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Army

Savings Served Up for Bradley Armor Plates



When a military contractor approached the Army with a proposal for significant savings on armor tiles for the Bradley Fighting Vehicle, the impulse to quickly go for the savings had to be postponed: The Bradley played such an important role in saving lives that keeping a steady flow of contracts was paramount.

Ultimately, however, the Army and the contractor split a savings of \$38 million as a result of using a different material to produce the critical armor tiles.

The \$19 million of savings by the Army is the largest achieved thus far by the Army Contracting Command-New Jersey, under a program called a Value Engineering Change Proposal, or VECP.

Under the program, a contractor can submit a proposal that, through a change in the contract, would lower the project's life-cycle cost.

The value engineering program is intended to reduce costs, increase quality, and improve mission capabilities across the entire spectrum of Department of Defense systems, processes, and organizations.

Although pursuing savings is important, the Army's critical equipment needs on the battlefield are also a critical part of the equation.

The Bradley, which entered Army service in 1981, is used by brigade combat team as an infantry fighting vehicle, cavalry fighting vehicle, fire support vehicle, command vehicle and engineer squad vehicle.

In 1995, General Dynamics Armament and Technical Products was awarded a contract to produce Bradley armor tiles for the Department of Defense, with the first contract for more than 2,000 reactive armor tile sets.

This system is made of 96 tiles which are mounted on the exterior of the Bradley, which is named after Gen. Omar Bradley, a senior Army commander during World War II.

Reactive armor tiles on the vehicle use small explosives that detonate when hit by incoming fire.

The detonations reduce damage to the vehicle and the effectiveness of incoming fire.

"When equipped with the reactive armor tiles, the combat vehicles are better able to withstand direct hits from a variety of anti-armor munitions, including shoulder-fired rocket propelled grenades that are prevalent in today's combat zone," said Mariah Hazlett, a contract specialist with ACC-New Jersey, which has its headquarters at Picatinny Arsenal.

In its engineering proposal, General Dynamics asked

to change the armor tile box material from titanium to aluminum for more than 800 reactive armor tile sets.

"They wanted to change the material for several reasons," said Peter Snedeker, a contracting officer with ACC-New Jersey. "It was easier to manufacture with aluminum rather than titanium, so there would be shorter lead times. Aluminum was also more readily available and cheaper."

However, changing a contract isn't a simple matter. The change can't have a material effect on the design, nor can performance be less than what the contract requires.

The aluminum must perform just as well or better than titanium to support the demands of the Soldier.

ACC-New Jersey's technical team performed an extensive analysis of the change proposal and continued to work with General Dynamics to determine if the material switch served the form, fit and function specified in the technical data package. Prototypes were developed, samples were provided to ACC for analysis, and testing began to determine if the initiative was worth pursuing.

Even with the time-consuming analysis and audits involved in evaluating the proposal, an important factor affected the time frame for any new contract.

"Because of some needs in the field, it was determined that we would put the negotiations aside and keep fielding as much as possible because it was saving significant lives so we had the priority of keeping the contracts flowing," Snedeker said.

"All of the testing was done up front and the negotiations happened on the back end," added Hazlett.

From start to finish, the change in contracts for the Bradley armor tiles stretched out for several years, a period that was longer than usual owing to the complexity and nature of the product, the need for analysis and audits, along with the fact that providing a continuous flow of armor tiles was critical for Soldiers in the field.

In addition to Snedeker and Hazlett, other persons who helped move the engineering proposal forward include contract specialist Stephen Ernyey, lead engineer Stephen Chico, quality engineer Matthew Molnar and pricing specialist Denise DiMatteo.

Although the entire process was long and involved coordination by many people, Hazlett said the outcome was very rewarding.

"With budgets being reduced there has been a push to save money and pursue more competitive actions," Hazlett said. "VECP gives us another tool to reduce costs for the government and taxpayers."

Editor's note: Ann Jensis-Dale is a public affairs specialist with the Army Contracting Command. Ed Lopez is editor of The Picatinny Voice.

Term of the day

Tachanka

The tachanka is a horse-drawn machine gun platform, usually a cart or an open wagon with a

heavy machine gun installed in the back. A tachanka can be pulled by two to four horses and requires a crew of two or three (one driver and a machine gun crew).



A regular civilian horse cart could be easily converted to military use and back. This made the tachanka very popular during the Great War on the Eastern Front, where it was used by the Russian cavalry. The use of tachankas reached its peak during the Russian Civil War (1917–1920s), particularly in the peasant regions of Southern Russia and Ukraine, where the fronts were fluid and mobile warfare gained much significance.

Tachanka tactics were centered around taking advantage of its speed to surprise the enemy. Tachankas, before the introduction of the tank or automobile to the battlefield, were the only way to provide high-speed mobility for the heavy, bulky machine guns of World War I. The speed of the horse-drawn cart would be used to move the machine gun platform to a favorable firing position, and then the enemy forces would be fired upon before they had a chance to react. Since the machine gun pointed towards the rear of the cart, the tachankas also provided effective suppressive fire onto pursuing enemy cavalry after raids and during retreats.

Originally used by Russian and Ukrainian armies, the tachanka was later adopted by a number of other countries' armies, notably the Polish Army which used it during the Polish-Soviet War. Initially mostly improvised, with time the Polish Army also adopted two models of factory-made tachankas, as they were called in Poland. They were used during the Invasion of Poland of 1939 to provide cavalry squadron support.

Despite a certain degree of standardisation, the tachanka's armament was, in most cases, improvised. In Russia, the PM M1910 machine gun was often used. The Polish cavalry of the Polish-Soviet War often used all kinds of machine guns available, including the Maxim, Schwarzlose MG M.07/12, Hotchkiss machine gun and Browning machine gun. The late models of standardised tachankas of the Polish Army were all equipped with Ckm wz.30, a Polish modification of the M1917 Browning machine gun which was also suitable for anti-air fire. The tachankas were also adopted by the Wehrmacht, which used the Jf. 5 model armed with double MG34 for anti-aircraft protection of infantry throughout World War II.

and used in Korea during the Joseon Dynasty (1392–1897). It had the ability to fire up to 200 singijeon, a type of fire arrow rocket, at one time.



The hwacha consisted of a two-wheeled cart carrying a board filled with holes into which the singijeon were inserted.

The hwacha's structure was very similar to a hand cart with a mobile wooden launchpad on the top filled with 100 to 200 cylindrical holes, into which the ignitors were placed.

The ammunition, similar to the Chinese fire arrow, consisted of a 1.1 m long arrow with the addition of a paper tube filled with gunpowder attached to the shaft just below the head. Approximately 100 projectiles were loaded and launched in one volley.

One variant had 5 rows of 10 gun barrels in the launchpad, each of which could fire a bundle of four arrow-like projectiles.

The back side of the hwacha featured two parallel arms that allowed the operator to push and pull the machine, and a vertical strip designed for in-line attacks or stand ground-sentry positions.

Hwachas were usually made of pine wood, although there are some versions made of oak. Ropes used within were usually made of hemp.

Defence Industry

Patria Delivered 1st Batch of NextGen Armoured Wheeled Vehicles to Sweden



Patria delivered the first Patria AMV armoured wheeled vehicles to the Swedish Defence Materiel Administration (FMV).

This was the first delivery of altogether 113 Patria AMV armoured wheeled vehicles to the Swedish Defence Forces, based on the agreement signed with FMV in 2010. The total value of the contract is approximately EUR 250 millions.

Term of the day

Hwacha

Hwacha was a multiple rocket launcher developed

Technology Alliance for an additional five years.

“The production of Patria AMVs has proceeded according to plans, and now the first vehicles are ready for delivery. Patria AMV represents state-of-the-art technology and it combines our extensive experience and know-how, which are highly appreciated by the users of the vehicles. The Swedish troops will receive a modern vehicle which offers excellent mobility and a high level of protection. These new armoured wheeled vehicles represent a continuation for the Patria AMV product family, which has received excellent feedback for its performance in international operations”, said the President of Patria Land Systems and Patria Land Services, Seppo Seppälä to Lena Erixon, the Director General of FMV, when delivering the first vehicles.

Partnership with the Swedish Defence Materiel Administration

The Swedish Defence Materiel Administration is one of the biggest users of Patria’s armoured wheeled vehicles. Early in the year 2011, the partnership agreement was signed between Patria and FMV, covering the technical maintenance and upgrading of approximately 200 XA-vehicles purchased earlier. The agreement is being updated annually and is also going to cover the life-cycle support of the next generation Patria AMV armoured wheeled vehicles. The partnership agreement is strategically important to both parties as it enables both Patria and FMV to combine their best competences to offer high-quality services to the vehicles’ end-user, The Swedish Armed Forces.

Patria’s most important export product

Patria AMV is the market leader of modern armoured 8x8s, which makes it Patria’s most essential export product. Patria has agreements with seven customers for a total of nearly 1,400 vehicles. Patria AMV entered the market in the year 2004. AMV products are under continuous development and the latest reliable technologies are being applied. The structural solutions of these vehicles enable high payload capacity, a high level of protection and the integration of heavy weapon systems. Patria AMV has received excellent feedback for its crisis management performance in Afghanistan and Chad.

As a result, the company will have a significant role working with the MAST Alliance’s team of scientists from the U.S. Army, academia, and industry as it advances bio-inspired micro-robotics technology to extend the remote sensing capability of U.S. ground forces. The goal of the research is to enable small robotic platforms – that would be used by individual soldiers – to remotely perform surveillance within complex urban environments and terrain.

“The technologies being developed under MAST will support products that extend soldiers’ capabilities while keeping them out of harm’s way,” said Bill Devine, MAST’s strategic development manager for BAE Systems. “We are proud to continue our successful collaboration with the ARL on the next phase of this exciting program.”

The second phase of the MAST program continues the research, development and integration of several key areas including micro-scale aeromechanics and ambulation; propulsion; sensing, autonomy, communications, navigation, and control; and microscale integration, among others, enabling several different mission-capable robotic platforms.

“Our recent review by the MAST Research Management Board received high marks for the quality and success of the research conducted over the past five years contributing greatly to the decision to award the five year option to extend the program,” said Dr. Brett Piekarski, ARL MAST Consortium manager.

BAE Systems, in cooperation with primary research labs from the University of Maryland, the University of Michigan, the University of Pennsylvania and the NASA Jet Propulsion Lab, will lead the effort for the ARL into 2017.

Defence Industry

Textron Marine & Land Systems to Build 135 Additional Mobile Strike Force Vehicles



Textron Marine & Land Systems, an operating unit of Textron Systems, a Textron Inc. company, announced today that it has been awarded a \$113.4 million firm-fixed-price contract from the U.S. Army Contracting Command, Warren, Mich., to produce an additional 135 Mobile Strike Force Vehicles (MSFV) for the Afghan National Army (ANA). The vehicles are being contracted through the U.S. Army Foreign Military Sales (FMS) process.

Robots

Micro-robotics Development Furthered with ARL Contract Extension



BAE Systems has been awarded a \$43 million cooperative agreement extension to lead the Army Research Laboratory’s (ARL) Micro Autonomous Systems and Technology (MAST) Collaborative

Work will be performed at Textron Marine & Land Systems' facilities in the New Orleans area, with vehicle deliveries scheduled through February 2014. Three armored vehicle variants are being produced: MSFV with enclosed turret; MSFV with Objective Gunner's Protection Kit; and an MSFV ambulance.

TM&LS was awarded a contract for Mobile Strike Force Vehicle full-rate production in May 2011. Since then, the company has been fulfilling contract orders for a total of 499 vehicles. More than 300 of these vehicles have been delivered, and are either in operations with ANA kandaks (battalions) or being fielded as part of a comprehensive in-country vehicle logistics support and operator training program.

"Several kandaks are fully trained and beginning to stand up Afghanistan's quick reaction force capability," explained Tom Walmsley, TM&LS senior vice president and general manager. "These vehicles deliver a combination of lethality, survivability, mobility and sustainability crucial to the Army's ability to effectively respond to security threats and maintain the peace."

General Sher Mohammad Karimi, chief of general staff of the ANA, speaking February 6 at the International Armoured Vehicles Conference in Farnborough, UK, said high-end armored capabilities are "critical to the survival of the state to develop capabilities to fight insurgents."

General Karimi also commented that the MSFV has been "significantly upgraded from the original design to make it more survivable in the IED environment."

Part of the TM&LS COMMANDO Select line of armored vehicles, the MSFV is derived from the combat-proven M1117 Armored Security Vehicle (ASV). All MSFVs are configured with Enhanced Survivability (ES) capability, which increases blast protection to mine-resistant, ambush-protected (MRAP) levels. The ES-equipped vehicles continue to possess the ASV's original, all-important V-shaped hull design, in addition to innovative protection design features that enable them to meet MRAP blast protection standards.

Rigorously tested and proven in the toughest environments, the COMMANDO™ family of vehicles offers a range of protection levels, unmatched on-road/off-road mobility and superior firepower. TM&LS produces four lines of COMMANDO four-wheeled vehicles - COMMANDO Utility, COMMANDO Advanced, COMMANDO Select and COMMANDO Elite.

As an end-to-end armored vehicle provider, TM&LS also offers its customers fielding, training, maintenance and logistics support throughout each COMMANDO vehicle's life cycle.

and associated assets, from protection technology company Protaurius AB. The acquisition is the first step into the field of ballistic protection technology.



Soft Armour is a patented technology that uses a spherical ceramic material to protect people and sensitive equipment from fine calibre and armour piercing ammunition. Soft Armour is self-healing and can withstand multiple hits in the same area. It can also be used in construction solutions, such as walls, shields and soft coverings.

"The acquisition of the rights to Soft Armour is a complement to our wide product portfolio within advanced camouflage. We are now expanding our investment in this type of product in both military and civil segments," says Anders Wiman, Managing Director of Saab Barracuda.

Saab Barracuda has previously collaborated with Protaurius whereby Barracuda marketed the product in certain markets.

"With this transaction, Barracuda is taking the first step in strategically widening its product portfolio beyond the technical field of signature management," continues Anders Wiman.

Soft Armour has been developed by specialists with vast experience of protective products for military, police and civilian purposes. It is an environmentally friendly and ricochet free protection against projectiles and shrapnel with a predictable and customisable level of protection that is easy to transport and handle. Soft Armour can also be reused and stored in bulk.

Saab Barracuda, with operations in Sweden, the U.S. and India, is a world leader in the field of advanced camouflage and signature management solutions for the defence market. Barracuda is part of the Dynamics business area, one of the six business areas at Saab.

Term of the day

Scale Armour

Scale armour is an early form of armour consisting of many individual small armour scales (plates) of various shapes attached to each other and to a backing of cloth or leather in overlapping rows.

Scale armour was worn by warriors of many different cultures as well as their horses. The material used to make the scales varied and included bronze, iron, rawhide, leather, cuir bouilli, seeds, and horn. The variations were primarily the result of material availability.

Scale armour offered better protection from blunt

Defence Industry

Saab Acquires Ballistic Protection Technology

Defence and security company Saab has purchased the rights to the protection technology Soft Armour,

attacks than mail. It was also cheaper to produce, but it was not as flexible and did not offer the same amount of coverage.



Contracts

Textron Awarded Contract to Produce Turrets and Provide Support for Colombia's APCs



Textron Marine & Land Systems (TM&LS), an operating unit of Textron Systems, a Textron Inc. company, announced today a \$5.5 million contract award from the U.S. Army Tank-Automotive and Armaments Command (TACOM) to provide 12 armored turrets, technical support services, vehicle repairs and spare parts for the Colombian Army's (COLAR) Armored Personnel Carriers (APC).

The COLAR has 39 COMMANDO™ Advanced APCs in operation with its Armored Cavalry units and, under a separate U.S. Foreign Military Sales case, has requested to purchase additional APCs.

Since fielding its APCs in May 2010, the COLAR has employed them extensively while combating internal revolutionary forces in Colombia. These vehicles have provided the mobility, protection and firepower needed to meet all COLAR tactical armored vehicle requirements.

TM&LS' APC is an extended version of the M1117 Armored Security Vehicle (ASV), combat proven over 10 years and used by the U.S. Army and other militaries in locations including Afghanistan and Iraq. The APC's additional two feet in length and six inches in internal height allow greater troop carrying capacity in areas of operations. These vehicles are part of the COMMANDO™ Advanced line of armored vehicles, which offer excellent on-road and off-road mobility

enabling them to operate in urban, jungle, desert and mountainous terrain. Crew protection is reinforced with a V-shaped hull bottom and 360-degree protection from direct fire.

"This contract is an extension of our positive working relationship with the Colombian Ministry of Defence and Army leadership, and an example of our capability as a full-spectrum armored vehicle provider," said Textron Marine & Land Systems Senior Vice President and General Manager Tom Walmsley.

"Colombia's APCs are performing exceptionally well in a variety of operational roles, while offering outstanding protection to COLAR soldiers. Building on this success, we're working with Colombia to increase the number of APCs in COLAR units while sustaining its entire vehicle fleet with a coordinated program of maintenance, training and field service support," Walmsley added.

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Army

US Army Developing New 120mm AMP Tank Round



The Army is developing a new Advanced Multi-Purpose 120mm tank round, known as AMP, that combines six different capabilities into a single round, service officials said.

The AMP is ready to enter into the Engineering and Manufacturing Development phase after a prototype successfully demonstrated Technology Readiness Level 6 through a science and technology program at Picatinny Arsenal, N.J., in 2006.

The new round will replace a rapidly aging inventory of tank munitions, said Col. Paul Laughlin, the 47th chief of Armor and commandant of the Armor School at the Maneuver Center of Excellence, Fort Benning, Ga.

"The new AMP round is long overdue," Laughlin said. "Tankers have struggled for years with a growing

number of main gun rounds capable of defeating single types of threats; this resulted in a mix of ammunition types carried on board the tank that was always a problem.

"This is not just an issue of logistics," he said. "It creates both operational and survival issues. No one wants to get into a tank engagement and not have the right ammunition to defeat the range of threats that we will see on the future battlefield. The AMP round is a game changer that greatly increases our effectiveness. We need to make a very modest and affordable investment, spread over 30 years, to field a highly versatile and reliable round with the capabilities we need for the future fight."

The AMP round will replace four tank rounds now in use. The first two are the M830, High Explosive Anti Tank, or HEAT, round and the M830A1, Multi-Purpose Anti Tank, or MPAT, round. The latter round was introduced in 1993 to engage and defeat enemy helicopters, specifically the Russian Hind helicopter. The MPAT round has a two-position fuze, ground and air, that must be manually set.

The M1028 Canister round is the third tank round being replaced. The Canister round was first introduced in 2005 by the Army to engage and defeat dismounted Infantry, specifically to defeat close-in human-wave assaults.

The M908, Obstacle Reduction round, is the fourth that the AMP round will replace; it was designed to assist in destroying large obstacles positioned on roads by the enemy to block advancing mounted forces.

AMP also provides two additional capabilities: defeat of enemy dismounts, especially enemy anti-tank guided missile, or ATMG, teams at a distance, and breaching walls in support of dismounted Infantry operations.

"The AMP round is a significant advance in tank ammunition capability," said Lt. Col. Brian Gruchacz, product manager for large caliber munitions at Picatinny Arsenal. "It uses an ammunition data link and a multi-mode, programmable fuze to achieve multiple effects that currently can only be achieved by selecting, loading and firing one of four different 120mm tank rounds the AMP round will replace. Together with the two additional capabilities provided by the AMP round, a single AMP round can now achieve desired effects against ATGM teams, reinforced walls, bunkers, light armor, dismounts, and obstacles."

"To demonstrate these individual effects with a single round is the result of the efforts of the men and women at the Army's Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J. They demonstrated the AMP capability using two key technologies that are actually quite mature, an ammunition data link and a multi-mode programmable fuze. Using these technologies, commands to select the desired effect are transmitted via data link to the fuze on the round. The fuze setting determines whether the round will function with a point-detonate, point-detonate delay, or airburst effect," Gruchacz said.

"While not yet approved to proceed to the next

developmental phase of the acquisition cycle, the Engineering Manufacturing and Development or EMD, phase, the AMP capability has been successfully tested and demonstrated," Gruchacz said.

Based on the AMP round's performance during development, many tankers and Army capabilities developers believe the AMP will also provide warfighters an improved Battle Carry capability.

Battle Carry is a term used by tank crews during combat when they are preparing to engage the enemy; they load the round they believe is the most likely needed to defeat the most likely threat target. If AMP were available to Army tankers, they'd be able to Battle Carry one round capable of achieving the desired effect across a wide range of targets.

Laughlin's final thoughts were "I have commanded tankers from platoon through regiment; I wish that each of my units would have had the capabilities that the AMP round provides. Now, as the chief of Armor, I can influence the system to give future tankers the ammunition they need to be more lethal, more survivable, and more effective."

By Kris Osborn and John D. Fuller



Term of the day

Siege Engine



A siege engine is a device that is designed to break or circumvent city walls and other fortifications in siege warfare.

Some have been operated close to the fortifications, while others have been used to attack from a distance. From antiquity, siege engines were constructed largely of wood and tended to use mechanical advantage to fling stones and similar missiles. With the development of gunpowder and improved metallurgical techniques, siege engines became artillery. Collectively, siege engines or artillery together with the necessary troops and transport vehicles to conduct a siege are referred to as a siege-train.



Term of the day

oriented light tanks and the armor and armament oriented heavy tanks.

Heavy Tank

A heavy tank was a subset of tank that provided equal or greater firepower as well as armor than tanks of lighter classes, at the cost of mobility and maneuverability.

Heavy tanks have usually been deployed to breakthrough enemy lines, though in practice have been more useful in the defensive role than in the attack. Design goals have included attacking obstacles, creating breakthroughs, and engaging enemy armoured formations.

Heavy tanks feature very heavy armour and weapons relative to lighter tanks, though they tend to push onboard power generators to the limits. As a result they tend to be either underpowered and comparatively slow, or have engine and drive train problems from overworking their engines. Heavy tanks tend to have excellent protection compared to their lighter cousins.

Heavy tanks achieved their greatest successes both fighting other, lighter tanks, and destroying fortifications with their very large guns. Although it is often assumed that heavy tanks suffered inferior mobility to mediums, this was not always the case, as many of the more sophisticated heavy tank designs featured advanced suspension and transmission precisely to counteract this drawback. But the greatest drawback is cost which translates into production, resulting in short supplies. The German Tiger I, for example, had similar speed and better terrain-handling characteristics when compared to the significantly lighter Panzer IV medium tank, albeit at the cost of low reliability and only 1,355 were produced compared to 8,800 Panzer IV and 58,000 Soviet T-34 and 40,000 American M4 Sherman medium tanks.

**Term of the day****Medium Tank**

Medium tank was a classification of tanks, primarily used during World War II. The medium tank, as the name suggests, represented a compromise in features between the reconnaissance and mobility

The most widely produced, cost effective and successful tanks of World War II (the Soviet T-34, the American Sherman tank and the German Panzer IV) were all medium tank designs, and the success of the concept would later lead to the development of the main battle tank (which sought to incorporate the best aspects of all three tank types).

Medium tanks are simply neither the heaviest nor lightest in weight, and many of the designs had successful balance of firepower, mobility, protection, and endurance, and could often be adapted to a variety of roles.

The first tanks to carry the name Medium appeared in the First World War with the British Medium Mark A "Whippet". It was smaller and lighter than the British heavy tanks and only carried machine guns.

The medium tank doctrine came into use in the interwar period. Its existence outlasted the super-heavy tank and heavy tank but eventually was eclipsed by the main battle tank.

**Term of the day****Tanegashima**

Tanegashima was a type of matchlock or arquebus firearm introduced to Japan through the Portuguese in the 16th century.

Tanegashima were used by the samurai class and their foot soldiers (ashigaru) and within a few years the introduction of the tanegashima in battle changed the way war was fought in Japan forever.

The name "tanegashima" came from the Japanese island (Tanegashima) where a Chinese junk with Portuguese adventurers on board was driven to anchor by a storm in 1543. The lord of the Japanese island, Tanegashima Tokitaka (1528–1579), purchased two matchlock rifles from the Portuguese and put a swordsmith to work copying the matchlock barrel and firing mechanism. The smith (Yaita) did not have much of a problem with most of the gun but "drilling the barrel helically so that the screw (bisen bolt) could be tightly inserted" was a major problem as this "technique did apparently not exist in Japan until this time." The Portuguese fixed their ship and left the island and only in the next year when a Portuguese blacksmith was brought back to Japan was the problem solved.

Within ten years of its introduction, an upwards of

300,000 tanegashima firearms were reported to have been manufactured.

■

Term of the day

Super-Heavy Tank



Super-heavy tanks are armored fighting vehicles of very large size, generally over 75 tonnes.

Programs have been initiated on several occasions with the aim of creating an invincible vehicle for penetrating enemy formations without fear of being destroyed in combat; however, only a few examples have ever been built, and there is no clear evidence any of these vehicles saw combat. Examples were designed in World War I and World War II, along with a few in the Cold War.

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