

STATEMENT
OF
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&
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DIRECTOR, CAPABILITIES DEVELOPMENT DIRECTORATE
COMBAT DEVELOPMENT & INTEGRATION
BEFORE THE
TACTICAL AIR AND LAND FORCES SUBCOMMITTEE
OF THE
HOUSE ARMED SERVICES COMMITTEE
ON
SOLDIER/MARINE AS A SYSTEM

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Chairman Bartlett, Ranking Member Reyes, and distinguished members of the Subcommittee, on behalf of our Marines, our families and our civilian employees, thank you for your continued and generous support for our Marines in OPERATION ENDURING FREEDOM, OPERATION NEW DAWN and other contingencies. It is an honor to appear before you today and for this opportunity to discuss the capabilities we have developed and are pursuing to ensure our Marines are effective, survivable and expeditionary on the battlefield.

INTRODUCTION

Our Marines continue to be the backbone of our Corps. Our goal is to give Marines the capabilities required to accomplish their mission. We accomplish this goal by considering the Marine and his gear as a total system, a system that is influenced by tactics, techniques, and procedures, equipped with extremely effective and capable weapons and personal protection equipment, and trained in the classroom, the crucible and live and simulated training facilities.

The United States Marine Corps is America's expeditionary force in readiness, tasked as a Marine Air-Ground Task Force (MAGTF). Whether it is the Marines in support of a humanitarian response to the crisis in Libya, or a portion of the 16,000 Marines conducting a campaign in the Sangin Valley in Afghanistan, we bring everything we need for the mission. Our equipment must be lightweight, reliable, effective, trainable, and expeditionary. For an individual Marine, his training, communications, weapon, uniform, personal protection equipment and everything he might carry must be viewed as a component of a bigger system, the "Marine." As such, applying systems engineering to the Marine is critical so that each piece of equipment meets or exceeds its performance requirements, and as

an element of the system, contributes to and complements the overall warfighting effectiveness of the Marine, the squad, and ultimately the MAGTF.

To do this, we constantly seek the balance between effectiveness and weight of the equipment and the speed, endurance and survivability of the warfighter. Each individual Marine is specifically equipped to perform his military occupational specialty. Our commanders in the field have the flexibility and the ability to tailor equipment sets to match the threat, the operating environment, and demands of the mission.

We have been engaged in OPERATION ENDURING FREEDOM, OPERATION NEW DAWN (formerly OPERATION IRAQI FREEDOM) and other contingencies for nearly a decade. During this time, we have adapted to our adversaries' ever-changing tactics on the battlefield. We have applied lessons learned in our efforts to develop new systems and enhance the effectiveness of existing systems to equip and safeguard our Marines.

The Marine Corps is mindful of the need to leverage programs, technologies, technical skills and competencies of other Services to ensure we deliver the most effective and affordable combat capability to our Marines. We work closely and collaboratively with our Army counterparts in Program Executive Officer (PEO) Soldier, PEO Combat Support & Combat Service Support, and the Natick Soldier Research Development and Engineering Center, as well as our partners at the Office of Naval Research, and other science and technology (S&T) organizations. We also seek to capitalize on our industrial base to identify and pursue innovative and ground-breaking solutions to meeting the warfighter's needs and to reduce acquisition and sustainment costs of our systems.

Additionally, we have partnered with our international and coalition partners in order to share the information we have learned and to harvest and implement the good ideas they may have. For example, the British have given us various ideas such as the protective undergarment. We are committed to using every resource available to maximize the overall combat effectiveness and survivability of our Marines while ensuring we are addressing the affordability needs of our Corps.

With your support, we will continue to make progress.

OPERATIONAL ENVIRONMENT

To protect against complex threats, requires increased protection and capability while providing agility. The fully equipped dismounted combat Marine carries a variety of gear at any given time while in theater. Aside from wearing his personal protection equipment, a Marine carries batteries, ammunition, food, water, weapons, and communications gear that contribute to the combat load. The Marine Corps recognizes that the load of a Marine coupled with an austere operational environment is challenging. That is why we continue to make advancements to not only improve the protection level of our body armor, but also to work towards reducing the weight of our equipment.

The weight on the combat-equipped Marine continues to drop for multiple reasons: a more mature theater of operation; multiple forward operating bases (FOBs) within an Infantry Company's Area of Responsibility making resupply easier; good decisions by small unit leaders; and to a lesser degree, weight reductions to equipment. For example, the transition to Scalable Plate Carriers vice Modular Tactical Vests was the largest contributor to weight reduction.

Consequently, in March 2010, the average assault load for Foxtrot Company, 2nd Battalion, 2nd Marines, from 30 randomly

selected Marines, showed an average weight of 58 pounds or 34% of their body weight. As compared, in April 2008, to the average assault load for 2nd Battalion, 7th Marines, from 30 randomly selected Marines, showed an average weight of 112 pounds per Marine or 63% of their body weight.

As one of two Marine Battalions that entered Afghanistan in 2007, 2nd Battalion, 7th Marines encountered a logistically immature theater of operations, limited logistics capability and very limited FOBs. In simple terms, when they left the patrol base, they needed to carry more with them because they may not be resupplied.

Lessons Learned

Added weight and thermal loading make Marines less effective in combat. Mobility and agility are two components that affect survivability. There is a correlation with reference to personal protection equipment effectiveness and mass. Harsh environmental conditions such as extreme heat have required research in thermal effects mitigation and adoption of tactics, techniques, and procedures by Marines to operate in adverse conditions. The balance of capabilities is achieved by modularity of components, ergonomic considerations, and integration as a system in order to optimize human performance. Understanding our Marines and the operational employment of capabilities are critical considerations in the optimization of material solutions.

EVOLUTION OF BODY ARMOR

There are significant advances in body armor in terms of where we were, where we are today, and where we are headed in the future. For example, in the late 1960s and early 1970s, the flak vest was introduced to U.S. troops during combat operations

in Southeast Asia. Flak vests provided greater protection to Marines against shrapnel from indirect fires, but very little, if any, protection against small arms ammunition.

Advancements in material solutions in the 1990s resulted in improved flak vests and improved helmets - both of which are used in our current overseas operations. We continue to make improvements in providing greater protection and lighter equipment for the dismounted Marine.

The asymmetrical threats faced by Marines have caused an increase in the need for more sophisticated personal protective equipment. Thanks to advances in technology, today's Marine is more protected than ever before. As a result, however, the Marine ended up with greater equipment weight. The Marine Corps now strives for that delicate balance between effectiveness and weight of the equipment and the speed, endurance and survivability of the warfighter.

EQUIPPING TODAY'S COMBAT MARINE

As a middleweight force, we are a strategically mobile force optimized for forward-presence and rapid crisis response, we are light enough to get there quickly, but heavy enough to carry the day upon arrival, and capable of operating independent of local infrastructure. The Marine Corps is an expeditionary force. To Marines, expeditionary is a state of mind that drives the way we organize our forces, train, develop, and equip.

The squad is designed as a complex and adaptive system with the physical and intellectual agility for employment throughout the spectrum of expeditionary operations. Each Marine within the squad has a mission and is equipped accordingly. Capabilities and equipment are developed and provided to each Marine to execute his function. The combat load weight differs among other squad members.

Personal Protection Equipment

Mission, enemy threat, maneuverability, weight, protection level and lethality are factors considered when equipping the warfighter. The wartime environment in OPERATION ENDURING FREEDOM is constantly evolving. We provide equipment that can be configured to meet varying levels of threat. No one is better suited to determine the most effective combination of personal protective equipment than the individual Marine.

The Marine Corps has published an Armor Protection Levels (APL) policy. The policy authorizes Combatant Commanders, down to the Lieutenant Colonel/Battalion Commander level, the authority and flexibility to tailor protection levels their Marines must wear based on the current mission, enemy threat and terrain while solving for the Marine's necessity to maintain mobility for individual survivability and lethality.

For example, the Scalable Plate Carrier (SPC) was fielded to provide a small arms body armor solution with greater mobility and reduced thermal stress in high elevations as well as thick vegetation and tropical environments. The trade-off is reduced fragmentation protection. The SPC is not intended to replace the Modular Tactical Vest (MTV) as the primary ballistic vest. Instead, it provides an option for a lighter weight ballistic vest that protects against a more specific enemy threat and allows Marines to remain combat effective when operating in extreme environments. We field the SPC to issue facilities where commanders prioritize and determine what PPE is subsequently issued based on their mission analysis.

The Marine Corps continues to focus on increased protection and weight reduction programs while maximizing our force protection. A portfolio of efforts is described below.

Improved Modular Tactical Vest (IMTV)

The IMTV is a replacement for the MTV and is a response to an Urgent Statement of Need. The IMTV provides improved load carriage, shoulder comfort, and cummerbund stability compared to the MTV. On a medium size chest, the IMTV reduces the weight of the MTV by 2.53 pounds. This is a seven percent weight reduction. The acquisition objective is 108,000 IMTVs and fielding is expected to begin 3QFY11.

Weight Comparisons

Item	MTV	IMTV
Weight (pounds)	33.83	31.30
Weight Reduction	2.53 (7%)	

Plate Carrier (PC)

The PC will replace the SPC that is currently fielded to Marines in Afghanistan. The PC provides reduced weight, reduced thermal loading, and improved mobility by reducing the soft armor area of coverage when compared to the MTV and IMTV. Improvements made to the PC include incorporation of a quick release mechanism, integrated shoulder padding and a cummerbund that is interchangeable with the IMTV. For a medium size vest, the PC reduces the weight of SPC by .28 pounds. This is a one percent weight reduction from the SPC to the PC. The acquisition objective is 108,000 PCs and fielding is expected to begin in 1QFY12.

Weight Comparisons

Item	SPC	PC
Weight (pounds)	24.53	24.25
Weight Reduction (pounds)	.28 (1%)	

Lightweight Helmet (LWH)

The acquisition objective for the LWH is 215,786. Fielding of the LWH was initiated in 3QFY03 and was completed in 3QFY09. In March 2006, a sustainment package was submitted to Defense Logistics Agency Troop Support (DLA TS) and was finalized in Nov 2007.

Suspension Pad System

The suspension pad system is a component of the LWH, and the acquisition objective is the same as the LWH. In November 2006, MCSC changed from the sling suspension system to a pad suspension system per Marine Administrative Message 480/06.

The suspension pad system is not a joint program. However, both the Marine Corps and the Army requisition the same National Stock Number suspension pad system currently sustained by DLA TS.

Enhanced Combat Helmet (ECH)

The Enhanced Combat Helmet (ECH) is an example of the Marine Corps' efforts to provide greater protection at approximately the same or less weight as the currently fielded Lightweight Helmet (LWH) and resists penetration by a selected small arms round. The ECH program uses the latest lightweight material technology, ultra-high molecular weight polyethylene materials to provide increased small arms protection above what is currently provided by the LWH. It is a remarkable achievement in materials manufacturing and production.

During developmental testing, in addition to small arms resistance to penetration, the ECH results showed 40-50 percent better fragmentation protection, better blunt impact performance, and better resistance to Ballistic Transient Deformation (BTD). Further, by adopting the Modular Integrated

Communications Helmet (MICH) design, the ECH provides a greater field of view, comfort and stability for the Marine.

The ECH is a collaborative effort between the Army, Navy and Marine Corps with the Marine Corps acting as the program manager lead. If First Article Testing is successful, the Enhanced Combat Helmet will be a Service common helmet with the Marine Corps fielding 38,500, the Army fielding 200,000 and the Navy fielding 6,750. The Marine Corps expects to field the ECH in 4QFY11.

Further efficiencies in production and cost reduction may be realized in future orders should all the Services adopt the ECH as their helmet of record program.

Weight Comparisons

Item	LWH	ECH
Weight (pounds)	3.21	3.06
Weight Reduction (pounds)	.15*	

* The LWH has 8% more head coverage when compared to the ECH thus if the ECH is compared with the MICH (a helmet that has the same coverage as the ECH) the weight is the same.

Flame Resistant Organization Gear (FROG)

Flame Resistant Organization Gear (FROG) provides Marines with increased burn protection from flash fires which are unexpected, sudden intense fire caused by the ignition of flammable, liquids, vapors, gases, or dust. This system consists of an ensemble of clothing (gloves, balaclava, long sleeved flame retardant shirt, combat shirt, and combat trouser) to provide commanders with options that are modular and scalable. FROG is issued to all Marines deploying to Afghanistan. We continue to make improvements to FROG with optimal blends of

flame resistant materials that balance durability and comfort while seeking to increase burn protection.

FROG is worn outside the wire to avoid severe burns caused in IED blasts. Generally, FROG is supposed to be worn in vehicles. However, because vehicles are generally at least a portion of the mission, FROG is generally worn all the time. Further, FROG has a knit torso that dissipates heat faster and wicks moisture better than the Marine Corps Combat Utility Uniform (MCCUU) so the Marines prefer it under their body armor because it makes them cooler. Presently in OEF, Marines are wearing FROG if they leave the Forward Operating Base. MCCUU is generally not worn, but if the commander believes that the flash flame threat is low he can authorize it.

Combat Utility Uniforms

Every Service member deserves the opportunity to wear an effective camouflage uniform commensurate with their assigned mission. The Marine Corps supports camouflage uniforms that reduce visual detection and enhance performance. There are no barriers to sharing the technology aspects of the Marine Corps' Combat Utility Uniform. All of the Services, including DLA, work closely with U.S. Army Natick Soldier Research, Development and Engineering Command (NSRDEC) and mutually benefits from the incremental advancements and technology leaps impacting the development of individual combat clothing and PPE.

The Marine Corps shares its uniform technology through multiple formal and informal venues. Formal collaborative venues include the Joint Clothing and Textile Governance Board (JC&TGB), the Cross-Service Warfighter Equipment Board (CS-WEB), and the Army-Marine Corps Board (AMCB). Informal collaborative venues include Commander-to-Commander and program office interaction between US Army's PEO Soldier and Marine Corps

Systems Command as well as the Marine Corps participating in technology sharing through its reliance upon the RDT&E capabilities of NSRDEC.

Batteries

On the individual Marine, over a dozen batteries, in six different configurations, are used at any given time. Centralizing power and reliably distributing power on a Marine will potentially reduce the reliance upon the multiple types of batteries that are currently used in systems and carried in significant quantities as spares. An S&T effort is currently under way with the Office of Naval Research to produce a prototype of just such a system. Solar panels have been fielded to the squads as a renewable energy source for rechargeable batteries. These systems are useful for Marines during long duration patrols or while manning observation positions. Power continues to be a challenging component of the weight reduction effort.

Weight Comparisons

Item	BA-5590 (one-time use battery)	Solar Power Adaptor for charging BB-2590 battery
Weight (pounds)	70 (Assumption: one battery used per day)	10
Weight Reduction (pounds)	In 30 days worth of missions, there will be a savings of 60 pounds per system	

Ammunition

We continue to work very closely with the U.S. Army under their role as the Department of Defense Single Manager for Conventional Ammunition. During each budget submission, the

Marine Corps and Army collaborate to ensure we align our procurements to gain cost efficiencies. In doing so, we balance our buys in the best interest of the Munitions Industrial Base, when feasible. Further, in those areas of munitions commonality, the Marine Corps consistently leverages the U.S. Army munitions Research, Development, Test and Evaluation (RDT&E) efforts to modernize our conventional ammunition stockpile and to prevent duplicative munitions RDT&E investment within the Department.

Small Arms

M-27 Infantry Automatic Rifle

A significant firepower enhancement is currently being fielded to four infantry battalions and a Light Armored Reconnaissance Battalion. The M-27 Infantry Automatic Rifle (IAR) is an accurate and reliable replacement for the M-249 Squad Automatic Weapon (SAW). The introduction of the IAR reduced the load of the three heaviest-burdened Marines in the rifle squad, the Automatic Rifleman. There is an eight-pound difference in unloaded weapons and a 14-pound difference in loaded weapons. This weapon significantly enhances the mobility of the Marines with the greatest quantity of automatic firepower in the squad and provides interoperability of ammunition throughout all the squad members by eliminating linked ammunition required by the M-249. As these infantry battalions continue to conduct pre-deployment training, the M-27 will debut on the OEF battlefield in the late May 2011 timeframe. The acquisition objection is 4,463.

<u>Weight Comparisons</u>		
Item	M-249 SAW w/bipod	M-27 IAR w/grip pod
Weight (pounds) Unloaded	16.98	8.8
Weight (pounds) Loaded	23.92 (200 round drum)	9.9 (30 round mag)
Weight Reduction (pounds)	Unloaded 8.18 (48.2%) Loaded 14.02 (58.6%)	

Communications

Currently, we are working to replace the radios being carried by dismounted users that require digital data transmission. The fielded AN/PRC-117F weighs 29.4 pounds with batteries. The replacement radio, AN/PRC-117G, is 20 percent lighter than the AN/PRC-117F. It adds the data networking capability equipping the end user with system that provides higher efficiency, greater information throughput, and expanded frequency range. These capabilities enable the Marine to communicate via Voice over Internet Protocol (VOIP), Command and Control Personal Computer (C2PC), Microsoft Internet Relay Chat (mIRC), and deliver streaming imagery simultaneously. No other dismounted Marine Corps tactical radio maintains the ability to concurrently transmit voice and data. Most of the radio replacements are taking place in theater and will transition into CONUS as long as funding is available to support the effort.

<u>Weight Comparisons</u>		
Item	AN/PRC-117F	AN/PRC-117G
Weight (pounds with batteries)	29.4	23.5
Weight Reduction (pounds)	5.9 (20%)	

OPTIMIZING THE INTEGRATED WARFIGHTER

Gruntworks

The Marine Corps has an established Marine Expeditionary Rifle Squad (MERS) integration facility called Gruntworks. Gruntworks characterizes how components of a Marine's equipment influence combat performance in terms of weight, bulk and flexibility and effectiveness. This effort provides a metric for mobility in various equipment configurations to evaluate future systems.

The MERS organization designs and refines the system—in this case, it is the Marine. MERS does not procure equipment; it works with all the Program Managers within Marine Corps Systems Command to ensure individual items are integrated into an effective combat fighting capability to deliver a balanced squad.

For example, the M16A4 service rifle continues to be the primary weapon in the rifle squad and for Marines throughout the Corps. The focus of improvements for the M16A4 this year is integration with equipment and ergonomic solutions to assist the diverse anthropometry found in the Marine Corps. Our small arms weapon systems within the rifle squad have been optimized with magnified day optics, image-intensified and thermal sensors, and multifunctional illuminators. These systems are provided to members of the squad depending on their billet and mission.

In the future, we will pursue a fully integrated infantry system of equipment that will be driven by an overarching requirement. This will drive integration of capabilities more effectively at the requirements level instead of trying to engineer it during materiel development. This requirement will define parameters for size, weight, power, interfaces, and integration as well as set goals for weight reduction from current capabilities. The first increment of this capability

will seek to better integrate the capabilities being fielded now or in the near future; the second increment will leverage emerging technologies to define attributes for the baseline load bearing, protection, and power systems and will require that all additional capabilities be fully integrated with those baseline systems. This will reduce or eliminate the need for additional equipment to have their own power, cabling, and carrying pouches, thereby reducing the bulk and weight of the requisite combat load. The Army is taking a similar approach, and the requirements and acquisition communities in both Services are sharing their ideas to collaborate where their interests coincide.

FUTURE INITIATIVES FOR LIGHTENING THE LOAD

An expeditionary force in an austere environment tends to carry more weight. For example, innovative logistics and resupply coupled with equipment weight reductions can reduce the burden of Marines. The Marine Corps Warfighting Laboratory (MCWL), which is part of the Combat, Development and Integration command (CD&I), has experimented in sea-based logistics along with robotics and autonomous aerial delivery for logistic resupply. In July 2010, MCWL concluded an experiment with a Company Landing Team (CLT). The CLT was ashore and was resupplied by amphibious shipping which was 40 nautical miles offshore. These experiments coupled with the S&T initiatives underway, by the Office of Naval Research (ONR), will provide a multi-pronged approach towards reducing the weight carried by a rifle squad in the Marine Corps.

CLOSING

We have been engaged in sustained overseas contingency operations for close to 10 years. During this time, we have made

many advancements to provide the best personal protection equipment for our warfighters. Through lessons learned, we have reduced weight, integrated equipment, transferred the load and enhanced human performance to lighten the load of your dismounted, combat-equipped Marines.

We continue to address the current threats of our enemy while looking towards future threats and solutions. This is accomplished by developing and fielding more capable systems faster and more efficiently.

We work hard to ensure the safety of our Marines by providing them with the best and most effective equipment. We cannot put a price on the lives of our Marines, Soldiers, Airmen and Sailors. Protecting them with better and more capable equipment has been, and will always be, the highest priority of the Marine Corps. Your support will position the Marine Corps to ensure our warfighters' safety. Again, thank you for your continued support.