

RECORD VERSION

STATEMENT BY

**GENERAL PETER W. CHIARELLI
VICE CHIEF OF STAFF
UNITED STATES ARMY**

BEFORE THE

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Chairwoman Kaptur, Ranking Member Young, distinguished Members of the House Committee on Appropriations I thank you for the opportunity to appear here today to provide a current status on Soldier Equipment Ergonomics. This is my first occasion to appear before this esteemed committee, and I pledge to always provide you with an honest and forthright assessment.

On behalf of our Secretary, the Honorable Pete Geren and our Chief of Staff, General George Casey, I would also like to take this opportunity to thank you for your continued, strong support and demonstrated commitment to our Soldiers, Army Civilians, and family members.

As all of you know, it has been a busy time for our Nation's military. We are at war, and we have been at war for the past seven-plus years. That has undeniably put a strain on our people and equipment. In spite of this, I continue to be amazed by the resiliency of the Force. Certainly, we have had our share of good and bad experiences. Our military has learned invaluable lessons from those experiences. And, we are continually making adjustments and improvements to our tactics, training, and equipment based upon those lessons learned.

The men and women serving in the Army today are well-trained, highly-motivated, and deeply patriotic. They are our Nation's sons and daughters, and our job as leaders is to ensure they have everything they need – the training, the information, the equipment, the confidence – to be safe – and successful in their mission. Technology is a great capability enhancer; however, it is people, not technology that win wars.

This New Strategic Environment Demands Flexibility

Today, the situation on the ground in theater is sometimes uncertain and frequently changing. The new strategic environment characterized by “Full Spectrum Operations” – ranging from Major Combat Operations (MCO) to Counterinsurgency (COIN) – demands flexibility in order to make necessary adjustments over time.

We have seen this demonstrated repeatedly in Iraq with the evolution of improvised explosive devices (IEDs). At the start of the war in 2003, U.S. Forces encountered huge numbers of IEDs, most rudimentary land mines. The Army immediately took measures to protect the Force against these IEDs by hardening vehicles, adding more plates and armor slats, employing air surveillance assets and jamming devices, etc.

However, just as we have continually made adjustments to our capabilities, so have our adversaries. Over the last several years, the enemy has employed more sophisticated devices, including command- or pressure-detonated roadside bombs, vehicular bombs, and explosive vests. Their tactics have evolved as well, to include employing multiple devices in tandem or a secondary device intended to target first responders.

Indeed, our efforts are by no means solely reactionary. To the contrary, our aim is to always stay ahead of the threat. And, in addition to employing defensive measures, we have actively engaged our adversary’s network in order to locate and disarm explosive devices before they are able to employ them. However, the emergence of new technologies does ultimately require us to figure out how to best use those technologies and equip Soldiers – without overloading them.

Since WWII, the Army has fielded numerous innovative technologies, including the Kevlar helmet, body armor, and individual and squad radios. These tools and many others have greatly enhanced Soldier capability, while also significantly reducing mortality rates. In fact, the ratio of Killed in Action (KIA) to Wounded in Action (WIA)

has decreased from 41% during WWII to 12% in the Global War on Terror; likewise, the number of hostile deaths per 100,000 has dropped from 2,086 to 210. However, the further challenge effected by this progress has been more and more weight added to a Soldier's load. During WWII, the Soldier's average fighting load weighed less than 36 pounds; today it weighs in excess of 63 pounds.

Physiological Impact of Soldier Load

Today, the average Soldier load consists of a rucksack, weapon, ammunition, helmet, and other gear; the total weight can range from 63-130+ pounds depending on the variables of mission type, duration, and environment. In addition, the various components of Individual Body Armor (IBA) worn by Soldiers ranges from 2.5 pounds (side plate carriers) to 9.6 pounds (outer tactical vest) to 10.5 pounds (front and back E-SAPI ballistic plate inserts); the total weight for a full set of IBA ranges from 26 pounds to over 41 pounds. These extra pieces not only add more weight, but the cumbersome gear can also hinder Soldier movement.

Multiple studies illustrate how carrying a load causes pain, reduces performance, and increases fatigue. In one study, infantry Soldiers carrying a load of 101 pounds for 12.5 miles had a decrease of 26% in marksmanship (number of targets hit), a 33% increase in distance from the target center, and an increase in back pain compared to pre-load and march scores.

Several studies have emphasized the physiological impacts of wearing combat gear on Soldiers' performance. A 72-pound load increases energy required by 40%; increasing the load further by 20% increases the heart rate by 20 beats per minute. The distance marched in 6 hours decreases 1.24 miles for every 10 pounds over 40 pounds the Soldier carries, and the time required to complete an obstacle course increases 10-15% for every additional 10 pounds carried. In studies where Soldiers wore body armor, heart rate, respiration, core body temperature, and maximum oxygen uptake all increased significantly. Lower body endurance decreased 15%, upper body endurance

decreased 60%, and there was a 39% decrease in the Soldier's ability to cool himself. And, in all cases Soldiers rated their tasks as more difficult with IBA.

Over the past several years, we have also seen an increase in musculoskeletal issues, including sprains, stress fractures, and knee, neck, and back pain reported by Soldiers in theater or upon return from deployment. According to recent studies, of the 48% of Soldiers who wore the IBA for 4 hours or more, 70% had neck and back pain. From July 2004 to October 2008, low back, mid/upper back, and neck pain were the chief complaints of Soldiers seeking care from physical therapists. Today, the risk for injury is even greater in Afghanistan (compared to Iraq), given the higher elevations and steep, rugged terrain. The reality is you cannot hump a rucksack at 8,000 to 11,000 feet for 15 months, even at a young age, and not have an impact on your body.

Army Deployability Rates

The "wear and tear" on Soldiers over the past seven-plus years has had a significant impact on Army deployability rates. Since 2006, the number of total non-deployables has risen by an estimated 2,000 to 3,000, putting the current figure at about 20,000. In many cases, injured Soldiers are sidelined for lengthy periods of time for recovery and rehabilitation. The time frame for tissue healing, in particular, varies greatly; in some cases there is no lost duty time and in other cases the damage ultimately results in a Soldier being medically discharged from the Army.

It is important to recognize that there are differing stages of recovery and rehabilitation. While it may take only a few days, for example, for shoulder pain to subside, it can take 6-12 or even 16 weeks for normal tissue healing to occur. And, in fact, Soldiers are more susceptible to further injury during these stages of recovery when they may "feel" better (less/no pain); meanwhile, the more serious injuries to ligaments, tendons, etc. are still healing. Without proper rest or rehabilitation the risk for further injury or re-injury increases.

Part of the challenge is environmental (elevation, terrain, weather conditions, road infrastructure, etc.) Another factor is physical size (heaviness/bulkiness) of a Soldier's load. The third aspect is cultural. Over the last 30+ years, the Army has seen an increase in average muscle mass and body fat percentages for new recruits. Experts have identified changes in diet (increase in consumption of junk food/soda/etc.), cutback in outdoor activities and mandatory physical exercise programs in schools, and an increase in more sedentary activities (computer games, television viewing, etc.) as contributing factors to the increase in body fat.

In the military, we train with a combination of running, jumping, marching, and multi-directional impact activities. Oftentimes, new recruits – even those in seemingly peak aerobic physical condition – end up suffering injuries, such as stress fractures, during basic combat training because their bones are not accustomed to nor prepared for this type of training and exercise. The Army is working hard to find better ways in the future to identify susceptible individuals, and to develop programs to train new Soldiers properly in order to avoid injury.

Today, the Army is pursuing a comprehensive approach (short-term, long-term, and R&D) to address the physiological impact of excessive loads on Soldiers deployed in support of combat operations. And, our efforts are focused on two key areas: the Army's physical training/conditioning programs and the weight of Soldier Load and IBA.

Physical Training / Conditioning Programs

Right now, the Army is in the process of changing its physical training doctrine in order to better prepare Soldiers for the physical demands of military operations.

The Center for Health Promotion and Preventive Medicine (CHPPM) worked with the U.S. Army Physical Fitness School (USAPFS) from 2001-2005 to develop, improve, and test the emerging Army Physical Fitness doctrine called Physical Readiness Training (PRT). According to their joint report, *"United States Army Physical Readiness Training: Rationale and Evaluation of the Physical Training Doctrine"*:

“PRT follows the principles of progressive overload, regularity, specificity, precision, variety, and balance. Specificity was achieved by examining the standard list of military (warrior) tasks and determining 1) the physical requirements, 2) the fitness components involved, and 3) the training activities that could most likely improve the military tasks. Injury prevention features include reduced running mileage, exercise variety (cross-training), and gradual, progressive training.”

The PRT concept focuses on improving Soldiers’ cardiorespiratory endurance; muscular strength, muscular endurance (anaerobic endurance), power; and movement proficiency (incorporates balance, flexibility, coordination, speed, and agility).¹

To date, PRT has been evaluated for its injury reduction potential in three Army environments (basic combat training, advanced individual training, and an operational infantry unit (4th Brigade, 10th Mountain Division, preparing for deployment to Afghanistan); and one laboratory study that compared PRT to an aerobic and weight training program. The battalion from 10th MTN Div (477 men) prepared for Afghanistan by focusing on ground tasks (running, calisthenics, guerrilla drills, etc.); off-ground tasks (climbing drills, conditioning obstacle courses, confidence obstacle courses, etc.); and combatives (close, medium, long-range.) And, the result was 20% fewer lower extremity injuries and fewer post-deployment injuries compared to other units. Overall, the adjusted risk of injury was 1.5 to 1.8 times higher in groups of Soldiers performing traditional military physical training programs when compared to groups using a PRT program.² The Army plans to begin implementing the new PRT doctrine across the Force over the next year.

In the meantime, units across the Army have adopted a variety of other injury prevention/performance enhancement programs. For example, the Ranger Regiment, U.S. Special Forces, and several Brigade Combat Teams (BCTs) have implemented

¹ Dr. Joseph J. Knapik, et al., “United States Army Physical Readiness Training: Rationale and Evaluation of the Physical Training Doctrine,” US Army Center for Health Promotion and Preventive Medicine, 5.

² Ibid, page 3.

programs that, in addition to traditional aerobic exercise, also emphasize core strengthening, plyometrics, and speed and agility drills. And, physical therapists are now assigned to and deploy with BCTs. Physical therapists use a sports medicine approach to identify, treat, and rehabilitate musculoskeletal injuries expeditiously. And, those units that have physical therapists have shown a reduction in injury rates.

Initial evaluations suggest that Soldiers who train and condition properly are much less likely to sustain an injury after deployment. Therefore, the best way that we can help our Soldiers to avoid suffering debilitating musculoskeletal injuries due to excessive load is by preparing them as well as possible for the physiological demands of their mission. By improving Soldiers' physical strength and conditioning we also improve the overall medical readiness of our Force. And, we have seen evidence of this assessment in the reduced Soldier injury rates for those units that, prior to deployment, used programs that emphasized PRT exercises, core strengthening, and aggressive strength training. Studies have also confirmed a decline in injury rates at initial entry training since the introduction of PRT.

Reducing Soldier Load

The Army recognizes that the weight a Soldier is carrying has a direct impact on his ability to perform his mission. Therefore, a concerted effort is being made to reduce the heaviness and bulkiness of combat gear and IBA required by Soldiers on the battlefield, without sacrificing survivability.

The reality is there is a trade-off to be made between force protection and effectiveness. Certainly we could outfit a Soldier with every piece of body armor and equipment available, essentially encasing him or her in a "cocoon" of protective technologies. However, doing so would greatly diminish his or her effectiveness, his or her ability to maneuver on the battlefield, and, as a result, actually put him or her at even greater risk. The cumbersome load, for example, may slow him or her down and limit his or her ability to quickly take cover in the event of an attack.

Lightening a Soldier's load can be accomplished by reducing the area of coverage and/or the level of protection in covered areas. And, Commanders on the ground are responsible for evaluating mission parameters (climate, environment, mission duration, etc.) to determine the correct configuration of a Soldier's load and IBA.

Other options the Army is pursuing include: lessening the weight of individual pieces of equipment, developing technologies that would carry part of the load on behalf of the Soldier, and transporting equipment or supplies to a forward location ahead of Soldiers. We are exploring both short-term solutions, as well as those that will meet ground forces needs well into the future.

In the short-term, the Rapid Equipping Force (REF), the Asymmetric Warfare Group (AWG), and the U.S. Army Natick Soldier Research, Development, and Engineering Center (NSRDEC) are in the process of tackling the challenge of the Soldier's Load on behalf of the Army.

The REF is an organization that has helped to address specific capability shortfalls by canvassing government, industry, academia, and the scientific community for existing or emerging technologies. The REF then provides limited quantities of the best available off-the-shelf equipment to the Warfighter as quickly as possible.

Among the many items REF has provided to units in theater are remotely-operated cameras that assist with force protection at Forward Operating Bases and Combat Operating Posts; IED and other explosive material detectors that help our Soldiers defeat IED threats; improved ballistic protection for military vehicles that increases survivability; and lighter machine guns in Afghanistan that are helping to reduce the weight of a Soldier's Load.

In September 2008 the REF Director and Sergeant Major visited units in Afghanistan and received requests from those units to lighten the load of Soldiers operating in extreme elevations greater than 6,000 feet. REF formed an Integrated

Product Team (IPT) in October 2008 with PEO Soldier, AWG, Army Test and Evaluation Command (ATEC), and United States Army Infantry Center to develop solutions. Within 47 days, the IPT identified, coordinated, and obtained from U.S. Special Operations Command 104 lightweight machine guns and delivered the weapons to the requesting BCT in Operation Enduring Freedom (OEF) with user training provided by Crane Naval Surface Center and the AWG. These weapons decreased the Soldiers load by up to 9 pounds. Concurrent to this effort, the AWG Field Team helped the BCT craft an Operational Needs Statements (ONS) focused on lighter body armor.

Simultaneously, AWG developed a formal assessment plan in partnership with John Hopkins University to prove or disprove the hypothesis that weight impacts on a Soldier's performance with regards to suitability, survivability, lethality, and maneuverability. The assessment takes a holistic look at the Soldier as a system and focuses on the implications and effects of lightening the Soldier's load, rather than assessing individual pieces of equipment.

When REF received the approved ONS from the Warfighting Commander, the organization coordinated with Program Executive Office (PEO) Soldier and the Army Staff; and, REF is now working with AWG and the IPT to provide a BCT in OEF with lightweight body armor and 14 additional pieces of equipment. These items, combined with the lightweight machineguns and lightweight body armor, have the potential to decrease a Soldier's load further by 14 to 23 pounds. Once completely employed, this equipment will be assessed in OEF by AWG, ATEC, and BCT personnel and the results – good or bad – will inform future REF equipping actions and Army fielding decisions.

While the REF focuses on existing and emerging technologies, NSRDEC conducts and sponsors research into future technologies, including lighter materials for body armor. Advanced fibers and carbon nanotube-based hard armor, for example, promise substantial reductions in the weight of future body armor, while improving body conformity and maintaining protection levels consistent with anticipated threats. The modern pack system design, developed by NSRDEC and currently used by Soldiers,

distributes the load in order to gain energy efficiency and minimize unwanted resultant forces exerted on the body.

Advances in food technologies achieved by NSRDEC have also resulted in a 40-50% reduction in the weight of combat rations carried by Soldiers during initial periods of high intensity conflict. And, the human and small unit modeling research currently being conducted by NSRDEC in an effort to better understand the trade-off between added weight and capability will help Commanders to make more informed decisions on what Soldiers should carry and why.

PEO Soldier, the Army organization that designs, develops, procures, fields, and sustains virtually everything the Soldier wears or carries, is also looking for ways to lighten the load on our Soldiers in the long-term. Over the last several years, PEO Soldier has been working to develop lighter systems for force protection, lethality, and advanced command and control gear. The Improved Outer Tactical Vest (IOTV) is approximately three pounds lighter than its predecessor, with greater coverage area. The combination of IOTV with X-SAPI is still lighter with more protection than the current OTV with E-SAPI.

In the weapons area, PEO Soldier is preparing for production of a lightweight medium machine gun, and an under barrel shotgun that will eliminate the need for some Soldiers to carry two separate weapons. These two improvements provide about 5 pounds of savings for the affected Soldiers.

Land Warrior, also developed by PEO Soldier, is helping to bring the networked battlespace down to the dismounted frontline troops. Land Warrior combines computers, lasers, navigation modules, radios, and other technologically advanced equipment in order to improve Soldiers' situational awareness, their ability to communicate on the battlefield, and, ultimately their ability to fight effectively and survive. Land Warrior – and, the next generation system currently being developed,

Ground Soldier Ensemble (GSE) – represent the Army's effort to increase mission effectiveness by linking the Soldier to the network.

GSE does incur a weight increase principally due to power requirements, but the Army is currently pursuing advanced technologies in an effort to further reduce this weight in future configurations. Right now, a smaller battery, the LI-80 (80 watt-hours) weighing approximately one pound less than the rechargeable LI-145 (145 watts-hours) battery can be used for shorter duration missions. The capabilities of GSE also eliminate the need to carry a military GPS (i.e., Defense Advanced GPS Receiver or DAGR) or inter-squad radio.

In the future, unmanned platforms could also contribute significantly to reducing injuries and wear and tear on Soldiers. As envisioned, such platforms could transport equipment, serve as resupply vehicles, provide emergency evacuation support, etc. The Army is aggressively seeking these and other advanced technology solutions to maximize Soldier effectiveness and reduce Soldier load.

Another option being exercised in Afghanistan to reduce the carrying burden on Soldiers is the conduct of resupply missions by aerial delivery using helicopters and fixed-wing aircraft with parachute systems. An average of 26,000 pounds of supplies (including liquids) are delivered per day via air drop, including small multifunctional packages of supplies, usually duffel bags filled with everything from food and water, batteries, ammo, and replacement uniforms. The container delivery system is the most commonly used method for the aerial insertion of supplies quickly for military and contingency operations. Using these air drops reduces the need for Soldiers to carry excessive amounts of supplies and it lessens the number of convoys on the roads. Aerial delivery is also necessary since many operating sites in Afghanistan simply cannot be resupplied by vehicle convoy. However, there are limitations to conducting precision aerial delivery of supplies and equipment, such as weather and threat conditions. And, in Afghanistan the mountains can frequently interfere with the accuracy of precision guidance systems.

Need for Procurement Reform

I assure the Members of this committee that we will never be complacent in our responsibility to ensure Soldiers have the right training and equipment to be safe and successful in their mission. The shortfalls Soldiers identify on the battlefield can mean life or death for them, and so we have an obligation to update training, find solutions, and deliver capabilities as quickly as possible.

Unfortunately, as Secretary Gates said at National Defense University in September 2008, “Our conventional modernization programs seek a 99 percent solution in years. Stability and counterinsurgency missions – the wars we are in – require 75 percent solutions in months.” Clearly we need to update our approach. In the past, the acquisition process was able to keep pace with technology. However, that is not the case today, and our Soldiers cannot afford to sit and wait.

Over the past several years, we have found ways to deliver needed capabilities to Soldiers in the short-term, and it has been made possible through the financial support of Congress. With your help, we have been able to field many critical capabilities in a matter of months versus years primarily through the use of Supplementals. By procuring COTS, or Commercial, off-the-shelf products, like the Mine Resistant Ambush Protected (MRAP) vehicles, we have saved arms, legs, and – most importantly – the lives of countless Soldiers.

Closing

In today’s dynamic environment, we must continue to be flexible. While we are focused on the critical mission at hand, we are absolutely committed to providing the best Force Protection available. However, as capabilities – ours and our adversaries – continue to mature, the challenge becomes how to equip Soldiers properly without overloading them. The reality is there will always be a trade-off between load and capability, even as advances in technology progressively lighten the weight of existing capabilities. Simply utilizing technology to reduce the weight of individual pieces of

equipment will not ultimately lighten a Soldier's load; it will only serve to make room for added capability, until the Soldier once again reaches maximum capacity. Therefore, in addition to pursuing lighter technologies, we must also ensure we truly understand the trade-offs between load and capability, and can identify that point of diminishing returns where any additional capability does more harm than good. I assure the Members of this committee that this challenge will continue to be a top priority for our Army's senior leaders.

I am confident that we are taking the correct actions to reduce the physical burden on Soldiers without compromising their survivability, by making adjustments to unit-level physical training and conditioning programs; finding further ways to reduce the weight of individual pieces of equipment and IBA; and pursuing improved and new technologies and methods for carrying or delivering part of a Soldier's load. Again, I can assure the esteemed Members of this committee that there is no greater priority for me and the other senior leaders of the United States Army than the safety and well-being of our Soldiers. The men and women who wear the uniform of our Nation are the best in the world, and we owe them and their families a tremendous debt of gratitude for their service and for their many sacrifices. I am deeply honored to serve alongside them.

Chairwoman, Members of the Committee, I thank you again for your continued and generous support of the outstanding men and women of the United States Army and their families. I look forward to your questions.

300 lbs
300 lbs

**OTV + DAP
+ Side Plate Carriers
Weight: 17.6lbs.**

Deltoid Axillary Protector (set) (DAP)
Weight (set) : 5.5lbs



Outer Tactical Vest (OTV)
Weight: 9.6lbs*



Side Plate Carriers (set)
Weight: 2.5lbs

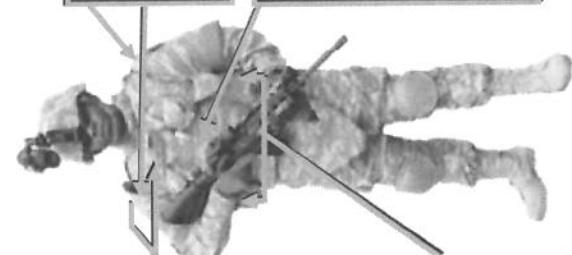


**IOTV + DP
Weight: 14.5lbs.**

Deltoid Protector (DP) (set)
Weight (set) : 2.5lbs



Improved Outer Tactical Vest (IOTV)
Weight: 12.0lbs*

Front and Back Ballistic Plate Inserts

E-SAPI Ballistic Inserts (set)
Weight (set) : 10.5lbs*



Note: An XSAPI plate weights 6-11oz greater than an ESAPI plate depending on size

Side Ballistic Plate Inserts (2)

Enhanced Side Ballistic Inserts (set) (ESBI)
Weight (set) : 5.0lbs*



X-SAPI Side Ballistic Inserts (set) (XSBI)**
Weight (set) : TBD



Interceptor Body Armor Weights				
System	X-Small	Small	Medium	X-Large
IOTV w Deltoid Protector /X-SAPI + ESBI	27.0lbs	29.4lbs	31.5lbs	34.5lbs
IOTV w Deltoid Protector /E-SAPI + ESBI	26.1lbs	28.4lbs	30.0lbs	33.2lbs
OTV w DAPS/E-SAPI + ESBI	29.1lbs	31.4lbs	33.1lbs	36.1lbs
OTV + DAP + Side Plate Carriers				41.6lbs

**** = Weight in size medium**

**** = X-SAPI Side Ballistic Inserts not yet procured**