The New Legionnaire and Modern Phalanx:

Modern Ballistic Armor's Role in Returning Heavy Infantry Doctrine to the Battlefield

CPT MATTHEW ALLGEYER

The invention of modern body armor that allows for effective protection from small arms has been greatly underappreciated as to its effect on modern combat. Modern body armor has brought about a problem the infantryman has not dealt with since before the gunpowder revolution. The problem is how does the military balance protection offered with the weight and mobility issues of heavier armor.

The current infantryman engages in what would have been considered historically light infantry tasks. This specification is due to the inability to provide personnel protection from small arms to the infantryman prior to the invention of modern ballistic armor. This current concept should be understood as a unified infantry concept: one type of infantryman tasked with all infantry tasks. Trying to make a one-size-fits-all approach centered on the current unified infantry concept has led to problems within the military at large. Load carriage issues, injuries, and difficulties managing equipment and combat effectiveness can all be traced to trying to find a balance between mobility and protection.

Historically, pre-gunpowder armies divided infantry between heavy and light, generally, to balance this mobility protection issue. Examining the historical uses of heavy infantry provides us broad insight into methods and techniques employed previously by heavy infantry. These historical examples can suggest how to solve our current infantry problems using a split infantry methodology. Embracing a methodology split between heavy and light infantry can solve many of the current problems while at the same time expanding the infantry's capabilities.

Soldiers from the 2nd Brigade Combat Team, 4th Infantry Division pause during a mission in Afghanistan on 28 March 2018. (Photo by SFC Jasmine L. Flowers)

Armor and Load Carriage: More Than Just an Endurance Problem

Load carriage is a perennial problem for Soldiers and has been an area of scientific inquiry for multiple nations' armies since the turn of the 19th century.[1] Though all sources acknowledge that it is a problem, most historical and modern studies agree that commanders are more likely to overload Soldiers then risk going without. The general understanding of load carriage in the U.S. Army today is informed by S.L.A. Marshall's *The Soldiers Load and The Mobility of a Nation,* which was published in 1950.[2] Marshall focused on the problems of Korea and World War II, and his work is often sighted as front material even though problems have been identified with his analysis.[3] Marshall identified some of the issues suffered from load carriage we are dealing with today, but he determined that the primary problem was that the psychological effect of exhaustion caused Soldiers to manifest anxiety. No other research has independently confirmed this analysis, which was gained from limited case studies. The operational Army's reliance on Marshall's book also demonstrates common misunderstandings of load carriage today. The current military understanding of load carriage is stuck in a 1950's mindset. It does not factor in new findings or take into account the intense effects modern personnel armor has on the Soldier.

Researchers in the Army and Navy's medical community and the National Institutes of Health are all actively working on the problem of load carriage today. One key takeaway from current research is that body armor, while adding to overall load carriage, also has an exponentially deleterious effect on the Soldier's physical performance. Standard carriage of a load has a linear negative effect on the Soldier — more weight will tire a Soldier even more quickly, further distance will tire a Soldier, and higher temperatures will tire a Soldier more quickly.[4] Body armor on the other hand does not only follow this linear effect. As walking velocity increases, energy expenditure and perceived intensity increase exponentially.[5] Additionally, it has been found that body armor on the trunk increases heat strain independent of the load carried.[6] Understanding body armor's more harmful effects beyond just load begins to explain the huge increase in acute and chronic injuries seen across the Army in the past decade. The U.S. Army and its research partners are taking the thermal strain problem seriously enough that they are experimenting with cooling vests worn underneath body armor.[7]

This potential cooling solution highlights problems created as the Army continues with its unified infantry concept. Equipping Soldiers with heavier body armor deceases their combat ability. Instead of finding a weight reduction solution, the Army attempts to equip them with more sensors and equipment to compensate, further decreasing their combat ability through reduced mobility. Modern technology has wide-sweeping potential to greatly enhance military effectiveness, but it will always have an increased load cost associated with it. All the U.S. Army's warfighting functions, save movement and maneuver, can be enhanced by equipment carried by the Soldier.[8] All of these enhancements will unavoidably carry a cost in a decrease to movement and maneuver. The legacy Land Warrior system for example offered a huge increase in intelligence available to the Soldier on the ground. The old program was eventually not adopted by the Army at large because Soldiers disliked it. It was too heavy and too costly without enough benefit.[9] For every one of these new solutions, a trade-off must be made with mobility and overall load carriage. The current situation has led to a bevy of other problems.

The U.S. Soldier over the last 20 years has carried anywhere between 40-50 percent of his body weight while conducting long-term operations.[10] Doctrinally, the U.S. Army knows that this is unsustainable, as the load carried regularly by Soldiers is the same body weight percentage recommended for an approach march or emergency march load.[11] The loads and distances are surpassing the doctrinally defined "exhaustion line," which is the point at which Soldiers will become degraded in combat and should have a recommended 24-hour rest period to avoid injury.[12] These excessive loads have led to endemic injuries in the fighting force. In 2012, there were approximately 2.2 million medical encounters across the Army for musculoskeletal injuries. Retired Soldiers with at least one musculoskeletal condition increased by close to 10 times from 2003-2009.[13]

Researchers reported in *Military Medicine* that through regressive analysis of the Total Army Injury and Health Outcomes Database (TAIHOD) they found that deployment increased soft tissue knee injury likelihood by 39 percent.[14] Injuries due to load carriage have secondary effects that last a lifetime. Young Soldiers are being diagnosed with early onset arthritis due to load carriage during deployments.[15] A 2014 study of an infantry brigade returning from Afghanistan found that 44 percent reported chronic pain lasting longer than three months and 15 percent reported being prescribed opioids as a result. Both of these rates of arthritis and opioid prescription are approximately double the rates of the civilian population.[16] Taking these issues into consideration, it is obvious the current one-size-fits-all approach to load carriage is not sufficient.

With the advent of the ceramic strike plate, Soldiers have effective protection from small arms for the first time since the gunpowder revolution. This in turn has created heavier and more constricting body armor, which in turn has greater effect on all combat tasks. A Naval Medical Center study found that body armor carriage had a detrimental effect on a service member's cardiovascular, strength, balance, and functional ability. Additionally, aerobic capacity was degraded to a greater degree than expected from just the additional load carriage.[17] This means that the simple act of wearing body armor during physical activity reduces a Soldier's physical capacity. A study conducted on extremity armor found that extremity armor carriage negatively affected gait and mobility.[18] Finally, a study designed to determine combat effectiveness of Soldiers in armor determined that the armor decreases Soldiers' overall combat effectiveness. Notable in this study is that this degradation is not linear. After a Soldier is wearing armor, adding additional armor (e.g. side plates, neck protector, etc.) does not have a scalable negative effect.[19] Body armor has many problematic effects on Soldiers beyond just load carriage; it is also undeniable that ballistic armor saves lives and preserves combat power. This life-saving ability is why the current approach is to simply add heavier armor onto light infantry Soldiers.[20]

Balancing the weight of modern ballistic armor is the primary issue in resolving load carriage injuries and lowered combat effectiveness. Secondary considerations like more or heavier sensors cannot be ignored, but body armor plays an outsized role. With the recent advances in armor technology, we should look to some historical solutions to help us solve this mobility protection issue. Pre-gunpowder era units used armor and carried comparable equipment loads but had several solutions to mitigate individual equipment load. These units carried equipment on carts or pack animals. Many would not arm nor armor themselves completely until contact had been made. These units also accepted less mobility for greater protection and weight. Before gunpowder made personal armor protection impracticable, militaries around the world determined that one approach to infantry materiel and doctrine would not work. To make use of the full range of capabilities and to mitigate problems associated with too much weight or too little protection, militaries divided their infantry between heavy and light.

Heavy Infantry as a Solution

The invention of modern ballistic body armor is a watershed moment in the history of warfare; to fully exploit it will require new models of thinking. Once understood, this clarifies the problems associated with this warfare-changing technology. New technology has more than once forced militaries to relearn heavy protective shock tactics such as with the advent of the tank.[21] Further back in history, infantrymen adapted the tactics of the Roman legion to deal with the changes of the gunpowder revolution.[22]

Ancient militaries had the same issues balancing load and protection with mobility and risk. Across the world, ancient and medieval armies came up with the same solution: heavy and light infantry forces.[23] Heavy infantry accepted limited mobility and a greater load burden to gain increased protection and close quarter lethality. Light infantry focused on mobility coupled with standoff from missile weapons to gain a decisive advantage utilizing favorable terrain. If we accept this basic premise, then some of the current issues that are facing the modern Army can be more immediately resolved. A splitting of standard equipment and materiel development allows for focus on two separate methodologies, avoiding the one-size-fits-all approach that is currently harming the military. Adopting a heavy infantry framework will also help the light infantry. Taking the arduous burden of heavy armor and excessive equipment load away from light fighters will allow the military to focus on the type of equipment they need to accomplish their tasks: lightweight, unencumbering equipment that needs little to no short-term logistical support.

It is important to understand that the term "heavy infantry" here is not what is currently embodied in the mechanized infantry. An armored fighting platform conveys mechanized infantrymen of today's Army to the point where they dismount and are, for all intents and purposes, light infantrymen. Heavy infantrymen would be something new on the battlefield; they would look and operate differently from any other gunpowder-era soldier. A modern heavy infantry soldier would be fundamentally different than any previous infantryman armed with a gun.

Historical Heavy Infantry: Different Materiel Means a Different Set of Tasks

Understanding how ancient and medieval forces used their heavy infantry in concert with their light infantry and cavalry forces can give us the broad shape of how the heavy infantry may return to the battlefield.

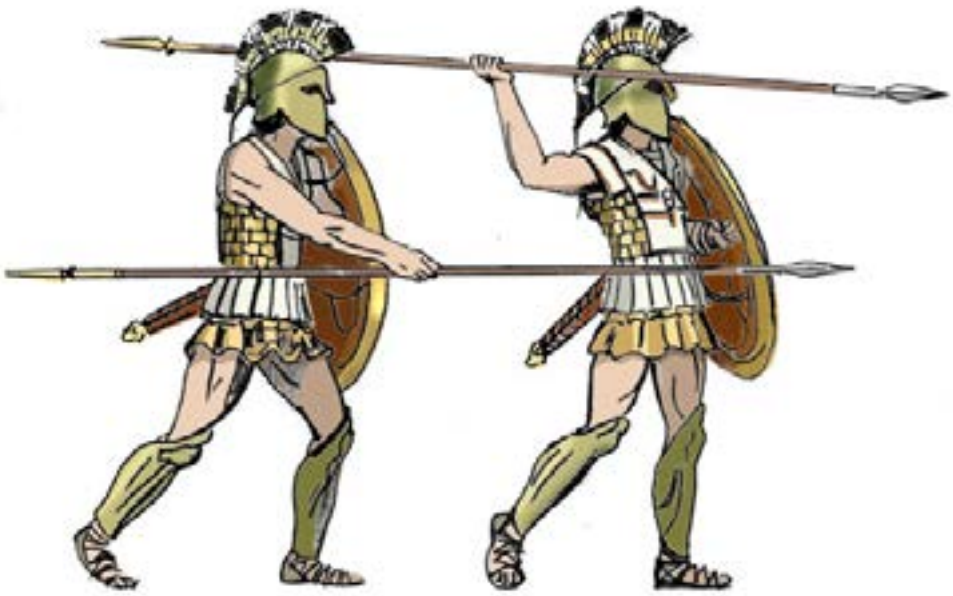
A common mistake today is to associate current infantrymen with ancient heavy forces. It is in the zeitgeist to name and associate current units in the American military with ancient heavy forces: Greek hoplites, Roman legions,

Greek Hoplite (*Illustration from A Short History of War: The Evolution of Warfare and Weapons* by Richard A. Gabriel and Karen S. Metz)

European knights, and Japanese samurai. All of these units were heavy and operated significantly differently than current infantrymen. Current infantrymen are the pinnacle of the gunpowder infantrymen that came to be in the late medieval to early modern era.[24] Their primary weapons are missile weapons. They face enemy contact (until very recently) with little to no armor. They rely on rapid movement and advantageous terrain for protection. They are vulnerable to shock effects from heavily armed forces maneuvering on them. In this way they operate and are employed much more similarly to ancient light forces.[25] This lack of historical understanding can at least in part be attributed to ancient sources' disdain for light infantry.[26] That these heavy unit types remain fixed in the mind of current military members is a testament to their historical importance.

Generally, ancient heavy infantry units were used at the point of decision. They used their increased protection to meet enemy formations directly, usually in a frontal assault. They could utilize shock against lighter armed and armored forces, and when met on open ground would scatter lighter formations. In general, during ancient warfare the heavy infantry force anchored the decisive point.[27] The ancient heavy infantry fulfilled a role between the current infantry and the current heavy cavalry — the armor. Understanding that role and how it figured into ancient and medieval warfare will guide our understanding of the potential of the new heavy infantry.

Perhaps the most famous example of the use of heavy infantry to the modern reader is the Greek hoplite during the Greek and Persian wars. A common misunderstanding is that in both of these conflicts, the Persians were militarily inferior in their thinking. Contrary to common understanding, they used a fairly advanced version of ancient



(Illustration courtesy of the National Endowment for the Humanities)

combined arms, which employed multiple weapon systems that complemented each other. They did not, however, have the protection and offensive capability of the hoplite in their heavy infantry. The Greeks, in contrast, employed few other types of troops than their heavy infantry and sought decisive engagements against Persian forces. The primary reason why the Greeks defeated the Persians was the Persians' inability to counter the hoplites' heavy protection. This was in spite of the fact the Persians had a larger, better funded, and more sophisticated military.[28] Heavy infantry deployed in advantageous terrain against an enemy unable to counter the heavy infantry's protection can be the decisive force in a battle.

Another historical example that is useful to us today is how ancient forces overcame the same limitations that confront today's infantry as they try to adapt to heavier armor. Heavy infantry units knew they could not march with the totality of their equipment that they needed to take into battle. Ancient heavy infantry like the hoplites and the legions were known to use carts, mules, and other types of baggage trains to move parts of their equipment.[29] Once scouts had made contact with the enemy, units would drop sustainment equipment and prepare protective equipment (unsling shields, unburden spears, etc.). It is unfeasible for any heavy infantry unit to march its soldiers through restrictive terrain in their equipment. Approach marches can be done through difficult terrain, and the heavy infantry can be decisive in this terrain. But this is where the light infantry is necessary as a supporting and shaping element. In general, heavy infantry utilized some means of conveyance to reach the battlefield. This was one of the primary reasons the Romans built their road network — to allow quick movement of the legion.[30] The transportation needs of heavy infantry lead many modern readers to overemphasize the importance of heavy cavalry in the Middle Ages. In many instances, knights would dismount and fight on foot, effectively becoming heavy infantry. This happened when missile threats made cavalry employment very difficult or when it was of greater advantage to mix skilled heavy fighting men in with light infantry. There were also famous heavy infantrymen who rode to battle and dismounted such as the Danish Huscarls.[31] Generally, heavy infantrymen are decisive to a battle, but they must be conveyed there to preserve their combat power.

The heavy infantry is properly employed with support from the light infantry. Though popular history seldom focuses on them, most major heavy forces were arrayed with light forces. The Athenians defeated the famous heavy infantry of Sparta by utilizing heavy and light infantry complementarily.[32] It was this Greek development, coupled with effective use of heavy and light cavalry, that later led to Alexander the Great's conquest of the ancient world.[33] The Roman legions, after the Marian Reforms, focused on developing their highly effective heavy infantry but actively sought auxiliaries to fulfill the role of light infantry. These auxiliaries were themselves sometimes key to Roman victory.[34] During the Middle Ages, light infantry — especially in the form of missile troops — were required to counter the heavy cavalry. The effectiveness of these two forces together was most famously demonstrated at

Agincourt, when the English successfully countered the French heavy cavalry and infantry with their own light infantry longbow men intermixed with their heavier infantry and supporting cavalry.[35] This example should not come as a surprise to the modern military member as the successor of the heavy cavalry, the tank, still relies on the infantry in modern conflicts. Light infantry forces have been used by all militaries across history. Any heavy infantry force has to account for how they will incorporate light infantry support.

Finally, mobility is still an important asset among the heavy infantry. When two of the preeminent ancient world heavy infantry forces came to battle with one another, it was mobility that proved decisive. At the battle of Cynoscephalae, the more flexible and mobile Roman legion came up against the Greek phalanx. The phalanx was nearly unstoppable during the frontal assault with its heavy weapons and armor, but it was unable to properly maneuver to meet the Roman legion's greater mobility. Both of these forces used light infantry and cavalry to shape the battle beforehand, but the Romans overcame the Greeks with a superior mix of heavy protection and mobility.[36] Even though accepting decreased mobility is key in the heavy infantry concept, planners should still give consideration to combat effectiveness when determining the proper amount of armor and load carried by the heavy infantry.

The presented examples were chosen because they were likely to be familiar to the reader. There are other worthwhile examples that are applicable (for example, Japanese samurai's employment of their historical light infantry — the ashigaru).[37] I note this because it should be understood that heavy infantry is not limited to western military tradition but a near-universal solution to the problem presented by armor that can effectively scale upon protection with greater weight. A modern heavy infantry concept will follow many of these trends, but as military strategists found with the tank: simply copying the tactical strategy of medieval knights was not a feasible solution. Old ways provided a guide, but they had to be adapted — some had to be discarded and new strategies adopted. The heavy infantry of today must be different than their progenitors.

The Legionnaire on the New Battlefield: The Heavy Infantry Adapted to Today

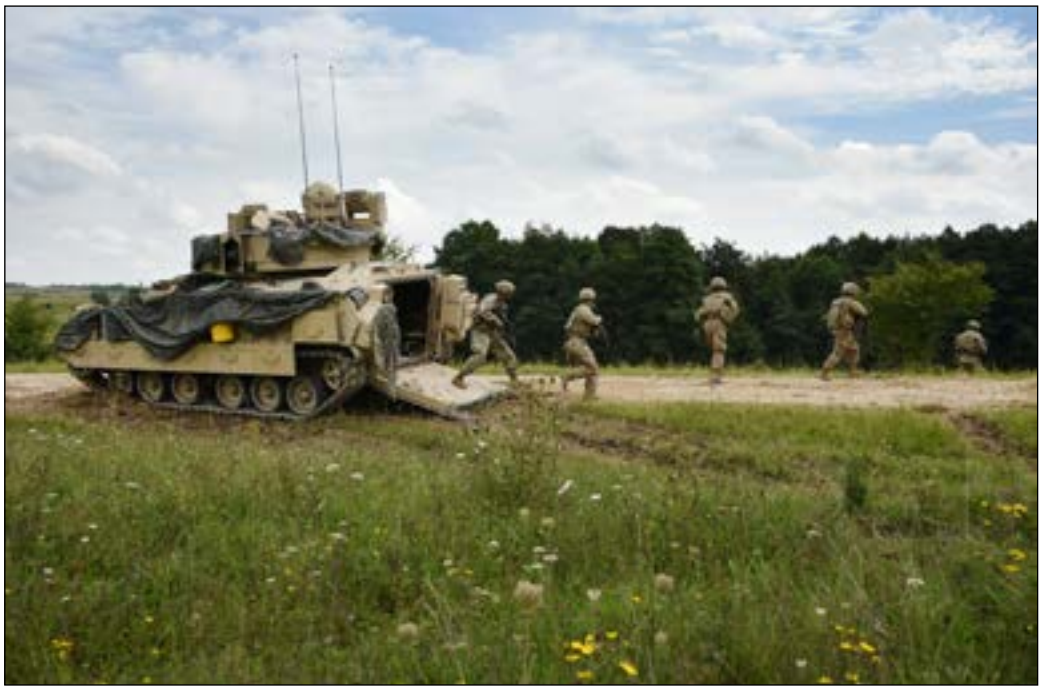
Armies that wish to adopt a heavy infantry concept must examine the equipment carried by the heavy infantry in detail. The heavy infantry as a modern concept has not been used during materiel development and acquisitions in the United States. All materiel currently has been focused on the unified infantry concept and therefore is inappropriate for both light and heavy in a dual infantry concept. A minimal requirement to make the heavy infantry a reality is purpose-built armor designed to be more protective than the current standard body armor. The heavy infantry will accept greater time exposed to enemy contact. This is a primary function for them — the ability to maneuver while under small arms fire. Therefore, further protecting them from small arms is essential. A priority focus for materiel testing is examining the effects of greater protection of the trunk of the body extending below the rib cage and protection to the thighs and pelvic area. Armoring the feet, shins, and arms should be examined as to its effects on soldier performance. Each piece of materiel's adoption or rejection must be based on testing. Heavier, more protective helmets to protect against small arms and resist concussive shock must also be considered.

Beyond protection, it will also be worthwhile to examine the arms carried by the heavy infantry. Ideally, a rifle purpose built to offer greater firepower with some increase in weight balanced with the added body armor would be used. New weapon acquisitions have proved difficult in the last few decades, and it may be that in the short term the heavy infantry will have a higher concentration of machine guns, anti-tank weapons, and other heavier, more casualty-producing weapons.[38] Additional equipment added to load carriage should be evaluated based on a cost-benefit analysis of its increase to combat effectiveness versus its adverse effects on Soldiers' mobility and performance. For items that directly affect the balance between load and capability, this balance can be easily measured. If a forced water-cooling vest or a spacer garment is added between the armor to help alleviate heat strain, it is easy to test the cost and benefit. Simply test Soldiers with and without configurations to see if the net gain in performance is greater than the added weight and encumbrance. When it comes to sensors, communications equipment, and other items that can't be put into a straightforward physical performance test, greater consideration must be given on whether to adopt them. As we saw with the Romans and the Greeks at Cynoscephalae, maximizing load and encumbrance for firepower and protection is not the best solution.

When determining the materiel makeup of the heavy infantry, the balance between firepower and protection with mobility and flexibility is still important. Heavy infantry forces must be able to accept and survive under small arms fire longer than what is currently feasible in the unified infantry concept. They must, however, still be able to move effectively in their equipment to maximize their potential. The balancing act still exists, but the calculations must change.

Considering load further, the load carriage solutions of antiquity are not completely adaptable to today's military. History demonstrates that heavy infantry must be conveyed onto the battlefield and will not conduct a long overland march armed and armored for combat. In the more modern high-speed and kinetic fights, due to mechanization, it's inappropriate to try and bring a cart and mule analog back to the battlefield. The heavy infantry must be equipped for battle when initial contact is made. This means that they will leave an assembly area ready to dismount. The short-term solution already exists in the form of the Bradley Fighting Vehicle. The Bradley can provide a 70-percent solution for the heavy infantryman. It can maneuver with the mounted force, provide protection to troops transported, and provide some firepower on the move. These will be required for the heavy infantry to be transported to the point of decision in battle. The Bradley, however, is not optimized for heavy infantry transport and that will lead to problems. The amount of equipment heavy infantrymen will bring with them in the form of personal armor, weapons, sensors, and other equipment will make them physically larger than Soldiers transported today. It will be impossible to fit the same number of heavy infantrymen into the troop compartment of the current Bradley as current infantrymen.[39] Ideally, the transport for heavy infantrymen would be optimized for them. During transport, heavy infantrymen will be armored, providing protection from spall and small arms. Taking this into consideration, platform protection will focus on larger weapon systems and anti-tank systems. Power system connection for personal-equipped systems should be available with a vehicle power system to compensate. The vehicle itself would need to be made on a larger internal scale to accommodate heavy Soldiers. Troop hatches, handholds, seats, and other personal equipment all need to be made larger and more robust to handle the increased weight and size of heavy Soldiers. The vehicle of the heavy infantry will have to be purpose built to move heavy Soldiers quickly, while in contact with the enemy, to the point of decision.

Consideration to unit manning must be made when adopting the heavy infantry concept. It will not be as simple as changing all the infantry Soldiers in an armored brigade combat team (ABCT) into heavy infantrymen. Heavy infantrymen cannot do all the tasks that the current unified infantry can do. It may be logical to take the resulting specialized light infantrymen and have them be the only type of infantry Soldier in current infantry brigade combat teams (IBCTs); the future of light infantrymen is beyond the scope of this article. History teaches us that heavy infantry will need light infantry support in restrictive terrain. The heavy infantry will give us the ability to bring shock and heavier direct firepower to restrictive terrain that the military is lacking today. When the approach march exceeds a few kilometers, the heavy infantry will need lighter, more mobile Soldiers to shape the battle and provide flank



Soldiers with Bravo Company, 1st Battalion, 8th Infantry Regiment, 3rd Armored Brigade Combat Team, 4th Infantry Division, dismount a Bradley Fighting Vehicle during the battalion's combined arms live-fire exercise in Germany on 18 August 2017. (Photo by Gertrud Zach)

security for them. This will mean additional logistical and materiel considerations when task organizing a heavy unit. Experimentation will need to be done to determine what the optimal level of task-organized light infantry is and what the proper troop ratio will be. Different armies fighting with similar technology historically found different optimal rates, and some armies of the same nation found that different units in geographical regions need a different mix of heavy and light troops. The U.S. Army's ratio of heavy to light infantry will be distinct, and the adopted heavy concept will change over time just as our current unit manning continues to do so today. At a minimum, light infantrymen in a heavy unit must be capable of the following things:

- They must effectively travel with the heavy infantry and survive to their dismount point.
- In a highly mobile kinetic environment, light infantrymen must be able to maneuver mounted with similar capabilities to heavy infantry mounted.
- They must also be able to move significantly faster dismounted than the heavy infantry.

It would be ineffective to have a stripped down heavy infantry concept or a light infantryman loaded with all manner of different sensors and equipment. Light infantrymen must still sacrifice protection for mobility and utilize terrain to make up the difference. The light infantry leader must be cross-trained with the heavy infantry. Ensuring that heavy and light infantrymen understand each other's tasks is paramount.

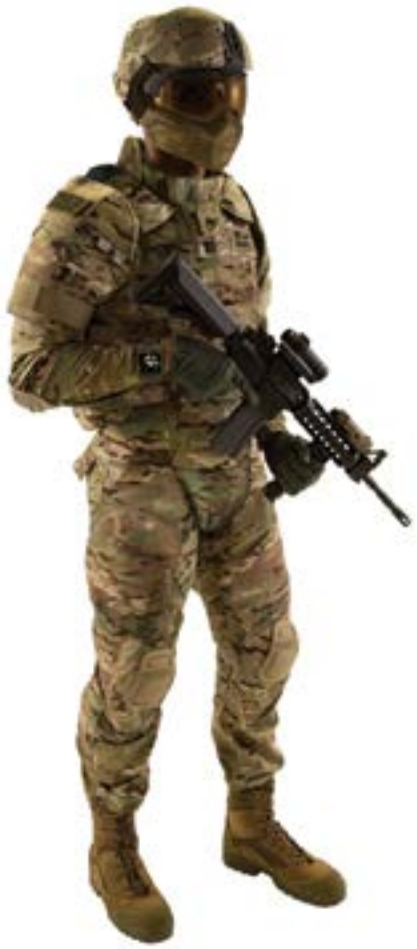
Much of this discussion has been about limitations and proper implementation, but the additional capabilities heavy infantrymen can bring are a persuasive reason to consider this methodology. Armoring Soldiers with significant protection over their whole body changes the way opposing formations can cause injury to Soldiers. Altering the effectiveness of current injury mechanics allows for a significant increase in a Soldier's capabilities. Obviously, armored strike plates covering the largest areas of the body will lend significant protection to Soldiers from small arms. Indirect fire generally uses three primary injury mechanisms: blast in the form of overpressure, shrapnel, and heat.[40] The effects of blast and heat reduce sharply based on distance from the explosion. Shrapnel is the most significant casualty-producing injury mechanism at range. In this manner, heavy Soldiers enjoy the same protective effects that they do from small arms. This would mean that the effective blast radius of opposing forces' indirect fire is significantly reduced when confronting a heavy infantry formation.

Considering what this would mean from an opposing force prospective can most readily let us understand the new capabilities. A heavy formation maneuvering on a light formation would be able to move more readily through open areas, advancing faster than a defending force would normally see with light infantry. An opposing force would see much less effects from its smaller caliber machine guns and indirect fires. In the defense, opposing forces would not halt or disrupt maneuver guns and indirect fires. In the defense, opposing forces would also not halt or disrupt maneuver as effectively, and in the offense they would not be able to suppress as effectively. To engage heavy infantry effectively, opposing forces would need to bring heavier weapons, which in turn would slow movement down, increase support requirements, and generally negatively affect opposing force maneuver. The opposing light infantry force would find itself in a situation similar to when it confronts medium armored vehicle formations; it would have a handful of effective weapons, but most of its personnel weapons would be ineffective.

Heavy Infantry: A Developing Solution to Developing Problems

The Army has been continuing to develop materiel solutions to overcome the mobility versus protection problem using the unified infantry framework. One current proposal, the Personal Protective Equipment Posture (PPEP) program, is designed to bring greater flexibility to load and armor carriage.[41] The proposed program advocates for a new type of modular body armor that is scalable — able to go from no armor acting as a load carrier to a plate carrier and then to a heavier configuration utilizing X Small Arms Protective Inserts (XSAPI) front and side plates. This is a logical progression of the current unified infantry concept and is internally sound.

The heavy infantry concept is a counterpoint to the current armor proposal. While helping to elevate some of the current problems, the PPEP program will leave the same issues as laid out above — mobility versus protection. Unit commanders have more freedom to decide what level of protection they think they need, but at its heart, it is no more than scaling armor up and down on light infantrymen. In a situation where a higher level of protection is deemed necessary, it's worth considering going past what can be scaled up on a light infantry armor frame. In close quarters combat or a mission where rifle fire is very likely, the current unified infantry concept has problems meeting the protection requirement. A unit able to close with the enemy and maneuver through terrain that would



The Soldier Protection System (SPS) is the Army's next generation Personal Protective Equipment system. SPS is a modular, scalable, tailorable system designed to defeat current threats at a reduced weight. (Photo courtesy of the U.S. Army Acquisition Support Center)

otherwise be very difficult — such as linear danger areas (LDAs) or open areas — would be more effective than what can be achieved with the unified infantry concept. Focusing on splitting the infantry between heavy and light would allow development and acquisition organizations to focus on better-designed and refined armor. Light armor that is designed to meet the mobility tasks of the light infantry will be better suited for these tasks than armor that has to make compromises between both.

Another developing problem that the heavy infantry concept can offer a solution to is the Army's ongoing attempts to develop a robotically assisted Soldier. The Army has been developing an infantry exoskeleton suit since the mid-2000s with the Future Force Warrior program.[42] The Army continues to have various proposed programs based on the remnants of the Future Force program that are still actively trying to bring powered exoskeleton assistance to the force at large. The most current program in robotically assisted combat is the Tactical Assault Light Operator Suit (TALOS) program being fielded by the Special Operations Command (SOCOM).[43] TALOS has a stated goal of initial fielding by 2018. The initial projected power capability of the system is approximately one hour of powered exoskeleton assistance.[44] This power limitation may meet the special operations community's needs, but it is obviously untenable for the current light infantry Soldier.

The wearable powered suit concept could be easily adapted for use by heavy infantry Soldiers. As previously discussed, heavy infantry Soldiers will need to be conveyed to the point of decision. Vehicle power available on platform would allow them to use battery power only when dismounted. A heavy, complicated set of wearable equipment supporting greater personnel protection and firepower is the classic model of the heavy infantryman. When discussing future technology, it's important to avoid the fanciful or to rely on history without analysis. This will not be the mechanized armor suit of science fiction, nor will we see the return of pure phalanx or legion tactics to

the battlefield. In examining this technology, we must understand current capabilities and limitations and rationally analyze them. The TALOS program reports to be able to increase personal armor protection from the current 19 percent to approximately 70 percent.[45] It also plans to integrate multiple communications and sensors. To enable this, they have created a powered exoskeleton that relies on current battery technology. Current battery technology severely limits operational time, and there are currently no solutions in development to change this.[46] In its current state, this system cannot be used by light infantrymen and therefore would not be adopted by the Army at large under its current unified light infantryman concept. The heavy infantry concept would allow for adoption by the larger Army for the specified tasks group encompassed by the heavy infantry. If the TALOS platform works as projected, it could be a significant force modifier to the heavy infantry and, by extension, the Army at large.

The heavy infantry concept can help create solutions for the developing problem set of increased urbanization and mega cities. Urban terrain is severely restricting to mounted capabilities. Mounted armor units have difficulty effectively engaging in urban canyons.[47] They are also very vulnerable to dismounted AT ambushes.[48] Enemy dismounted forces can operate relatively undetected within close proximity to mounted distance by utilizing abundant buildings and other urban obstacles. The current solution to these issues is to dismount, but the only operational dismounted framework is the unified light infantry concept.

Problems with urban, mounted maneuvers are generally well understood by the military at large. The problems and solutions to dismounted infantry operations have been the work of the last decade of conflict and have created a generation of Soldiers more comfortable with counterinsurgency operations than conventional fighting. Soldiers have adapted to urban operations, but problems with light dismounted infantry fighting in dense urban terrain remain. They stem from the intersection of the terrain's effect and operational capabilities of the light infantry. Wherever the next conflict takes place, it will, with a high degree of certainty, take place in an urban environment. It is worth considering some of the inherent shortcomings of the current concept and to consider a new concept's solutions when preparing for the future urban fight. Urban combat has the potential to be extremely costly in the terms of lives and time compared to other types of less complex terrain.[49] The realities of dismounted urban operations suggest that Soldiers will receive substantial amounts of effective enemy small arms fire.

Compounding this issue is the marked advantage urban terrain gives a defender. Historically, Army doctrine determined that the proper force ratio is three to one to effectively overcome a conventional defense.[50] The force ratio in an urban environment doctrinally can require three to five times greater force density than a similar operation in other less complex terrain.[51] This defender's advantage is one of the prime factors that allowed loose groups of comparatively poorly trained insurgents to survive for as long as they did during Operation Enduring Freedom and Operation Iraqi Freedom.

The Army is currently developing doctrine to confront the problem of urbanization and mega cities. Increased terrain complexity, additional levels to the battlefield (specifically subterranean), massive civilian populations, and potential refugee crises all make a future urban conflict potentially more difficult by an order of magnitude. If we cannot bring our heavily armed and armored mounted platforms into the conflict and if the current infantryman does not possess the appropriate amount of protection, then the heavy infantry concept provides us with a new solution to fill the gap between the two. The heavy infantry would allow us to bring shock and firepower to individual point targets in the urban environment. Heavy infantrymen would be able to overcome some of the advantage to the defender in the urban environment as well. Much of the advantage to the defender is achieved by the artificial constraints to maneuver put on movement through in urban terrain: successive choke points in the form of doors, windows, and entry ways; constrained rapid avenues of advance overwatched by hundreds of covered and concealed firing positions in the form of streets lined with buildings; and multiple successive LDAs overwatched by advantageous positions. All of these serve to the defender's advantage, but heavy infantry Soldiers can mitigate these advantages. While heavy infantrymen are not immune to small arms fire, they can be made resistant to it. This, in turn, would allow them to take greater risk while confronting an enemy.

Heavy infantrymen may receive small arms fire in any one of the many disadvantageous terrain areas in a city, but they are not affected in the same way as light infantrymen. If engaged with small arms, they could reasonably face the heavier armored front toward the enemy and attack them directly. Minimizing the defender's ability to use small arms to set hasty ambushes or use canalizing terrain to his benefit reduces light infantrymen's defensive advantages in urban terrain. While it does not nullify them, it does force the defender to set more deliberate

defenses and consolidate his heavier weapons. This reduces his freedom of maneuver and constrains him to more readily identifiable points of advantage. If he elects to use his light anti-tank systems, he cannot engage from an enclosed area. If he opts to use his heavier caliber machine guns or automatic grenade launchers, he will not be able to maneuver away rapidly. Areas of likely enemy occupation become easier to identify before an operation begins. Enemy actors are forced to become more concentrated and easier to maneuver on during the operation.

Conclusion

As an armor officer, you may be wondering why I, or any other non-infantry Soldier, should care about how the infantry operates and its capabilities. A truth for the military at large is that the infantry has been and still is the center of the military endeavor. A tank may be able to advance rapidly across open terrain to close with and destroy the enemy and a fighter jet may be able to effectively deliver its payload onto point targets, but if the infantryman is not able to stand on the adversary's ground and hold it, all of the rest is for naught. The advantages to the mounted force that the heavy infantry can bring are primarily what caused me to be interested in this topic. Tanks and mounted mechanized infantry advance rapidly and engage in highly kinetic warfare. Infantrymen are asked to leave the protection of the armored platform to dismount into this environment with nothing more than a SAPI plate and an M4 rifle. To prevent this from being an automatic death sentence, the mounted force is highly constrained in how it goes about dismounting infantry or bringing infantry into an engagement at all. The heavy infantry will not be able to fight dismounted with enemy armored platforms, but its survivability in such an environment will allow for greater freedom in employment.

I will be the first to admit that there are a lot of unknowns when it comes to the potential future heavy infantry concept. There is currently a real and imminent problem in armor carriage and load carriage that must be addressed. We have a new and potentially linchpin technology on par with the stirrup in effective ballistic armor. Innovation and new modes of thinking will be required as we move forward confronting these issues and developing novel solutions. Predicting the future of warfare is a difficult proposition, but there is a reason that organized militaries across history adopted a heavy infantry concept. If modern body armor continues to provide an effective protection to firearms, it is reasonable to expect modern armies to come to similar conclusions.

Notes

[1] Major N.V. Lothian, "The Load Carried By the Soldier," *Journal of the Royal Army Medical Corps*, Vol. 37 (October 1921); Lieutenant Carre (French Army), "Historical Review of the Load of the Foot Soldier," *Journal of the United States Infantry Association*, Vol. 5, No. 1 (July 1908): 756.
[2] S.L.A. Marshall, *The Soldiers Load and The Mobility of a Nation* (Quantico, VA: The Marine Corps Association, 1980).
[3] Joseph Knapik and Katy Reynolds, *Load and Carriage in Military Operations* (Walter Reed Army Medical Center: Borden Institute Monograph Series, 2008), 3; LTC Charles E. Dean, "Soldier Loads in Combat" (Presentation: Center for Army Lessons Learned), accessed from http://www.thedonovan.com/archives/CombatLoadPresentation.pdf on 29 August 2017; John Whiteclay Chambers II, "S.L.A. Marshall's Men Against Fire: New Evidence Regarding Fire Ratios," *Parameters* Vol. 33, Issue 3 (Autumn 2003).
[4] Knapik and Reynolds, *Load and Carriage,* 32-33.
[5] M.L. Puthoff, B.J. Darter, D.H. Nielson, H.J. Yack, "The Effects of Weighted Vest Walking on Metabolic Responses and Ground Reaction Forces," *Medicine and Science in Sports and Exercise* 38 (2006):746-752.
[6] S.N. Cheuvront, D.A. Goodman, R.W. Kenefick, R.J. Montain, and M.N. Sawka, "Impact of a Protective Vest and Spacer Garment on Exercise-Heat Strain," *European Journal of Applied Physiology* 102 (2008): 577-583.
[7] RINI Technologies, Personal Thermal Management System (PTMS) accessed from http://rinitech.com/wp-content/uploads/2016/03/MILITARY_COOLING.pdf on 11 September 2017.
[8] Army Doctrine Reference Publication (ADRP) 3-0, *Operations*, 4-3.
[9] Forecast International, "Land Warrior-Archived Report" Forecast International, accessed from https://www.forecastinternational.com/archive/disp_pdf.cfm?DACH_RECNO=110 on 11 December 2017.
[10] Knapik and Reynolds, *Load and Carriage,* 5-14; Dean, "Soldiers Loads in Combat."
[11] Army Techniques Publication (ATP) 3-21.18, *Foot Marches*, 3-9.
[12] Ibid, 3-8.
[13] Laurie Blanchard, "Impact of Load on Dismounted Warfighter Performance" (Presentation: Biophysics and Biomedical Modeling Division, U.S. Army Research Institute of Environmental Medicine).

[14] MAJ Owen Hill, Lakmini Bulathsinhala, SGT Dennis Scofield, LTC Timothy Haley, Thomas Bermasek, "Risk Factors for Soft Tissue Knee Injuries in Active Duty U.S. Soldiers, 2000-2005," *Military Medicine* 178 (June 2013).
[15] Seth Robbins, "Rigors of War Leave Troops Battling Arthritis at a Young Age," *Stars and Stripes*, 25 September 2011. Accessed from https://www.stripes.com/news/rigors-of-war-leave-troops-battling-arthritis-at-a-young-age-1.156110#.WYlgCzYUnlU.
[16] Robin Toblin, Phillip Quartana, Lyndon Riviere, Kristina Walper, "Chronic Pain and Opiod Use in U.S. Soldiers After Combat Deployment," *JAMA Internal Medicine* 174 (2014).
[17] Marlene DeMaio, James Onate, David Swain, Stacie Ringleb, Steven Morrison, Dayanand Naiak, "Physical Performance Decrements in Military Personnel Wearing Personal Protective Equipment (PPE)" (Presentation: Human Performance Enhancement for NATO Military Operations Symposium, Sofia, Bulgaria, 2009).
[18] Albert A. Adams III, "Effects of Extremity Armor on Metabolic Cost and Gait Biomechanics" (Thesis: Worchester Polytechnic Institute, 2010).
[19] Kari Loverro, Tyler Brown, Jeffrey Schiffman, "Use of Body Armor Protection Levels With Squad Automatic Weapon Fighting Load Impacts Soldier Performance, Mobility, and Postural Control," U.S. Army Natick Soldier R and D Center Technical Report, 2012.
[20] Technical Manual (TM) 10-8470-208-10, *Operator Manual for Improved Outer Tactical Vest (IOTV) and Improved Outer Tactical Vest GEN II (IOTV GEN II)*, March 2010, 5-25; Meghann Myers, "Army Designs New Harness to Protect Your Groin from Blast Debris," *Army Times*, 16 November 2016, accessed from https://www.armytimes.com/news/your-army/2016/11/16/army-designs-new-harness-to-protect-your-groin-from-blast-debris/.
[21] Bruce L. Gudmundson, *On Armor* (Westport, CT: Prager Publishing, 2004).
[22] Henrick O. Lunde, *A Warrior Dynasty The Rise and Fall of Sweden as a Military Superpower 1611-1821* (Oxford, England: Casemate Publishers, 2014), 64.
[23] Brian Todd Carey, Joshua B. Alfree, John Cairns, *Warfare in the Ancient World* (Barnsley, England: Pen and Sword Books, 2005), 1-17.
[24] Jeremy Black, *War and Technology* (Bloomington, IN: Indiana University Press, 2013), 71-99.
[25] Mary Frances Williams, "Philopoemen's Special Forces: Peltasts and a New Kind of Greek Light-Armed Warfare," *Journal of Ancient History* Vol. 53, No. 3 (2004): 257-277; Catherine M. Gilliver, *Mons Graupius and the Role of Auxiliaries in Battle* (Cambridge, England: Cambridge University Press, 1996).
[26] Gilliver, *Mons Graupius*, 1.
[27] Carey et al., *Warfare in the Ancient World*, 12-20.
[28] Ibid, 121.
[29] Lothian, "The Load Carried By the Soldier;" Adrian Goldsworth, *The Complete Roman Army* (NY: Thames & Hudson, 2003), 168-179.
[30] Goldsworth, *The Complete Roman Army*, 153-156.
[31] Matthew Bennett, Jim Bradbury, Kelly DeVries, Iain Dickie, and Phyllis Jestice, *Fighting Techniques of the Medieval World, AD 500-AD 1500 Equipment, Skills and Tactics* (NY: Thomas Dunne Books, 2006), 7-31.
[32] Carey et al., *Warfare in the Ancient World*, 24-28.
[33] Ibid, 32-60.
[34] Gilliver, *Mons Graupius*.
[35] John Keegan, *The Face of Battle* (NY: Penguin Books, 1976), 78-107.
[36] N.G.L. Hammond, T"he Campaign and the Battle of Cynoscephalae in 197 BC," *The Journal of Hellenic Studies* 108, (November 1988): 60-82.
[37] Stephen Turnbull, *Ashigaru 1467-1649* (Oxford, England: Osprey Military, 2001).
[38] Alex Horton, "Experts: Pentagon Must Look for More Powerful Rifles and Ammo to Replace the M4," *Stars and Stripes*, 17 May 2017, accessed from https://www.stripes.com/news/experts-pentagon-must-look-for-more-powerful-rifles-and-ammo-to-replace-tje-m4-1.468940.
[39] Christopher S. Foss, *Jane's Tank Recognition Guide* (NY: Harper Collins, 2006), 210-211.
[40] Ove S. Dullum, Kenton Fulmer, N.R. Jenzen-Jones, Chris Lincoln-Jones, and David Palacio, "Indirect Fire: A Technical Analysis of the Employment, Accuracy, and Effects of Indirect-Fire Artillery Weapons," Armament Research Services (ARES) Special Report, Perth, Australia, January 2017, 77-81.
[41] 199th Training Brigade, Soldier Lessons Presentation at Fort Benning, GA, 2017.
[42] Noah Shachtman, "Army Dreams: Super-Strong, Laser-Proof, Genius G.I.s," *Wired,* 4 May 2009.

[43] COL James Miller, TALOS Baseline Presentation, SOF Acquisition, Technology & Logistic Presentation, July 2016.
[44] SOF Acquisition, Technology & Logistics, TALOS Systems Breakdown Overview Presentation, 2016.
[45] Ibid; COL James Miller presentation.
[46] Fred Schlachter, "No Moore's Law for Batteries," *Proceedings of National Academy of Sciences of the United States of America* Vol. 110. No. 14 (2 April 2013).
[47] ATP 3-20.15, *Tank Platoon*, December 2012, 7-21.
[48] Ibid, 7-20.
[49] William G. Robertson, general editor, and Lawrence A. Yates, managing editor, *Block by Block: The Challenges of Urban Operations* (Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 2003), 439-450.
[50] FM 7-20, *The Infantry Battalion*, 3-15.
[51] FM 3-06, *Urban Operations*, 1992, 5-2 (Rescind).

CPT Matthew Allgeyer is the assistant plans officer for the 1st Battalion, 16th Infantry Regiment, 1st Armored Brigade Combat Team, 1st Infantry Division. He holds a bachelor's degree from Hamline University in St. Paul, MN. He previously served as an NCO in the U.S. Marine Corps.