

**NOT FOR PUBLICATION
UNTIL RELEASED BY
THE HOUSE APPROPRIATIONS
COMMITTEE
SUBCOMMITTEE ON DEFENSE**

**STATEMENT OF
GENERAL JAMES F. AMOS
ASSISTANT COMMANDANT OF THE MARINE CORPS
BEFORE THE
HOUSE APPROPRIATIONS COMMITTEE
SUBCOMMITTEE ON DEFENSE
CONCERNING
COMBAT LOAD INJURIES
ON
MARCH 11, 2009**

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Introduction

Chairman Murtha, Congressman Young, and distinguished Members of the Subcommittee, I want to thank you for your generous support and the opportunity to speak to you today about the weight of the combat equipment your Marines carry and injuries that weight may cause. Additionally, I will share with you our ongoing efforts to lighten the equipment loads of your Marines.

The health and welfare of our most sacred resource, the individual Marine, is critical to the long-term success of our Corps. Despite high operational tempo, your Marines continue to be resilient and highly motivated, performing superbly in all assigned missions. Today, over 26,000 Marines are deployed to the U.S. Central Command's area of responsibility in support of Operation IRAQI FREEDOM (OIF) and Operation ENDURING FREEDOM (OEF). We are facing enemies and operating environments that are different than decades past, and Marines are adapting accordingly.

The goals of improving our equipment and lightening our Marine's load have been with us since the founding of our Corps. Six years of combat in challenging and varied environments have taught us that optimal combat effectiveness requires a balance between protection, maneuverability, and lethality, among other factors. Combat environments constantly change, and experience has shown that Marines on the battlefield are in the best position to determine the most effective combat load for a given situation. Operational commanders determine how best to equip their Marines based on their analysis of mission requirements, the enemy situation, and environmental conditions. To enable this flexibility, we provide a range of options in personal protective equipment that can be configured to meet varying levels of threat.

Over the last four years, the Marine Corps has not seen a significant increase in injuries directly related to changes in the weight and type of equipment. Regardless, we continue to seek out and acquire lighter, more effective equipment. With your continued support, we will outfit your Marines with the latest in protective technology.

Conditioning, Deployment Tempo, and Injury Trends

Conditioning

An essential part of Marine Corps culture is to condition Marines for combat and ensure they are physically ready for the fight. We treat physical conditioning as an essential part of

readiness for combat and view Marines as professional athletes. To reduce injuries and promote fitness, we recently increased the number of physical therapists and sports medicine physicians at core Marine Corps training facilities such as the Marine Corps Recruit Depots, Officer Candidate School, and The Basic School; and at our major bases at Camp Lejeune, North Carolina and Camp Pendleton, California. These health professionals have mitigated the occurrence of injury and educated our warfighters on how to prevent injuries and develop, maintain, and recondition their bodies. Additionally, in October 2008 we added the Combat Fitness Test to the Corps' fitness requirements. The Combat Fitness Test measures the abilities demanded of Marines in combat – running in boots and camouflaged trousers, low crawling, and carrying loads and simulated casualties. In short, our physical training regime is designed to prepare Marines for the rigors of combat, which include wearing body armor and carrying combat loads.

Deployment Tempo

The Marine Corps has been able to sustain and deploy operationally ready and mission capable forces despite the strain of harsh environments and heavy loads on individual Marines. However, we recognize that both these factors take a toll on the human body over extended periods. Our plans to grow the force to 202K Marines, which, with your continued support we will achieve by October 2009, will increase the dwell time of Marines and provide a longer period to recover between deployments. The current deployment-to-dwell ratio of many of our operating forces is slightly more than 1:1. Our growth to 202k supports our goal of increasing the deployment-to-dwell ratios of our operating forces to 1:2. A 1:2 deployment-to-dwell ratio, which will provide Marines 14 months at home station for every seven months deployed, is critical to the long term health of our forces.

Injury Trends

According to the Naval Health Research Center and the DoD Center for Deployment Health Research, musculoskeletal injuries are the predominant contributors to Non-battle Injuries (NBI) occurring in theater. They consist of falls, strains, sprains, and musculoskeletal overuse injuries. We frequently see injuries due to embarking and disembarking from vehicles where limitations in motion, disturbances in balance, and increased muscular demands created by wearing personal protective equipment (PPE) may have been a contributing factor. Also, some

evidence suggests that the weight and bulk of personal protective equipment have been contributing factors in injuries and deaths caused by delays evacuating vehicles underwater or on fire.

Analysis of active duty USMC injury data from January 2005 to May 2008 was conducted by the Navy and Marine Corps Public Health Command (NMCPHC). The injury rates below are expressed as a percent of all injuries for the time period.

Injuries treated as inpatients

	2005	2006	2007	2008
Fracture	19.43%	21.34%	26.15%	23.75%
Back Injuries	1.61%	2.49%	2.47%	2.68%
Lower Extremities Sprains/Strains	1.61%	1.62%	1.41%	4.59%

Injuries treated as outpatients

	2005	2006	2007	2008
Fracture	16.25%	17.49%	17.47%	16.56%
Back Injuries	8.92%	7.37%	7.30%	8.66%
Lower Extremities Sprains/Strains	25.52%	24.86%	24.43%	26.37%

Overuse injuries classified as stress fractures

YEAR	NUMBER OF STRESS FRACTURES	TOTAL NUMBER OF OVERUSE INJURIES	PERCENT OF STRESS FRACTURES OF ALL OVERUSE INJURIES
2004	995	20380	4.9%
2005	3211	57720	5.6%
2006	2791	52332	5.3%
2007	2612	58426	4.5%
2008	962	21332	4.5%
Totals	10571	210190	5.0%

To put the difference between inpatient and outpatient injuries into perspective, there were 7,841 inpatient discharges compared to 563,916 ambulatory clinic visits for the same time period. Marines are seen for injuries in outpatient clinics at an 80:1 ratio to injuries treated as hospital admissions.

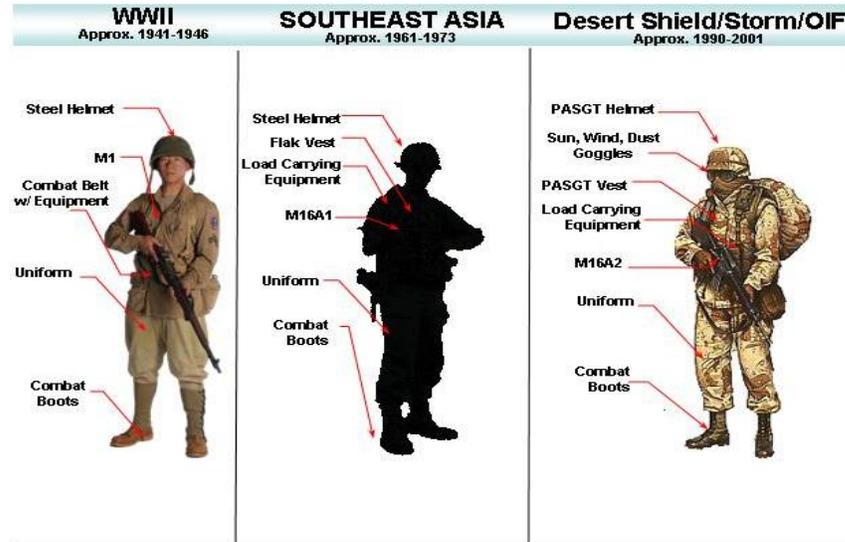
The NMCPHC analysis indicates there has been some variation in rates of fracture, back and lower extremity injury rates over the past 4 years, but no dramatic upward trend in any specific injury which could be directly tied to changes in personal protective equipment or pack weight.

Evolution of Body Armor Protection

Prior to the late 20th Century, Marines engaged in combat were outfitted with minimal personal protection. Personal protection afforded to the soldiers of World Wars I & II was limited to helmets. However, even with minimal protection, the average Marine still found himself weighed down with equipment. (See Table 1)

Table 1

PPE Evolution

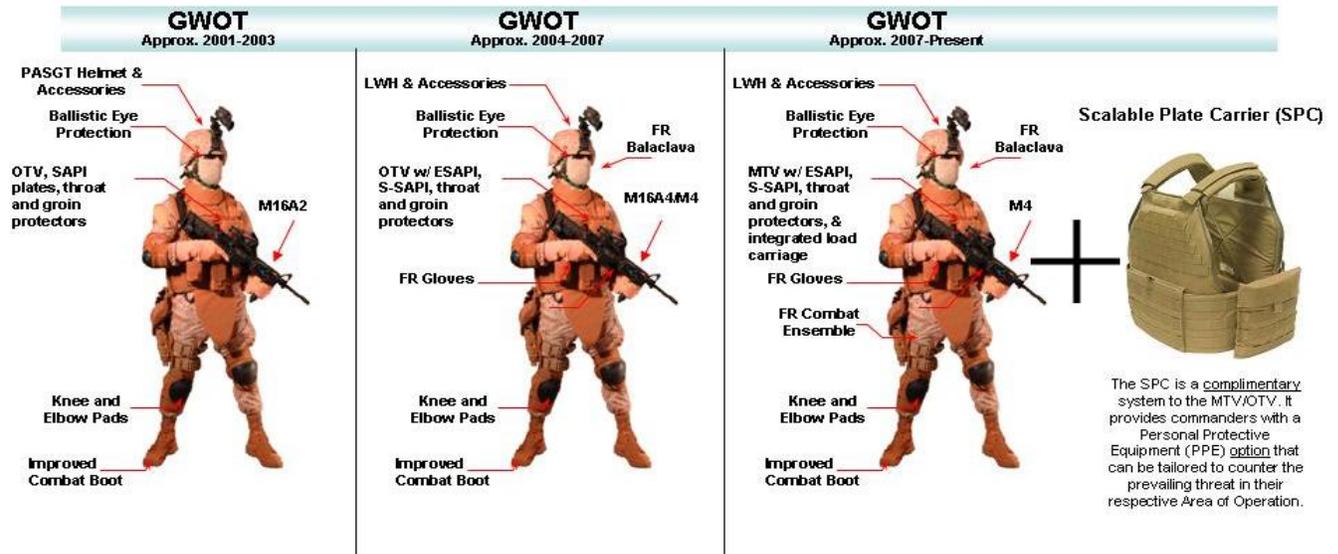


It was not until the U.S. became involved in combat operations in Southeast Asia that body armor in the form of the flak vest was introduced for the first time. Improvements in materials resulted in new, better helmets and flak vests in the 1990s. Flak vests provided greater protection to Marines against shrapnel from indirect fires, but very little, if any, protection against small arms ammunition. (See Table 1)

As a result of technological advancements, today's Marine finds himself more protected than ever before. Protective vests with Small Arms Protective Insert (SAPI) and Enhanced Small Arms Protective Insert (ESAPI) plates provide the Marine with armor protection against small arms ammunition in addition to fragmentation. Additionally, areas of protection have expanded to the eyes, groin, and deltoids. Although the current ensemble of protective gear has saved lives, it has increased the amount of weight carried by the Marine on the battlefield. (See Table 2)

Table 2

PPE Evolution



Typical Personal Marine Combat Load

The typical personal infantry Marine combat load must provide a balance of lethality, survivability, maneuverability and communication/situational awareness. Currently, the specific combat load carried by the individual Marine is based upon the situation. We have fielded items that enhance our commanders' ability to scale loads to best suit each situation. Today, Marines are provided with the best available Personal Protection Equipment (PPE) such as the Scalable Plate Carrier (SPC), Modular Tactical Vest (MTV), Lightweight Helmet (LWH) and Flame Resistant Organizational Gear (FROG). Their infantry weapons systems include rifles, optics, pointers, ammunition, and grenades enabling them to engage the enemy accurately at a moments notice. Equipment enhancing the warfighter's communication/situational awareness includes Personal Role Radios, Global Positioning Systems, binoculars and night vision goggles.

Weight versus Protection

Frequently, a challenge we face is that each advance in capability comes with a weight penalty. The evolution of body armor has added weight to the combat load as a result of

providing more protection. Increases in body armor weight seen in the recent 4-5 year period are due to incremental increases in protection levels and areas of coverage provided. We evolved from the flak vest to the Outer Tactical Vest to the Modular Tactical Vest (MTV), with SAPI, and finally with ESAPI. In the case of the protective vest, we have mitigated the weight increase by improving weight distribution on the shoulders and hips. Future efforts will concentrate on weight reduction through improved, lighter materials.

One example of our efforts to reduce weight without compromising our warfighter's safety is a modular body armor system called the Scalable Plate Carrier (SPC). The SPC provides the commander options for load and protection scalability to suit the mission at hand. This body armor capability allows greater mobility with reduced thermal stress as compared to the MTV. This could be particularly helpful in high elevations, thick vegetation and tropical environments. In a size large, the SPC, with cummerbund and groin protector, weighs approximately 25% less than the same MTV configuration. The SPC is not intended to replace the MTV as the primary protective vest. Instead, it provides a lighter form of ballistic protection while still allowing the Marine the ability to remain combat effective when operating in extreme environments.

Another advancement in PPE is the Lightweight Helmet. The current LWH, size medium, weighs 3.1 lbs, approximately 6% less than its predecessor, the Personnel Armor System for Ground Troops (PASGT) helmet, and provides a greater level of protection.

As we shift focus to OPERATION ENDURING FREEDOM, cold weather clothing needs will increase. Newer technology allows for components containing better moisture management properties, lighter weight and less volume. For example, the evolution of the long johns has progressed from cotton to polypropylene to the currently fielded Desert Tan Silk Weight which not only provides the same thermal protection at a lighter weight than its predecessors, but it is now flame resistant (FR), no melt, and no drip.

Next Generation of Combat Load Equipment

The Corps recognizes that PPE contributes to a significant portion of the current infantry combat load. We are planning improvements on weight reductions through new, light weight, high performance materials and fabrics for next generation PPE. Modular PPE designs are being explored to reduce basic combat weight. The MTV is undergoing a pattern analysis and redesign

to eliminate the overlapping areas and provide the optimal range of coverage necessary for the warfighter's protection and mobility. The Marine Corps is closely monitoring new technology and materials that have the potential to improve protective elements of body armor. These efforts are coordinated through our Science and Technology (S&T) community at the Office of Naval Research (ONR), located in Arlington, VA, and Naval Research Lab (NRL), located in Washington, D.C.

The Marine Corps has challenged industry to develop and design equipment that can perform as effectively as today's gear but with reduced weight and volume. We have been working closely with the Army to present our common requirements to industry. Collaboration with our industry partners, academia, sister Services and other Departments and Agencies continue to involve discussions about ways to decrease the burden on the individual Marine.

Future Initiatives

In June 2007, at the request of the Commanding General, Marine Corps Combat Development Command, the Naval Research Advisory Committee (NRAC) completed a study which focused on Lightening the Load of the Marine. The objectives of the study were to assess the elements of the Marines combat load, identify primary weight and volume contributors, identify and evaluate technology initiatives, and consider changes in operations, logistics, and training in order to reduce the burden without adversely affecting combat effectiveness, safety and tactics. The NRAC approached the study from four perspectives: reduce the weight, transfer the load, enhance human performance, and a systems approach.

Reduce the Weight

The NRAC study found that, in the future, the use of advanced materials, caseless ammunition, and advanced batteries has the promise of significant weight reduction. The study stated that these improvements could amount to a possible savings of approximately 15 to 21 pounds per Marine.

Transfer the Load

NRAC recommended transferring the load of equipment from the squad to an organic load-carrying asset. The Office of Naval Research (ONR) is evaluating the use of autonomous

robotic "mules" and other electro-mechanical load bearing systems to help alleviate the loads on dismounted warfighters. Defense Advance Research Projects Agency (DARPA) is also conducting science and technology studies on an Unmanned Ground Vehicle (UGV) referred to as the Multifunction Utility, Logistics, and Equipment Vehicle (MULE). The MULE is an unmanned platform that provides transport of equipment and/or supplies in support of dismounted maneuver forces. One such project is a quadruped UGV called Big Dog, which successfully proved the concept to offload equipment using an autonomous vehicle.

The Legged Squad Support System (LS3) Program is another effort by DARPA to develop a walking platform, preferably a quadruped, which can accompany dismounted Marines and increase their combat capability. LS3 is envisioned to augment squads by maneuvering with them in complex terrain where wheeled tactical vehicles cannot go, carrying equipment for the squad. LS3 is intended to carry 400 pounds or more of payload, allow for 24 hours of self-sustained capability including 20 miles of maneuver, with a total weight (including payload and fuel) of no more than 1250 pounds.

Enhance Human Performance

There are several factors other than weight that can cause injury due to combat loads. Fatigue, thermal strain, physical fitness, human performance, nutrition, proper sizing, and proper training can all influence the individual Marine's susceptibility to injuries related to equipment. There are several S&T efforts aimed to enhance human performance and mitigate the effects of weight via a better understanding of human physiology and cognition. The Army's Natick Research Development and Engineering Command has developed improved rations that provide more calories and carbohydrates to boost energy. Caffeine supplements are now included in Meals Ready to Eat (MREs) and other supplements (tyrosine, quercetin, etc) are being studied. Other promising near term gains may be in the areas of ergonomics and training. We appreciate your continued support of the multiple research initiatives underway to explore ways to reduce the effects of combat load on our Marines.

A Systems Approach

The Marine Expeditionary Rifle Squad (MERS) program applies a systems engineering approach to equipping a Marine rifle squad. The MERS program views the Squad as a System

with the objective of distributing capabilities across the squad and integrating all the equipment carried within the squad. The primary function of MERS is integration and modernization of everything worn, carried, and consumed within the squad by coordinating integration across all programs that provide material solutions for the squad. One benefit of this program is the evaluation of weight on the performance of an infantry squad. The MERS program is able to coordinate systems to eliminate redundant weight and volume. Looking at the Squad as a System allows us to make improvements and distribute capabilities that would not be feasible at the individual level.

To better focus on these critical areas, Marine Corps Systems Command and the Marine Corps Combat Development Command have established the Squad Integration Facility or *GRUNTWORKS*. The facility provides a venue to test the capabilities and limitations of all equipment in development, and under consideration for procurement, that will be delivered to the infantry squad. It focuses on human factors, ergonomics, and a systems engineering approach towards weight reduction and balanced loads. For the first time in the Marine Corps, human factors analysis is being applied to the physical integration of the infantry squad's equipment. The physiological, ergonomic, and performance impacts of fielding new equipment create a constant set of trade-offs between weight management, lethality, survivability, mobility, and sustainment. MERS highlights these trade-offs and refines solutions that incorporate the capabilities of the Marine rifle squad as an integrated system.

Conclusion

The best weapon in the Marine Corps is the well trained and equipped Marine. As we outfit our forces with the latest in protective technology, we continue to strive towards an optimal combat load that allows the individual warfighter to accomplish the mission at hand. Our goal is to provide your Marines with technologically advanced equipment that enables them to achieve an ideal combat load, one that allows them to remain lethal and healthy, while increasing their survivability and mobility on the battlefield. With your support, we continue to procure the very best equipment industry has to offer.

We recognize that these next few years will be challenging. The Marine Corps must rapidly adapt to broad strategic conditions and wide-ranging threats. We remain faithful to our enduring mission—to be where and when our country needs us and to prevail over whatever

challenges we face. We achieve this by recruiting and retaining the best of our Nation's sons and daughters, training them in tough, realistic scenarios and providing them the best equipment available. With your continued support, your Corps will remain the Nation's force in readiness and continue to fulfill its mission of being "*most ready when the Nation is least ready.*"