separate stocks of parts and tools for IFVs and MBTs. Also, training of crewmen and maintenance personnel would be simplified, because there would be only one set of vehicle operation and maintenance procedures.

The combined arms tank offers a degree of operational flexibility that cannot be matched by either the infantry fighting vehicle or the main battle tank. Unlike the Bradley, the CAT can operate without tank support, because it is a tank. Unlike the Abrams, the CAT can operate without accompanying infantry vehicles, because it has its own onboard infantry. The combined arms tank unites the best characteristics of the IFV and the MBT, and the result is a multi-role

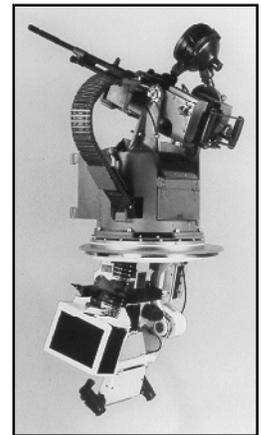
combat vehicle suitable for employment across the operational spectrum.

The Close Assault Vehicle

Unfortunately, the CAT also shares two potentially significant disadvantages with the M2A2: the infantrymen would have minimal spatial awareness while mounted, and no means to engage the enemy until after dismounting. The IDF, which has extensive and prolonged experience with the use of mechanized forces in military operations in urban terrain (MOUT), has addressed these issues with the creation of the Acharsit infantry vehicle.²³ The Acharsit — which can carry ten infantrymen — is created by removing the turret from an obsolete T-55 tank, replacing the old engine with a new, more compact diesel that is offset to the left in the engine compartment, installing a rear access hatch and passageway to the right of the engine, and adding 14 tons of advanced composite armor to the hull. Armed with three 7.62mm machine guns, the Acharsit is a “super-ACAV” that allows the infantrymen to have excellent awareness of the surrounding terrain, enables them to fight while mounted, and gives them near-invulnerability to antiarmor weapons!

The Russians, too, have developed a heavily-armored infantry vehicle (the BTR-T)²⁴ in response to the devastating losses of conventional IFVs during the savage fighting in Chechnya. Also built on a T-55 chassis, the BTR-T differs from the Acharsit primarily in armament, troop capacity, and entry/exit hatches for the infantry. Whereas the Israelis have in essence made a heavy ACAV, the Russians have basically created a heavy IFV; the BTR-T is armed with a 30mm cannon that is externally-mounted on a low-profile, unmanned turret, augmented with an ATGM. Troop capacity is only five men, and the soldiers must enter and leave the vehicle through roof hatches, as the engine and transmission are unchanged from the original.

The Acharsit and BTR-T are low-budget approaches to developing a close assault vehicle (CAV) for mechanized infantry, and the same methodology could undoubtedly be followed to make a similar combat vehicle from M1 tank hulls.²⁵ However, it would be far more desirable to develop a state-of-the-art CAV, with a full-width exit ramp, forward-located engine, maximum armor protection, and optimal armament. As for armament, the auto-cannons currently in vogue do not seem appropriate for infantry vehicles, in part because the excessive



Top, overhead weapon station (OWS) assemblies mount 7.62mm machine guns above day/night sight unit and internal controls. Flexible chute feeds ammunition from 230-round box. Above, an internal view of an M113 with overhead weapon stations installed. Single gun unit is at right. OWS machine guns can be also fired from the open hatch, as shown in top photo. (Photos: Rafael, Israel)

amount of hull space required by the turret system reduces the number of infantrymen that can be carried, but also because use of a large, two-man turret would interfere with any viable weapon stations for the mounted infantrymen.

There should be a minimum of four weapon stations, arranged so that each gunner would have primary responsibility for a separate sector of observation and fire. Fields of fire should be overlapping, though, so that at least two weapons could be brought to bear on targets in any one sector; this would minimize dead spots, and provide some redundancy in case a gun was put out of action.

Armament should be the 25mm objective crew served weapon (OCSW) — if and when it is fielded — or 7.62mm or larger machine guns (5.56mm lacks sufficient range and penetration capability²⁶). Such weapons would be far more effective for mounted combat than either the standard M16A2 rifle or the M231 FPW, which have extremely limited (30-round) magazine capacities, and have very low hit probabilities when fired from a moving vehicle. There are at least three

usable methods for installing the weapons: on a pintle mount (with or without a gun shield), as on Vietnam ACAVs and IDF M113s; on an overhead weapon station (OWS),²⁷ another Israeli development; or on a cupola, similar to that on the Abrams MBT. Pintle mounts would be the easiest to implement, would permit the greatest number of gun positions, and would allow maximum utilization of the vehicle's internal volume; a disadvantage of this method is that the gunners would be exposed to small arms fire, shrapnel, and the NBC threat when manning their weapons.

Weapons mounted on the overhead weapon station can be operated from either within the vehicle, or by the gunner standing up in the open hatch, thereby giving him the choice of having maximum protection or maximum spatial awareness; one drawback to this system is that the OWS mechanism and the gunner's seat occupy a considerable volume, thereby significantly limiting troop capacity. Use of the M1-style cupola would provide comparable protection and about the same number of weapon stations as



Still in development, the Objective Crew-Served Weapon, at right, is touted as the successor to the machine gun. Its 25mm ammunition is seen above in comparison to 40mm and .50 caliber ammo. The ammunition family would include air-burst fragmentation, armor-piercing, and training rounds. (Photo: GD-Primex)



the OWS, but might take up less internal space, and allow a full infantry squad to be carried; also, the cupola would offer a greater degree of traverse than the OWS, especially when operating with open hatches.

All of these options for mounting the vehicle armament allow mounted combat by the infantrymen, with the most significant difference between them being the number of soldiers that can transported when the weapon systems are installed. A decision as to the appropriate size for the infantry team²⁸ would, by default, indicate which weapon mounting method to select. Regardless of the type of weapon and mount that might be chosen, a close assault vehicle would enable the infantry to fight effectively while mounted, with survivability far exceeding that of conventional infantry vehicles.

Conclusion

Pending the creation of either incredibly advanced lightweight armor, or extremely effective active defense mechanisms, it would seem difficult to justify the continued development of lightly armored, infantry combat vehicles. A downsized Army cannot afford the losses of personnel and equipment that have historically occurred when light armor has been employed in high-intensity battles. Whether it's the M113 in Vietnam and Lebanon, the BMD in Afghanistan, the Malaysian Condor in Somalia, or the BMP in Chechnya, engagements with determined opponents who were well supplied with antiarmor weapons have too often resulted in disastrous losses of men and materiel, regardless of whether the battle was won or lost.

There is no reason to think that the M2A2 Bradley would fare any better,

especially in the urban combat scenario that so many individuals think is likely.²⁹ If what is really desired is a tank that carries a few dismounts, don't make the future infantry vehicle another under-gunned, underarmored, light tank — make it a lethal, survivable, combined arms tank. On the other hand, if what is wanted is a vehicle that permits and promotes effective mounted combat by the infantry, then develop a close assault vehicle that has the weapons and armor that will enable the infantrymen of the future to win the mounted fight, and live.

Notes

¹Steven J. Zaloga and LTC James W. Loop, *Modern American Armor* (London: Arms and Armour Press, 1982), p. 48.

²*Ibid.*, p. 48.

³*Ibid.*, pp. 48-50.

⁴U.S. Army TACOM, *M113 World Class Systems Data Book*, 1995, p. 2.

⁵Zaloga and Loop, p. 52.

⁶COL R. R. Battreall, "The Origin of the ACAV," *ARMOR*, Nov-Dec 1998, p. 3.

⁷SFC Gregory T. Dean, "The ACAV Lives...in Bosnia," *ARMOR*, Mar-Apr 1999, p. 50.

⁸LTC David Eshel, "Armored Anti-Guerrilla Combat In South Lebanon," *ARMOR*, Jul-Aug 1997, p. 29.

⁹TACOM *M113 Data Book*, Appendix C, p. 5.

¹⁰Eshel, p. 29.

¹¹Zaloga and Loop, p. 56.

¹²*Ibid.*, p. 58.

¹³*Ibid.*, p. 58.

¹⁴United Defense L.P., *Bradley A2 — M2/M3 Fighting Vehicles* (brochure).

¹⁵Lester W. Grau, "The RPG-7 on the Battlefields of Today and Tomorrow," *INFANTRY*, May-Aug 1998, p. 6.

¹⁶Tom Carhart, *Iron Soldiers* (New York: Pocket Books, 1994), p. 301.

¹⁷CPT Jonathan J. Negin, "DESERT STORM — The First Firefight," *ARMOR*, Mar-Apr 1994, p. 8.

¹⁸Carhart, pp. 243, 265.

¹⁹*Ibid.*, p. 224.

²⁰CPT Harold L. Spurgeon and Stanley C. Crist, "The Tank Is Dead — Long Live The Tank!" *ARMOR*, Mar-Apr 1987, pp. 45-46.

²¹*The Armored Fist* (Alexandria, Va.: Time-Life Books, 1990), p. 88.

²²Eshel, p. 29.

²³*Ibid.*, p. 29.

²⁴Jim Warford, "The Resurrection of Russian Armor: Surprises from Siberia," *ARMOR*, Sep-Oct 1998, pp. 30-32.

²⁵Gregory A. Pickell, "Designing the Next Infantry Fighting Vehicle," *INFANTRY*, Jul-Aug 1996, pp. 22-32.

²⁶MAJ James B. Baldwin, "Machineguns in the Infantry," *INFANTRY*, Nov-Dec 1995, pp. 7-8.

²⁷Rafael, *OWS — Overhead Weapon Station* (brochure).

²⁸The published consensus among currently-serving mech infantrymen is that the Bradley's 4-6 man dismount section is inadequate, and that the future infantry vehicle should be built to carry a full-sized, 9-11 man squad. For a prime example, read the letter by MAJ Mark D. Winstead, *ARMOR*, May-Jun 1999, pp. 3-4.

²⁹MG George H. Harmeyer, "Armor and MOUT," *ARMOR*, May-Jun 1999, pp. 5-6.

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