The Russian BMPT-72 and the Problem of Direct-Fire Support in Armored Formations

by 2LT E.R. Chesley

The tank was originally developed as a direct-fire support platform for infantry, but today the tank is a finely tuned machine designed very specifically to kill other tanks, a task it performs far better than any other weapons system. Unfortunately, in becoming a tank-killer, the tank has lost most of its ability to engage other types of targets.

While the tank has been liberally equipped with weapons and ammunition for dealing with troops, personnel carriers, trucks, field fortifications and air targets, all of these weapons and ammunition represent stopgaps rather than perfect solutions. The tank in and of itself lacks adequate direct-fire capability to deal efficiently with the peripheral threats on the modern battlefield.

Traditionally the tank has been supported in the offense and the defense by mechanized infantry. Mechanized-infantry troops and carriers combine to form a weapons system uniquely suited to support the tank by destroying non-tank targets. However, a tactical gap has developed between the tank and the mechanized-infantry squad that renders the latter ineffective in its fire-support role. The Russians have noted this gap, and they have developed the BMPT-72, a system designed to fill the direct-fire-support role within their armored formations.

This article provides an overview of the BMPT-72 tank-support vehicle and advocates for the creation of an American equivalent.

What is BMPT-72?

The BMPT-72 is an almost completely unique vehicle and, because there is no real equivalent, it is worth asking what exactly it's designed to do. The BMPT-72 is not an infantry fighting vehicle, armored personnel carrier (APC) or cavalry reconnaissance vehicle, and it is certainly not a main battle tank (MBT), so what role does it fill?

The BMPT is the world's first dedicated tank-support vehicle (TSV), a type of vehicle designed specifically to provide direct-fire support for tanks. The BMPT is built on a modified T-72 MBT chassis, meaning it cannot carry infantry. Unlike a T-72, it does not possess a hard-hitting, high-caliber main gun. Instead it is armed with two 30mm autocannons, four anti-tank guided missile (ATGM) tubes and a coaxial 7.62mm machinegun, all mounted in an unmanned turret with two automatic grenade launchers mounted in the hull of some models. This array of firepower allows the BMPT to efficiently destroy a range of battlefield targets, while its powerful chassis makes it as maneuverable and survivable as the tanks it supports.[1]

Figure 1. The first model of BMPT-72. Note the unarmored ATGM tubes, hull-mounted grenade launchers above the tracks and Active Protection System tubes barely visible at the base of the turret. *(Photo copyright Vitaly Kuzmin. Licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License*.)

To better explain the role a TSV might play on the battlefield, I will detail how and why the BMPT-72 came to be.

Origins of BMPT-72

In the Russian military, the armored assault is predicated on the idea of close coordination among armor, artillery and mechanized infantry. This close cooperation proved difficult to achieve as infantry carriers are generally too slow to keep up with tanks and too vulnerable to survive on a modern battlefield. Thus the Russians saw a tactical gap developing between the mechanized-infantry squad and the tank. In the midst of this revelation, the Russians experienced acute deficiencies in direct-fire capability during their invasions of Afghanistan and Grozny.[2] [3] [4]

These tactical issues led to the BMPT-72's development, designed to counter the gamut of battlefield threats by offering the suppressive capability of a mechanized-infantry squad in a package that was as protected and maneuverable as the tanks it would accompany.

Figure 2. A Russian army BMPT-72 with a T-80 and T-90. *(Photo copyright Vitaly Kuzmin. Licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License*.)

TSV for U.S. Army

A purpose-built TSV would greatly improve American lethality against the type of mechanized threat that near-peer adversaries pose. TSVs could provide obvious and not-so-obvious advantages to maneuver formations in all sorts of tactical situations:

- A formation of MBTs and TSVs facing a much larger mechanized formation could prioritize targets by vehicle type, with MBTs focusing on the anti-tank fight while TSVs eliminated light armor and dismounts. This division of labor would change the "correlation of fires" in favor of U.S. forces. This would also mean tanks could carry a greater proportion of sabot rounds, increasing their endurance and anti-tank capability.
- In urban environments, TSVs could provide direct-fire support to MBTs and dismounts with the advantage of being able to fire at higher angles. The TSVs also create less collateral damage than a tank's main-gun fire. For obstacles requiring greater firepower than 30mm cannons, ATGMs could be swapped for unguided direct-fire obstacle reduction rockets.[5]
- TSVs could carry mine rollers and plows in breaching operations to breach and proof obstacles. Distributing obstacle-reduction equipment to the lighter TSVs would reduce mechanical stress on the already heavier MBTs, and they would be free to overwatch the breach operation.
- A TSV with an unmanned turret would be exceptionally survivable and easily repairable if damaged. Also, an elevated unmanned turret like the one found on the BMPT-72 would allow the TSV to fight without exposing its crew to direct fire.
- A TSV's cannons could easily destroy a *boyevaya mashina pekhoty* (BMP – Russian fighting vehicle) and a *bronetransportyor* (BTR – Russian armored personnel carrier), but given an airburst round or an anti-air-capable fire-control system (FCS), the TSV could turn a Hind (Russian helicopter) into temporarily airborne modern art far more quickly and easily than a man-portable anti-tank system air round. TSVs could even accept small modular radar arrays and swap ATGMs for surface-to-air missiles to provide tactical air

defense with gun and missile systems. Adoption of an air-defense anti-tank system (ADATS)-type weapon would allow one missile to perform both anti-air and anti-tank functions.[6]

- TSVs could also be co-opted to provide direct-fire support to infantry formations or guard mobile artillery pieces operating close to the front. Any role requiring flexible direct-fire support could be filled by a TSV.

Modularity

A key aspect of a TSV should be modularity. By creating turret and hull systems that are easily modifiable, even in theater, the TSV could be quickly and easily adapted to a variety of "roles within a role." Although the role of a TSV is to provide direct-fire support to tanks, other missions and a range of different threats on a range of different battlefields would make it difficult to create a one-size-fits-all platform.

For example, a TSV moving into an urban area would require different subsystems than one assigned to accompany armored formations in an attack or defense against a sophisticated mechanized threat in open country. Alternatively, in the case of an urban environment, a commander might want explosive or semi-armor-piercing ammunition, a Common Remotely Operated Weapon Station-mounted machinegun or automatic grenade launcher, an acoustic gunfire-detection system and the previously mentioned obstacle-reduction munitions, along with applique armor to increase all-aspect protection without endangering dismounts.

Against a mechanized threat, a commander might want armor-piercing and high-explosive ammunition, ATGMs, advanced day-night optics and an explosive reactive armor (ERA) package. By designing modularity into the platform, the TSV could fulfill multiple roles on a variety of battlefields.

The Stryker can be seen as an example of the benefits of modularity. Despite the Stryker's distinct lack of survivability and cross-country mobility, the Army has leveraged this basic platform into a range of vehicles with unique capabilities. As an example, the Army's current short-range air defense (SHORAD) solution – the Stryker-based A1 IM-SHORAD – sees a Stryker chassis equipped with an anti-aircraft gun, missiles, radar and electronic-warfare systems.[7] [8] [9] The Army also apparently intends to equip the vehicle with emerging laser anti-drone weapon systems.[10]

By using a modular platform as a base on which various weapons and systems can be attached, the Army has created a platform to deal with conventional air threats as well as the emerging threat of small unmanned aerial systems. Unfortunately, while a big step in the right direction, any Stryker-based system remains woefully incapable of accompanying armor. A more mobile and better protected, but equally modular, platform could present a solution to a range of tactical problems that at present are filled by stopgap solutions.

Organization

One critical, non-materiel question to be asked when considering the adoption of a new platform, especially a conceptually new platform that is not simply replacing an existing system, is how the new weapon should be integrated into an existing organization.

Let's consider an armored brigade combat team. If TSVs are integrated independently from the combined-arms battalions (CABs), perhaps as one or two companies in the brigade engineering battalion (like the Stryker main-gun system in the Stryker BCT), or in a novel "maneuver fire-support battalion" with one or two companies of mechanized infantry, there would be an benefit in terms of maintenance and organization. If these platforms were grouped together, the brigade commander would have greater control over how they were used, and he or she could mass their effects. If centralized, TSVs could be controlled and commanded by officers and Soldiers who have the experience and background to make the best tactical use of the platform. Also, centralization of these platforms would make resupply and maintenance more straightforward.

On the other hand, integration of TSVs into the CABs by supplementing or replacing the mechanized-infantry companies would provide greater tactical efficiency. The Russians found that integrating combined arms at the battalion level allowed better and more regular combined-arms training. Integration at the battalion level would lend itself to tactical efficiency as more training opportunities would be available and tactical leaders would be more familiar with each other's systems and tactics.

The Russians eventually found that managing the training, maintenance and supply of many different platforms proved to be an overwhelming burden for battalion commanders and the CAB structure was eventually abandoned, but there are several important differences between U.S. and Russian battalions.[11]

First, U.S. battalion commanders tend to be much more experienced than their Russian counterparts and, critically, tend to have a much larger staff.[12] Second, Russian formations tend to be less flexible at battalion levels and retain more initiative at echelons-above-battalion, making them less capable of integrating combined arms at a tactical level.

As to the issue of maintenance and supply, if the TSV was developed on an Abrams chassis, these problems might be even less of an issue than they are now. Also, despite past Russian failures, the United States has seen success with tactical combined arms as exemplified by the armored-cavalry troops (ACTs) organic to armored-cavalry regiments (ACRs), which I will discuss later.[13]

Another important consideration is the fact that the Russians have returned to the use of CABs in the form of their battalion tactical groups, which are, at present, in wide use.[14]

I propose that a sort of best-of-both-worlds solution could be achieved in terms of organization. In the CABs, TSVs could be integrated as separate TSV companies within the CAB – or even integrated at the company level along the lines of the ACR's ACT, with one or two platoons of TSVs operating with two or three platoons of Abrams.

Also, at the brigade level, one or two companies of TSVs could be maintained as a more flexible resource for use by the brigade commander. These brigade-level assets could include TSVs equipped for air defense, infantry fire support or security missions, with the added benefit that these niche-support vehicles could be operated by Soldiers with relevant military-occupation specialties (MOSs) such as the 11 or 14 MOS series.

Bradley and Desert Storm

There is the question of why the Army should pursue an entirely new platform when the Bradley already exists. This is a good question because the Bradley is a proven platform, and it is similar to a TSV in many ways. During the 1991 invasion of Iraq, the Bradley worked closely with the Abrams as part of the ACT and acted as both a reconnaissance vehicle and, in many cases, a makeshift TSV.

At the Battle of 73 Easting, a microcosm of Operation Desert Storm, Bradleys used ATGMs to engage targets outside the range of the Abrams main gun and used autocannons against softer targets such as APCs, infantry and field fortifications.[15] There are even accounts of Bradleys destroying multiple tanks at close range, but despite their performance, there are limits to the efficacy of the Bradley that can be uncovered by looking closely at the 1991 invasion.

First, Desert Storm, as the name reminds us, occurred in an open desert where visibility conditions were limited by severe weather. This meant that coalition armor was often able to use superior optics and FCS to see through dust and engage enemy targets from beyond the range at which the low-quality export-model T-72s could respond. The fact that Iraqi armor was often unable to lay effective direct fire, even at close ranges, underscores this point.[16] This lack of effective fire-control capability meant that Bradleys were less exposed to enemy direct fire and their much weaker armor did not present an issue.

That being said, in this situation, it is important to consider that there were far more casualties among Bradley crews than Abrams crews.[17] [18] [19] The Bradley is vulnerable to direct fire and, in a European conflict, armored formations would be exposed to accurate direct fire, and the Bradley would be forced to either remain far behind the armor or suffer inordinate losses. Therefore one of the key principles of the TSV concept is that they should be as survivable as the MBTs they support.

Figure 3. An M2 Bradley Fighting Vehicle operates in desert conditions at the National Training Center, Fort Irwin, CA. *(U.S. Army photo by SGT Eric M. Garland II)*

The second issue with the Bradley relates to its limited mobility. While post-Desert Storm sources stated that the Bradley was able to keep pace with the Abrams, there were some issues, notably with reverse speed.[20] The Abrams reverse speed is about double that of the Bradley, which resulted in vulnerable Bradleys being left behind by rapidly reversing Abrams. Also, the Abrams is flat-out faster than the Bradley, and a TSV built on an Abrams chassis would probably be about 10-20 tons lighter still than an Abrams, meaning that more rapid and shocking attacks would be possible.

The Bradley is a good weapon system and an important part of any maneuver formation, but it will not prove an effective substitute for a purpose-built TSV. Although creating a new weapons system from scratch may not be ideal, there is no need to develop a completely new vehicle when the Army already has many of the parts necessary to simply "assemble" one.

Approach to acquisitions problem

While simply shoehorning a pre-existing platform like the Bradley into a new tactical role would be cheaper than creating an entirely new vehicle, the cost of creating a TSV need not be prohibitive. The Army would be able to pursue a more "evolutionary" approach to the acquisitions process, as many of the subsystems necessary to create an effective TSV are already battle-tested and relatively little ground-up design work would be required.[21]

The TSV could make use of a redesigned Abrams chassis with the entire crew moved into the hull to make room for an unmanned turret. Private industry has already created an Abrams with an unmanned turret, and it has recently displays mockups of a new version of the same concept.[22] The TSV would require a new unmanned turret, but there are a variety of suitable weapons systems in the U.S. inventory now. These include the Bushmaster and several new larger-caliber autocannons; the tube-launched, optically tracked, wire-guided missile; Hellfire and Javelin missiles; and a full selection of machineguns and automatic grenade launchers. With these options already on hand, design work could focus on creating a new housing for pre-existing weapons and systems.

It might also be desirable to rearrange armor around the TSV to enhance all-aspect protection at the expense of a bit of frontal-aspect protection, but this type of redesign could be accomplished relatively easily by making use of ERA or applique armor.

Ultimately, there is no need to reinvent the wheel for a system that represents more of a conceptual change than a technological one.

Mechanized infantry

On the subject of mechanized infantry, the Russians have not discounted their value in the combined-arms team, and neither do I.[23] In fact, I believe that an American TSV would free the infantry to focus on missions for which it they are more uniquely suited, such as clearing and patrolling close terrain, reducing bypassed enemy formations and assisting in defensive actions from well-sited and prepared positions. Reducing the exposure of mechanized infantry to anti-tank weapons by removing them from the bleeding edge of the battlespace would allow infantry-vehicle concepts that more closely conform to the dismounted mission.

The Bradley is relatively well-armed and -armored because it was conceived for high-intensity Cold War conflict against T-72s and BMPs.[24] It pays for this substantial combat capability by having limited space for dismounts and less cross-country mobility than a lighter platform. If mechanized infantry were not forced to closely accompany MBTs in combat, their exposure to direct fire would be decreased and infantry vehicles could return to an APC concept, typified by lightly armed and armored platforms that are highly mobile and provide protection from artillery, machinegun and light anti-tank weapon fire.

As an example, during the Vietnam War the lightly armed and armored M113 APC was often found to have better mobility across difficult terrain than even dismounted troops due to its light weight and amphibious capabilities.[25] Lighter, faster and more capacious vehicles would allow the infantry to focus on missions at which they excel by allowing dismounts to maneuver to an objective more rapidly and in greater numbers.

Also, TSVs could provide more effective direct-fire support for infantry than any presently available platform, making up for the loss of firepower from their old transport vehicles.

TSVs in Russian military

To date, the BMPT-72 has not been widely incorporated into Russian Army structure. While this might seem to discredit the concept, there are several reasons for this apparent lack of interest.

While the BMPT-72 has not been widely integrated, it has been accepted for service, and the Russian Ministry of Defense (MoD) has begun to take deliveries of the platform. It seems that despite ongoing development, the MoD has only just deemed the BMPT-72 to be acceptable but probably not fully so. Despite the limited adoption, development is proceeding on future models of the BMPT-72, indicating an ongoing interest in the concept. The next model of TSV will reportedly make use of the Armata chassis and be even more heavily armed.[26]

When looking at Russian arms development, it is important to consider the MoD's relatively limited financial resources. Despite devoting a proportionally large amount of money to "defense," Russia has historically been unable to field all its newest and most effective gadgets.

The Armata platform is a perfect example. It seems likely that Russia would like to adopt the T-14 and other Armata-series vehicles, but it has proven more financially viable to acquire greater numbers of older, but still very capable, tanks and armored vehicles.[27] Acquisition of the BMPT-72 will likely proceed at a limited rate due to financial difficulties rather than lack of interest.

Another consideration is the fact that the most recent model of the BMPT-72 was apparently specifically designed for the export market.[28] This may play a role in its limited adoption, as Russian export vehicles are generally inferior to their domestic acquisitions.

Figure 4. The latest model of BMPT-72 destined for the export market. Note the redesigned turret and lack of forward-facing grenade launchers. *(Photo copyright Vitaly Kuzmin. Licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.)*

Algeria has apparently fielded a substantial number of imported BMPT-72s alongside imported T-90s, and Kazakhstan has enthusiastically incorporated the BMPT-72 into its force structure, even going so far as to commence domestic production under license.[29] [30] One possibility is that Russia may be making shrewd use of an opportunity to field an advanced testbed by selling it to other countries and closely monitoring its performance before pursuing final development for themselves; however, this is entirely my own speculation.

As a final note on the subject, a Chinese corporation has developed a TSV similar to the BMPT-72. The QN-506 is built on the Type 59 tank chassis and features an even wider range of weapons than the BMPT. However, it is unclear whether the vehicle will be adopted for service in the Chinese army.[31]

Conclusions

My proposal here is not novel. The BMPT-72 demonstrates that Russia, the world leader in armor theory, is pursuing solutions to the problem of direct-fire support in armor formations. This is not even a new idea in the West. In 1996 an article was published in ***ARMOR*** that provided a detailed proposal for a vehicle built on an Abrams chassis, designed to provide air defense and direct-fire support with autocannons and missiles.[32] However, the collapse of the Soviet Union and the beginning of the Global War On Terrorism resulted in an almost complete lack of interest in developing platforms for symmetric warfare.

With a resurgent Russian military, focus is returning to the armored fight. The U.S. Army has about 20 years of resting on the laurels of Desert Storm to reckon with. Given the wide range of anti-tank threats on the battlefield, the tank's limited ability to deal with these peripheral threats and the mechanized infantry's increasingly limited ability to accompany armored formations, it seems clear that a new solution to the problem of direct-fire support in the armored formation is warranted.

Figure 5. The Object 787, an early prototype TSV. *(Photo copyright Vitaly Kuzmin. Licensed under a Creative Commons Attribution-NonCommercial- International License NoDerivatives 4.0.)*

Figure 6. The Russian Army BMPT-72. Note that the turret has been modified with armor surrounding the ATGM tubes and some other changes, but the hull retains the grenade launchers. *(Photo copyright Vitaly Kuzmin. Licensed under a Creative Commons Attribution-NonCommercial- International License NoDerivatives 4.0.)*

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Notes

[1] Dr. Lester W. Grau, "Preserving Shock Action: A New Approach to Armored Maneuver Warfare," ***ARMOR***, September-October 2006.

[2] Yago Rodríguez Rodríguez, ***Revista Ejercitos*** on-line, Oct. 13, 2018, https://www.revistaejercitos.com/2018/10/13/bmpt-terminator-i/.

[3] Grau, "Preserving Shock Action: A New Approach to Armored Maneuver Warfare."

[4] CPT Charles K. Bartles and Dr. Lester W. Grau, "A New System Preserves Armor Dominance of the Future Battlefield: BMPT 'Terminator-2'," ***ARMOR,*** April-June 2015. This article represents the main source of my ideas on this subject. I would highly recommend reading this article in its entirety to better understand my article, specifically the Russian basis for developing the BMPT-72.

[5] Or rockets could make use of high-explosive squashhead-type warheads, which have exceptional effects against obstacles.

[6] Dr. Asher H. Sharoni and Lawrence D. Bacon, "Forward Area Air-Ground Defense: Do We Need A Dual-Role Hybrid Air-Ground Defense System for the Armored Forces?", ***ARMOR***, July-August 1996: "[ADATS] is a single-stage, multipurpose, highly accurate, day/night and adverse-weather missile system. It has a true and unique dual-target capability for engaging low-flying aircraft, advanced attack anti-tank helicopters and armored vehicles."

[7] "Department of Defense authorization for appropriations for Fiscal Year (FY) 2015 and the future years defense program." According to GEN Raymond Odierno, "The analysis found that the Stryker, as currently designed, lacks sufficient off-road mobility to maneuver in the same operational environment as armored brigade combat team (ABCT) combat vehicles. Although the Stryker provides improved force protection against underbody threats, it lacks protection against direct fire and indirect fire threats." This was in 2015 and little (nothing) has changed.

[8] Eric Miller, "Stryker Problems Highlight Testing Shortfalls," ***Defense News***, Nov. 1, 2004, http://pogoarchive.pub30.convio.net/pogo-files/alerts/national-security/ns-siav-20041101.html. In an attempt to convince the House Armed Services Committee to block purchase of two Stryker brigades' worth of platforms, retired COL Douglas Macgregor stated that the Stryker lacks the "firepower, protection, mobility and organic logistical support to be a full-dimensional warfighting organization, and its operational utility will continue to be limited to peace support or paramilitary police operations."

[9] "AUSA 2019: General Dynamics unveils Stryker A1 IM-SHORAD air-defense armored vehicle," Army recognition, Oct. 22, 2019, https://www.armyrecognition.com/ausa_2019_news_show_daily_coverage_report_united_states/ausa_2019_general_dynamics_unveils_stryker_a1_im-shorad_air_defense_armored_vehicle.html.

[10] Department of Defense FY 2020 budget estimates: justification book of missile procurement, Army, March 2019. https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2020/Base%20Budget/Procurement/02%20Missile%20Procurement%20Army.pdf. Page 33 discusses the addition of the mobile experimental high-energy laser to the SHORAD platform, but it also uses some questionable phrases such as "long-term capability."

[11] Bartles and Grau, "A New System Preserves Armor Dominance of the Future Battlefield: BMPT 'Terminator-2.'"

[12] CPT Charles K. Bartles and Dr. Lester W. Grau, ***The Russian Way of War***, Fort Leavenworth, KS: Foreign Military Studies Office, 2016. Discusses Russian "operational art" and how it influences their command and staff structure.

[13] Field Manual (FM) 34-35, ***Armored Cavalry Regiment and Separate Brigade Intelligence and Electronic Warfare Operations***, Chapter 2 (organization) describes the ACR's organization in the 1090s with two tank platoons and two Bradley scout platoons per company.

[14] CPT Nicolas J. Fiore, "Defeating the Russian Battalion Tactical Group," ***ARMOR***, Spring 2017. Describes the Russian battle tactical group and provides an overview of their use in Ukraine.

[15] Transcript of taped interview with officers of Troop E, 2/2 ACR, and scout-platoon leader from Troop G, 2/2 ACR, March 3, 1991, https://mcoepublic.blob.core.usgovcloudapi.net/library/ABOLC_BA_2018/Research_Modules_B/ 73_Easting/2-2_ACR-1.pdf. This source provides a thorough overview of the tactical-level battle at 73 Easting and includes a number of cases where Bradleys were used to provide direct-fire assistance for Abrams. Examples can be found on Pages 8, 15, 19, 22, 23, 27 and 29.

[16] Ibid.

[17] CPT Michael Gollaher, "Two Scouts Under Fire Helped Injured Buddies During Night Battle," ***ARMOR***, May-June 1991. This article encapsulates the argument. Bradleys were able to provide effective direct-fire support but were not survivable in the face of enemy armor.

[18] Tony Wunderlich, "Lucky Scouts Dodge 'Big Bullets' That Ripped Their Bradley," ***ARMOR***, May-June 1991. This article describes how an Iraqi armor-piercing, fin-stabilized, discarding sabot tank round was able to blow through a Bradley without harming the crew. It is important to remember that Iraqi sabots were made of maraging steel rather than depleted uranium and lacked the latter's post-penetration pyrophoric effects, which would have probably killed the entire crew. This article also describes how a single 12.7mm round disabled a Bradley.

[19] Vince Crawley, "Minute by minute, death by death," ***Stars and Stripes***, March 9, 1991, https://www.stripes.com/news/minute-by-minute-death-by-death-1.6319. Describes a number of casualties among Bradley crewmen that occurred during the Battle of 73 Easting.

[20] U.S. General Accounting Office report to the chairman, subcommittee on regulation, business opportunities and energy, Committee on Small Business, House of Representatives, "Operation Desert Storm early-performance assessment of Bradley and Abrams," January 1992, https://www.gao.gov/assets/220/215553.pdf. Pages 18-19 include a discussion of reverse speed issues.

[21] Bartles and Grau, "The Russian Way of War." Includes an explanation of "evolutionary" acquisitions and elaborates on its advantages.

[22] I have personally seen the unmanned turret Abrams prototype at the Maneuver Center of Excellence's Armor Restoration Shop. As for the private-industry mockup, I saw a model of it at the Maneuver Warfighter Conference in 2019 and confirmed that it was conceived as an Abrams chassis with a new unmanned turret.
[23] Grau, "Preserving Shock Action: A New Approach to Armored Maneuver Warfare": "It was not an infantry fighting vehicle (BMP) and the Russians were not discounting the value of mechanized infantry in the combined-arms team. They were recognizing that the mechanized infantry may not be at the critical point at the critical time."
[24] Diane L. Urbina, "Lethal beyond all expectations: The Bradley Fighting Vehicle" – in Chapter 12 of George F. Hofmann and Donn A. Starry (editors), ***Camp Colt to Desert Storm: The History of U.S. Armored Forces,*** Lexington, KY; The University Press of Kentucky, the author discusses how the Bradley was steadily upgunned and uparmored in response to the threat of Soviet armored forces.
[25] Ibid.
[26] Petri Mäkelä, "Check out Russia's Deadly 'Terminator' Tank That Was Built for Urban Warfare," ***The National Interest***, Aug. 13, 2019: "There is also a Terminator-3 version that is based on the T-14 Armata platform. The issues with the T-14 have delayed the introduction of the Terminator-3 into the future."
[27] Tomas Malmlöf lecturing at the Center for Strategic and International Studies on "The Russian Military of 2035," May 24, 2017, https://youtu.be/iKhOgYA2L30?t=1020. Lecturer starts discussing procurement around the 17-minute mark.
[28] Mikhail Voskresenskiy, "Russian MoD Decides to Buy 'Terminator' Combat Vehicles – Here's Why," Aug. 25, 2017, https://sptnkne.ws/fqtC: "The Terminator 1 and the Terminator 2. They're both earmarked for export and haven't been purchased by the Russian Defense Ministry."
[29] "Finest Armour in Africa: Algerian Army Receives New Batch of T-90SA Battle Tanks," Jan. 11, 2020, https://militarywatchmagazine.com/article/finest-armour-in-africa-algerian-army-receives-new-batch-of-t-90sa-battle-tanks: "Serving alongside the T-90SA are BMPT-72 Terminator 2 tank-support vehicles, for which Algeria was the first foreign client."
[30] Bartles and Grau, "A New System Preserves Armor Dominance of the Future Battlefield: BMPT 'Terminator-2'": "In 2012, Kazakhstan, a country with a post-Soviet Army that somewhat resembles the Russian military in force structure and tactics, signed an agreement to purchase nine BMPTs on T-72 chassis, with deliveries starting in 2013. Apparently, the BMPT was perceived as a great success, and in April 2014, Kazakhstan signed another contract with Uralvagonzavod to produce the BMPT in Kazakhstan under a licensing agreement."
[31] Kyle Mizokami, "China's 'Terminator' (TSV) Is Bristling With Weaponry," Nov. 7, 2018, https://www.popularmechanics.com/military/weapons/a24793656/chinasterminator-tank-support -vehicle-is-bristling-with-weaponry/.
[32] Sharoni and Bacon, "Forward Area Air-Ground Defense: Do We Need A Dual-Role Hybrid Air-Ground Defense System for the Armored Forces?"

Acronym Quick-Scan

ACR – armored-cavalry regiment
ACT – armored-cavalry troop
ADATS – air-defense anti-tank system
ATGM – anti-tank guided missile
APC – armored personnel carrier
BCT – brigade combat team
BMP – *boyevaya mashina pekhoty* (Russian fighting vehicle)
CAB – combined-arms battalion
ERA – explosive reactive armor
FCS – fire-control system
FY – fiscal year
MBT – main battle tank
MoD – Ministry of Defense
MOS – military-occupation specialty
SHORAD – short-range air defense
TSV – tank-support vehicle