

ARMOR, VEST, M-1952A
MEDIUM
STEIN BROS. MFG. CO.
24 MARCH, 1954 Q.M. 34420
N. Y. Q. M. P. A.
74 - A - 31 - 235

ARMOR, VEST, M-1952A
THIS VEST MAY SAVE YOUR LIFE!
WHEN PROPERLY WORN IT WILL PROTECT VITAL
AREAS AGAINST SHELL AND GRENADE FRAGMENTS
WHICH CAUSE MOST COMBAT CASUALITIES.

FOLLOW THESE INSTRUCTIONS:

WEAR VEST OVER SHIRT AND UNDER FIELD JACKET.
ADJUST SIDE LACES TO MAKE VEST FIT THE BODY,
BUT STILL PROVIDE PROPER VENTILATION.

DO NOT FIT TOO TIGHTLY.

USE PROTECTIVE FLAPS TO COVER OPENING UNDER
SIDE LACES AND SLIDE FASTENER. PROTECT SLIDE
FASTENER BY FASTENING SNAP CLOSURE.

This Vest May Save Your Life!

U.S. Army Body Armor from World War II to Present

Christopher E. Howard

Abstract: *The adage ‘speed is security’ applies to vehicles, aircraft, or individual soldiers. But security, increased by armor, can reduce mobility. Since World War II, the U.S. Army has worked to develop body armor that acceptably balances these two competing factors.*

“The use of body armor is motivated by one of the most powerful impulses in our psychological makeup, i.e., the desire to survive. In the heat of actual combat, soldiers have reported later, time and again, that they rarely notice the weight and bulkiness of the vests. In these tense periods it seems that the desire for protection outweighs the physiological deficit resulting from the added burden.”¹

This observation was made in 1952 by the U.S. Army Body Armor Test Team, during the field test of the Army T-52-1 body armor vest with front-line troops in Korea. The team found that the new vest stopped 75.7 percent of all fragments, and 24.4 percent of small arms projectiles.² This was remarkable progress, given the state of body armor development when the Korean War started in 1950.

Since then, the U.S. Army has continuously developed body armor to increase the survivability of soldiers. This article summarizes the advancements in U.S. Army body armor from World War II to the present. It also includes a brief description of U.S. Special Operations Command (USSOCOM) body armor initiatives, specifically through its Special Operations Forces (SOF) Personal Equipment Advanced Requirements (SPEAR) program.

World War II

During World War II, under the direction of its Command Surgeon, Colonel Malcolm C. Grow, the U.S. Army Eighth Air Force pioneered the development of modern body armor.³ In 1943, bomber pilots and aircrew in the ‘Mighty Eighth’ began receiving an armored vest manufactured in Great Britain.⁴ Incorporating two-inch square manganese steel plates, sewn into a canvas vest, it protected against shrapnel from exploding anti-aircraft shells, commonly known as ‘flak.’⁵ Once testing was complete, the design was standardized and U.S. Army aviation vest manufacturing was moved stateside.⁶ Officially dubbed the Flyer’s Vest, M1, the vests were more commonly referred to as ‘flak vests’ and ‘flak suits.’⁷

The 17 pound, 6 ounce weight of the M1 vest was not a significant issue for bomber pilots and seated crew



M1

The Flyer’s Vest, M1, seen here with the Flyer’s Apron, M3, was developed during World War II to protect U.S. Army Air Forces bomber crew from anti-aircraft shell fragments. Combined, the armor vest and apron weighed approximately 22 pounds.

Left: The inside tag of the M-1952A vest bore a clear message: “This Vest May Save Your Life!”

“A miss – almost,” were the words of this B-17 *Flying Fortress* waist gunner, seen here holding his damaged M1 Flyer’s Vest (left) and parachute pad (right).

(Photo Credit: U.S. Army Center of Military History)



members, some of whom sat on their vests, because the greatest threat came from below the aircraft. Sitting was not an option for the waist gunners, who manned .50 caliber machine guns on either side of the fuselage.⁸ In time, specialized armor was provided to crew members, based on their biggest threats. The Flyer’s Apron, M3 was for crewmen in confined spaces, such as ball turret gunners; the Flyer’s Apron, M4, for waist gunners; and Groin Armor, M5, for seated personnel (pilots, copilots, bombardiers, and navigators).⁹ By war’s end, over 300,000 Flyer’s Vest, M1s, had been produced, along with nearly 100,000 Flyer’s Vest, M2 designs, the latter of which was provided to pilots and copilots, who sat in armored cockpit seats.¹⁰

A 1944 Eighth Air Force study of battle casualties reported that body armor had led to a reduction in fatalities from thoracic [chest] wounds (36 to 8 percent) and from abdominal wounds (39 to 7 percent).¹¹ This data, complemented by first-hand bomber crew testimonials, validated the effectiveness of body armor. Still, the Army initially rejected armor for ground troops, due to its weight and restrictive designs.¹² Late in the war, the Army Ordnance Corps developed the 12-pound M-12 vest, consisting of aluminum plates and nylon fabric. The war in the Pacific ended before the field tests could be conducted.¹³

In 1947, the Army Ordnance Corps relinquished body armor development to the Quartermaster Corps. Based on the threat facing U.S. soldiers, it focused on armor for engineer troops doing mine clearance.¹⁴ A 1949 Army study determined that armor for active ground troops was impractical, based on weight.¹⁵ Thus, when war erupted in Korea in June 1950, the WWII-era M-12 vest was pressed into service as a ‘stop-gap’ measure, until better designs could be fielded.¹⁶

Korean and Vietnam Wars

Two successful body armor designs emerged during the Korean War. The first, the M-1951 vest, resulted from joint Army-Marine Corps experiments. It incorporated nylon and Doron, a laminated fiberglass material developed during World War II.¹⁷ Weighing just under eight pounds, this ‘Marine Vest’ was issued to both Army and Marine troops.¹⁸ The second design was the Army’s M-1952A Body Armor, Fragmentation Protective, an 8.5 pound vest made up of twelve layers of flexible laminated nylon.¹⁹ It proved effective in field tests, but did not begin reaching front-line troops until late 1952, and then only in relatively small quantities.²⁰

During the Vietnam War, the M-1952 was still widely issued, along with the M-1955, which replaced the M-1951 ‘Marine Vest.’ The M-1952 was replaced by the Body Armor, Fragmentation Protective Vest with



M-12

Developed late in World War II, the *Armor, Vest - M12* incorporated aluminum plates sewn into nylon and weighed 12 pounds, 3 ounces. The vest pictured here includes the optional Apron, T-65. The M-12 was used in Korea until newer vests could be fielded.

(Photo Credit: National Infantry Museum)



M-1952

The *Armor, Vest, M-1952* was an all nylon vest that weighed 8.5 pounds. M-1952A vests began reaching U.S. Army troops in Korea in late 1952, and remained in service through the Vietnam War.



M-69

The *Armor, Body Fragmentation Protective, with ¾ Collar*, better known as the M-69, was fielded during the Vietnam War. The M-69 was very similar to the M-1952 it replaced, but included a stiff collar that provided neck protection, but sometimes interfered with the wear of the M1 steel helmet.

3/4-inch Collar, M-69. Weighing 8.4 pounds, the M-69 vest was very similar to the M-1952, consisting of twelve layers of ballistic nylon filler, sealed in a waterproof casing.²¹ Its main improvement was the protective collar, which was disliked for interfering with the wear of the M1 helmet.²² Despite armor availability, soldiers seldom wore body armor while patrolling, as it was bulky and trapped heat and moisture in tropical Vietnam.²³ Instead, it was worn by troops manning static defensive positions, and those in unarmored vehicle convoys.²⁴

While ground troops found body armor lacking during Vietnam, Army aviators fared somewhat better. During the Korean War, helicopter pilots and crew had not been provided body armor, as it limited the payload of the underpowered early helicopters. More powerful troop-carrying helicopters in Vietnam attracted more ground fire. At first, World War II and Korean War-era body armor was issued but, in 1963, the Army provided body armor made specifically for aviators. However, it was not well-received by pilots, due to its 18.5-pound weight, restrictions on movement, and tropical temperatures.²⁵

In 1964, the Army introduced ceramic plates to aviator armor, to protect aircrew from .30 caliber armor-piercing bullets.²⁶ An improved version was introduced

in 1966 that provided increased protection and comfort, but weighed 28.5 pounds.²⁷ However, the plates had a tendency to splinter when hit, endangering pilots and aircrew with secondary fragmentation. A field-expedient solution was to wear standard issue M-1952A or M-69 vests over their plates, to contain the fragments.²⁸ Helicopter door gunners and crew chiefs wore like armor, but with an additional back plate that added eight pounds.²⁹ In the early 1970s, a new vest was tested that, according to an August 1972 Army report, was “less bulky and present[ed] fewer wearer and production problems than any system to date.”³⁰ It concluded that the new vest “is more satisfactory than wearing the standard flak vest over the small arms protective ceramic plates.”³¹

Post-Vietnam to 9/11

Throughout the Vietnam War, body armor for ground troops was Korean War-vintage. The Army relied on laminated nylon primarily for ballistic protection, judging it superior to steel in stopping fragments.³² Despite the increase in small arms wounds in Vietnam, ‘variable-type’ armor that combined ‘soft’ fragmentation protection and ‘hard’ small arms protection did not reach ground troops until 1969, and then in limited quantities.³³ Post-Vietnam, the Army began redesigning its body armor with a promising new lightweight material: Kevlar.

In 1983, the Army introduced the Personnel Armor System for Ground Troops (PASGT), a Kevlar ‘soft’ armor vest in camouflage print. At nine pounds, the PASGT vest weighed slightly more than the M-69, but provided better fragmentation protection, was more flexible, and fit better. Some U.S. soldiers wore PASGT vests in Grenada (Operation URGENT FURY) in 1983, Panama (Operation JUST CAUSE) in 1989-90, and in the Middle East (DESERT SHIELD/DESERT STORM) in 1990-91.

U.S. Army Combat Capabilities Development Command Soldier Center

Since 1954, the U.S. Army has conducted body armor research and development at the U.S. Army Natick Soldier Systems Center (NSSC) in Natick, Massachusetts. Known by several names over the years, Natick’s Combat Capabilities Development Command (CCDC) Soldier Center continues to optimize and modernize soldier performance, to increase combat readiness and lethality. As part of the new Army Futures Command, the CCDC Soldier Center and its Soldier Protection and Survivability Directorate continuously works to “lighten the soldier’s load and keep our warfighters protected, optimized and lethal.”¹



PASGT

The *Body Armor, Fragmentation Protective Vest, Ground Troops*, better known as the PASGT, provided better protection with its Kevlar inserts than the ballistic nylon vests used in Korea and Vietnam (M-1952 and M-69), with no significant weight increase.



U.S. Army CCDC Soldier Center logo.



U.S. Army Rangers put their new Ranger Body Armor (RBA) to the test during the Battle of Mogadishu in October 1993.



RBA

Ranger Body Armor was the first Army vest to combine a ceramic plate for ‘hard’ small arms protection with ‘soft’ Kevlar fragmentation protection. It influenced subsequent designs, including the Interceptor Body Armor, and marked the transition away from ‘flak jackets’ that provided only fragmentation protection. Initially fielded with just a front plate, the vest shown here was designed to carry front and back plates.

(Photo Credit: U.S. Army CCDC)



ISAPO

The Interim Small Arms Protective Insert (ISAPO) incorporated front and back ceramic plates and weighed 16 pounds. When worn over the PASGT vest, the complete system weighed 25 pounds.

(Photo Credit: U.S. Army photo/David Kamm)

To meet the unique fighting requirements of the Army Rangers, the U.S. Army Natick Soldier Research, Development and Engineering Center developed the PS-930 Ranger Body Armor (RBA) in the early 1990s.³⁴ The RBA had the same Kevlar inserts as the PASGT, but also had an eight-pound aluminum oxide ceramic plate to protect the front torso from 7.62mm ball ammunition. During the Battle of Mogadishu, October 1993, it saved lives and reduced the seriousness of bullet wounds.³⁵ The later addition of a back plate brought its weight up to 25.1 pounds.

The value of ‘hard armor’ plates was validated in Somalia. In 1996, the Army fielded the Interim Small Arms Protective Overvest (ISAPO), a ‘plate carrier’ with front and back boron carbide ceramic plates to stop 7.62mm bullets. It was worn over the PASGT, adding 12 to 16 pounds, depending on the size of the plates, for a total weight of 21 to 25 pounds. ‘Interim’ meant fewer than 4,000 ISAPO were fielded.³⁶ Yet, the RBA and ISAPO marked a departure from ‘flak jackets,’ for fragmentation protection, to body armor that protected against fragmentation and small arms fire. The cost was more weight to carry while climbing over obstacles and running.

The Interceptor Body Armor (IBA), introduced in June 1999, solidified this transition. With improved Kevlar inserts in an Outer Tactical Vest (OTV), the wearer could survive fragmentation and 9mm pistol bullets. Two boron carbide ceramic Small Arms Protective Inserts (SAPI) enabled the wearer to withstand

multiple strikes from 7.62mm ball ammunition hits. At 8.4 pounds, the OTV was lighter than the PASGT. The inclusion of two SAPI plates raised the weight to 16.4 pounds, still about nine pounds less than the PASGT with ISAPO.³⁷ An additional benefit of the new OTV was its compatibility with Modular Lightweight Load-carrying Equipment (MOLLE), which allowed accessories such as pistol holsters, ammunition pouches, and first aid kits to be attached to the outside of the armor vest. Relatively few IBAs had been fielded when terrorists attacked the United States on 11 September 2001.

Post 9/11

Soldiers in Operations ENDURING FREEDOM (OEF) and IRAQI FREEDOM (OIF) initially wore a combination of the new IBA and legacy RBA and PASGT vests. The large commitment of ground forces to OIF raised an issue: only one set of SAPI plates was issued for every three OTVs fielded because of SAPI costs (\$712/set). The U.S. Army Special Forces Command (USASFC) got an exception to Army policy, and received one set of SAPIs for all OTVs. Not all Army units were that fortunate.³⁸ In October 2003, U.S. Central Command (USCENTCOM) directed that all soldiers and Department of Defense civilians in its theater would be issued “one suit of body armor” (i.e., OTV, with SAPIs).³⁹ By 2006, the Army had fielded 953,079 OTVs and 896,069 sets of SAPI plates.⁴⁰

Studies of combat wounds during OIF and OEF prompted incremental improvements to the IBA. Deltoid



IBA

The Interceptor Body Armor (IBA) initially consisted of the Outer Tactical Vest for fragmentation protection (shown here), and front and back Small Arms Protective Insert (SAPI) plates. Removable neck, throat, and groin protection was also provided that increased weight and decreased comfort. Deltoid and Axillary Protectors (DAPs) and Enhanced Side Ballistic Inserts (ESBIs) were added later, in response to emerging threats, pushing the total weight over thirty pounds.

and Axillary Protectors (DAPs), weighing three pounds, were added in 2004, extending fragmentation protection to the upper arms and shoulders.⁴¹ In 2006, two Enhanced Side Ballistic Inserts (ESBIs) were attached to the IBA in side pouches to expand ‘hard’ protection to vulnerable abdominal areas, adding five more pounds.⁴² Enhanced Small Arms Protective Insert (ESAPI) plates capable of stopping .30 caliber armor piercing ammunition were also fielded (5.5 lbs. ea.), replacing the earlier SAPIs (4 lbs. ea.).⁴³ Complete, the IBA weighed 33 pounds, without factoring the weight of other gear attached to the vest, such as ammunition magazines, pistol, radio, first aid kit, and canteens or hydration carrier.⁴⁴

The assortment of body armor vests initially employed in Operation IRAQI FREEDOM is on display in this photo of an Information Operations (IO) ‘Tiger Team’ operating in Mosul, Iraq, in April 2003. In the front row, the soldiers on either end are wearing Ranger Body Armor (RBA), while the other three soldiers have Interceptor Body Armor (IBA). In back, the soldier on the far right has the Personnel Armor System for Ground Troops (PASGT) vest, and the captain in the center is wearing the Body Armor Load Carrying System (BALCS).





IOTV
The Improved Outer Tactical Vest (IOTV), shown here with Deltoid and Axillary Protectors (DAPs), was first introduced in 2007. It provided a similar level of protection as the IBA that it replaced, but benefitted from a quick release that made it easier to remove in the case of emergency.

To address issues of weight and comfort, the U.S. Army Program Executive Office (PEO) Soldier introduced the Improved Outer Tactical Vest (IOTV) in 2007. The IOTV provided a similar level of protection as the IBA, and used many of the same ‘add-on’ components (DAPs, ESBI, and groin protector). Its primary advantage over the IBA was a quick release mechanism that allowed the wearer to remove the vest rapidly in emergency situations, such as a vehicle rollover, fire, or submersion, and provided quick access to wounds. Advertised as lightweight, a complete IOTV weighed approximately 32 pounds.⁴⁵

Motivated by constituent concerns, particularly those from the parents of service members, Congress questioned whether the Department of Defense was too slow to develop lighter-weight body armor.⁴⁶ In a 2011 hearing, Army Brigadier General (BG) Peter N. Fuller, Commanding General, PEO Soldier, admitted to a subcommittee of the House Armed Services Committee that body armor had “hit a technical wall” with regard to weight.⁴⁷ He also acknowledged the necessity of making tradeoffs in the level of ballistic protection and area of coverage, in order to “provide Soldiers with relief from the weight of body armor.”⁴⁸

BG Fuller’s conclusions were echoed in an Army-commissioned RAND Corporation study entitled “Lightening Body Armor” (2012). The good news was that the current body armor worked: “There have not been any known penetration of the body armor or fatalities associated with the threat of projectiles that the currently issued body armor is designed to stop.”⁴⁹ The bad news was that there was no ‘silver bullet’ solution to the weight problem.⁵⁰

To address these concerns about body armor weight, PEO Soldier introduced the Soldier Plate Carrier System (SPCS) in 2010, a lighter-weight alternative to the IOTV with front, back, and side ballistic plates. At 22 pounds, it weighed 10 pounds less than a fully-loaded IOTV, but lacked ‘soft’ armor fragmentation protection.⁵¹ It was issued primarily to troops deploying to Afghanistan, where high altitude and difficult terrain made mobility

a greater concern.⁵² Meanwhile, the balance of the Army continued wearing the IOTV. Both the IOTV and the SPCS are still in service, while the Army tests its newest design: the Modular Scalable Vest (MSV).

Part of the Army’s comprehensive Soldier Protection System (SPS), the MSV weighs 25 pounds and offers a greater range of motion, better cooling, and an overall better fit than the IOTV.⁵³ The system includes a ballistic combat shirt, blast pelvic protector, integrated head protective system, and transition combat eye protection. Some components of the system have been fielded and the complete system was scheduled for field testing in fiscal year 2019.⁵⁴ How much the final SPS configuration will reduce the soldier’s load remains to be seen.

Special Operations Body Armor

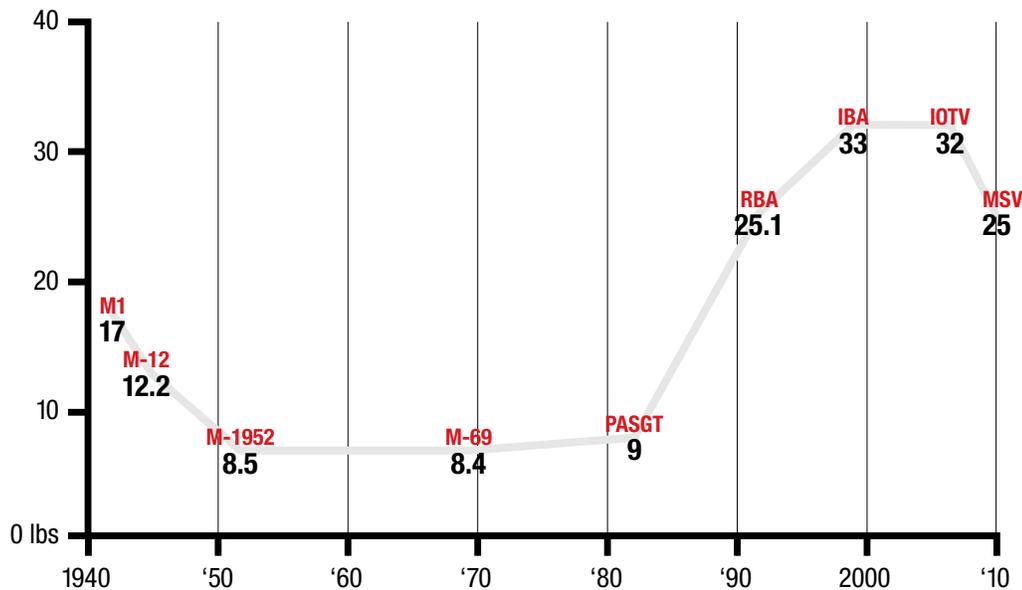
The U.S. Army Special Operations Command (USASOC) pursues body armor solutions for ARSOF soldiers through the U.S. Special Operations Command (USSOCOM)-funded SOF Equipment Personal Advanced Requirements (SPEAR) program.⁵⁵ Modular body armor and load bearing equipment development has been part of the SPEAR charter since 1996.⁵⁶ It first led to the Body Armor and Load Carrying System (BALCS) in 1999.

Within USASOC, the BALCS was issued primarily to Rangers and Special Forces soldiers.⁵⁷ Tactical



BALCS

The Body Armor Load Carrying System (BALCS) vest, an early USSOCOM body armor design, was worn by Special Forces soldiers early in Operations ENDURING FREEDOM and IRAQI FREEDOM. (Photo Credit: US Army CCDC Soldier Center)



USSOCOM led the way for modular body armor; the Army followed suit, with its multi-layered Soldier Protection System, featuring the Modular Scalable Vest. ‘Scaling down’ body armor protection levels requires an acceptance of risk, but modularity will likely be the offset to the weight issue for the foreseeable future.

BG Peter Fuller said it well in 2011: “Reducing area of coverage presents increased risk of injury to unprotected areas of the

Psychological Operations (PSYOP), Civil Affairs (CA) and ARSOF support soldiers were issued SPEAR armor as it became available; standard issue body armor (IBA, IOTV, and SPCS) were interim substitutes.⁵⁸ SPEAR also helped ARSOF aviators through its ‘Aircrew’ initiative. Subsequent SPEAR designs included the Releasable Body Army Vest (RBAV) and the Modular Body Armor Vest (MBAV).

Through SPEAR, USSOCOM has impacted Army body armor development, as seen in the SPCS and MSV.⁵⁹ The SPEAR program also influenced the development of the Army’s ESAPI plates.⁶⁰ This trend continues with the fielding of the latest generation of SPEAR body armor, the Adaptive Vest System (AVS), in 2014.⁶¹ Part of the Family of Tactical Ballistic Armor (FTBA), the AVS is similar in concept and design to the MSV, but uses lighter ballistic plates and Modular Supplemental Armor Protection (MSAP), instead of the Army ESAPI and ESBI plates.⁶²

Conclusion

Since the Korean War, the U.S. Army has issued body armor to enhance soldier survivability. The level of protection afforded has increased considerably since the first M-12 vests reached Korea, but the associated weight has exacted a toll on soldier mobility and effectiveness.⁶³ Until the introduction of the Ranger Body Armor and Interim Small Arms Protective Overvest in the mid-1990s, individual body armor seldom weighed more than ten pounds. Since then, it has seldom weighed less than 25 pounds, as efforts to lighten soldier loads have been offset by the weight of additional armor.

Absent a breakthrough in lighter-weight materials, ‘scalable’ and ‘modular’ have become the go-to concepts in the past decade. Through its SPEAR program,

however, it provides the soldier greater mobility, which may result in greater survivability in some terrains or combat situations.”⁶⁴ He was acknowledging that there are situations on the modern battlefield where speed of movement still provides the best security. 🇺🇸

Takeaways:

- 1 The escalating demand for better protection has created a paradox: lighter, more effective protective materials do not result in lighter body armor; some result in heavier armor, when other levels of protection are added.
- 2 ‘Modularity’ and ‘scalability’ refer to soldiers’ ability to adjust protective gear to best accomplish the mission; the Army Modular Scalable Vest (MSV) and USSOCOM Adaptive Vest System (AVS) provide that capability.
- 3 Reducing protection levels assumes risk; however, today’s ‘scaled-down’ armor still provides far better protection from small arms fire than early flak jackets.

Acknowledgements:

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Endnotes

- 1 Medical Department, U.S. Army, "Wound Ballistics," (Washington, DC: Office of the Surgeon General, Department of the Army, 1962), 742-743, hereafter Medical Department, "Wound Ballistics," page number.
- 2 Medical Department, "Wound Ballistics," 741. The armor's 'total effectiveness' (i.e. percentage of hits, both fragments and small arms projectiles stopped) was placed at 67.9 percent.
- 3 Medical Department, "Wound Ballistics," xvi. Malcolm C. Grow would later become the first Surgeon General of the U.S. Air Force, retiring as a Major General in 1949.
- 4 Franklin D. Roosevelt, *Seventeenth Report to Congress on Lend-Lease Operations: Reverse Lend-Lease Aide from the British Commonwealth of Nations* (Washington, DC: Government Printing Office, 1944), 17. The U.S. Government considered the initial run of body armor, enough for "600 United States Eighth Air Force bomber crews," to be "reverse lend-lease," referring to materiel assistance provided to the U.S. by other Allied nations, under the Lend-Lease Act of 1941. Once a design was tested and standardized, production of the Flyer's Vests shifted to the United States.
- 5 The armor was primarily intended for the crew of the 'heavy bombers,' a term referring to four-engine B-17 *Flying Fortress* and B-24 *Liberator* bombers that conducted 'deep penetration' bombing missions over enemy territory, and therefore encountered the most enemy antiaircraft fire.
- 6 Simon Dunstan, *Flak Jackets: 20th Century Military Body Armour* (Peterborough, UK: PrintOnDemand-Worldwide, 2009), 10-11, hereafter Dunstan, *Flak Jackets*, page number.
- 7 The terms 'flak vest' and 'flak jacket' remained in the military lexicon through the 1990s, when the standard issue Personnel Armored System Ground Troops (PASGT) vest was in use. Starting with the Interceptor Body Armor (IBA), introduced in 1999, the vests were more commonly known as "body armor," or by the acronym of the vest (i.e. "IBA," or "IOTV").
- 8 Over 300,000 of the M1 Flyer's Vest were produced by the end of World War II.
- 9 Dunstan, *Flak Jackets*, 11.
- 10 Dunstan, *Flak Jackets*, 11. The M2 was a modified version of the M1 issued to pilots and copilots, who sat in armored seats, and therefore did not need a vest with armor in the back.
- 11 Medical Department, "Wound Ballistics," 666. The study also noted, "After the introduction of body armor there was a reduction of 77.1 percent in the fatality rate of thoracic wounds and a reduction of 82.8 percent in the fatality of abdominal wounds."
- 12 Medical Department, "Wound Ballistics," 673. "Numerous investigators in the Ordnance Department and in the other technical services had contemplated the development of armor for ground troops in the early stages of World War II. However, very preliminary investigations had shown that most models were too heavy, were incompatible with standard items of equipment, and tended to restrict the mobility of the soldier. Therefore, the development of armor for ground troops was initially rejected as an unsound idea, and the development of a flyer's armor received more or less full attention. However, continued investigation in the development of lighter weight metallic ballistic material and in the relatively new field of nonmetallic ballistic material led to a resurgence in interest for armor for ground troops"
- 13 Medical Department, "Wound Ballistics," 676-677.
- 14 Office of the Quartermaster General, "Armored Vest Fact Sheet," 23 December 1952, on internet at http://www.qmmuseum.lee.army.mil/korea/armored_vest.htm, 1, hereafter "Armored Vest Fact Sheet," page number.
- 15 "Armored Vest Fact Sheet," 1.
- 16 Medical Department, "Wound Ballistics," 677. By war's end, most sets of M-12 body armor had been transferred to the South Korean troops.
- 17 "Armored Vest Fact Sheet," 1. 'Doron' was an eponym, derived from the name of Brigadier General Georges Doriot, World War II chief of the Research and Development Branch, Office of The Quartermaster General of the Army.
- 18 Medical Department, "Wound Ballistics," 758. As of 31 December 1951, 29,534 M-1951 'Marine Vests' were available to Army units, along with 10,867 of the older M-12s, and 4,584 of the Army's new M-1952A.
- 19 Shelby Stanton, *U.S. Army Uniforms of the Korean War* (Harrisburg, PA: Stackpole Books, 1992), 192.
- 20 Dunstan, *Flak Jackets*, 21. Approximately 26,161 M-1952 vests had reached Korea by the end of hostilities in July 1953.
- 21 Shelby Stanton, *U.S. Army Uniforms of the Vietnam War* (Harrisburg, PA: Stackpole Books, 1989), 94, hereafter Stanton, *U.S. Army Uniforms of the Vietnam War*, page number.
- 22 Stanton, *U.S. Army Uniforms of the Vietnam War*, 94.
- 23 Stanton, *U.S. Army Uniforms of the Vietnam War*, 91. Stanton notes, "[T]he body armor was cumbersome, relatively heavy, and hot to wear. The sweltering tropical heat retained by the vest sapped body strength and caused severe sweating, dehydration, and even heat prostration."
- 24 Dunstan, *Flak Jackets*, 24; Stanton, *U.S. Army Uniforms of the Vietnam War*, 96. Stanton: "Throughout the war, body armor was seldom seen on Army personnel, unless they were in mechanized units like the 11th Armored Cavalry or were manning positions that required little movement."
- 25 Stanton, *U.S. Army Uniforms of the Vietnam War*, 97. Curved shields developed in the early 1960s were so heavy and uncomfortable that many pilots preferred to take their chances.
- 26 Stanton, *U.S. Army Uniforms of the Vietnam War*, 97-98. The early plates used tiled ceramic plates that were effective against 7.62mm/.30 caliber bullets, but vulnerable at the seams. This weakness was corrected with the introduction of 'monolithic' (i.e. one-piece) ceramic plates in 1966. These were often referred to as 'chicken plates' and were made of a various ceramic composites, of varying cost and weight.
- 27 Stanton, *U.S. Army Uniforms of the Vietnam War*, 98-99; Dunstan, *Flak Jackets*, 26-27. The aluminum oxide ceramic plates favored by the Army were the heaviest (28.5 pounds) but cost the least (\$195 each); the boron carbide ceramic plates used by the Air Force, Marine Corps, and Navy weighed only 20.75 pounds, but cost \$1,018 each.
- 28 Thomas H. Judge and Paul J. Buttkus, *Ballistic and Spall Tests for Aircrew Body Armor*, (Natick, MA: U.S. Army Natick Laboratories, 1972), 1, hereafter Judge and Buttkus, *Ballistic and Spall Tests*, page number.
- 29 Judge and Buttkus, *Ballistic and Spall Tests*, 1; Stanton, *U.S. Army Uniforms of the Vietnam War*, 97-98. The total weight of the body armor, fragmentation, small arms protective, aircrewmembers, gunner/crew chief, front and back plate version was 34 pounds, 3 ounces.
- 30 Judge and Buttkus, *Ballistic and Spall Tests*, ii.
- 31 Judge and Buttkus, *Ballistic and Spall Tests*, ii: The new vest weighed 16 pounds, 4 ounces; the vest it replaced weighed 14 pounds, but required the standard 9-pound M-69 'flak jacket' be worn over it, to reduce the threat from secondary fragments.
- 32 "Armored Vest Fact Sheet," 1.
- 33 Stanton, *U.S. Army Uniforms of the Vietnam War*, 96. In 1968, the Army developed a 'variable-type' vest that combined a ballistic-nylon felt vest and two (front and back) ceramic fiberglass plates. The total weight of the armor was approximately twenty pounds, which was over twice that of the M-69. Additionally, each vest cost \$800, compared with \$35 for the M-69. The relatively small number of these vests that made it to Vietnam in 1969-1970 were worn by soldiers conducting motorized, boat unit, or stationary operations. The program was cancelled in early 1970 and the idea of 'hard' armor plates for ground troops did not gain widespread support until the mid-1990s.
- 34 Jane Benson, "NSRDEC-Developed Body Armor Saved Lives in the Battle of Mogadishu," 5 October 2018, https://www.army.mil/article/212068/nsrdec_developed_body_armor_saved_lives_in_the_battle_of_mogadishu.
- 35 Robert L. Mabry, MD, John B. Holcomb, MD, Andrew M. Baker, MD, Clifford C. Cloonan, MD, John M. Uhorchak, MD, Denver E. Perkins, MD, Anthony J. Canfield, MD, and John H. Hagmann, MD, "United States Army Rangers in Somalia: An Analysis of Combat Casualties on an Urban Battlefield," *The Journal of Trauma Injury, Infection, and Critical Care* 49:3 (September 2000): 523, on internet at https://archive.org/details/DTIC_ADA628420?q=body+armor+%2B+vietnam: A study of combat wounds incurred by Task Force RANGER (TFR) during the Battle of Mogadishu found: "Body armor seems to have reduced mortality from injuries to the chest. This statement is additionally supported by the comments of TFR soldiers. There are at least a dozen anecdotal accounts of soldiers whose armor was hit by bullets and fragments." The study also noted that the RBA prevented "small fragment wounds to the abdomen," [thus] "eliminating the need to perform additional diagnostic studies, serial examinations, and surgical exploration required by such casualties, thus significantly reducing the surgical workload."

- 36 "Interim Small Arms Protective Overvest," 21 October 2001, <https://web.archive.org/web/20011221181143/http://www.globalsecurity.org/military/systems/ground/isapo.htm>
- 37 Leif Hasselquist, Carolyn K. Bense, Brian Corner, and Karen N. Gregorczyk, *An Investigation of Three Extremity Armor Systems: Determination of Physiological, Biomechanical, and Physical Performance Effects and Quantification of Body Area Coverage* (Natick, Massachusetts: U.S. Army Natick Soldier Research, Development, and Engineering Center, 2012), 3; "Interceptor Body Armor," no date, <https://www.globalsecurity.org/military/systems/ground/interceptor.htm>.
- 38 U.S. Army Special Forces Command (Airborne), Assistant Chief of Staff G7 – Force Integration, "Materiel Modernization Master Plan, FY 03-09," March 2003, copy in USASOC History Office Classified Files, Fort Bragg, NC.
- 39 Inspector General, United States Department of Defense, "DoD Procurement Policy for Body Armor," 31 March 2008, 26, hereafter IG Report, "DoD Procurement Policy for Body Armor," page number.
- 40 IG Report, "DoD Procurement Policy for Body Armor," 26.
- 41 IG Report, "DoD Procurement Policy for Body Armor, 5. Deltoid and Axillary Protectors (DAPs) were also known as the Deltoid and Axillary Protector System (DAPS).
- 42 IG Report, "DoD Procurement Policy for Body Armor, 7-8; Hearing before the Subcommittee on Tactical Air and Land Forces of the Committee on Armed Services, House of Representatives, "Update on the Use of Combat Helmets, Vehicle Armor and Body Armor by Ground Forces in Operation IRAQI FREEDOM and Operation ENDURING FREEDOM," 15 June 2006, 109, hereafter HASC Hearing, "Use of Combat Helmets, Vehicle Armor, and Body Armor," 15 June 2006, page number.
- 43 HASC Hearing, "Use of Combat Helmets, Vehicle Armor and Body Armor," 15 June 2006, 106. **ESAPI plates provide 'Level IV' (National Institute of Justice [NIJ], Type IV) protection, indicating the ability to stop .30 caliber (7.62mm) armor piercing ammunition. Previous SAPI plates had been rated 'Level III' (NIJ Type III), meaning that they protected against 7.62mm ball ammunition, but not armor piercing bullets. An interim 'Improved SAPI' could stop 7.62 x 39mm armor piercing ammunition, but not 7.62 x 54mm rounds used by snipers in Afghanistan and Iraq, at the time.**
- 44 Hydration carriers (often referred to by the brand-name 'Camelback') were often integrated into the vest, for convenience. Other accessories included 'dump pouches,' for empty magazines, the Individual First Aid Kit (IFAK), and plastic zip ties (i.e. 'flex cuffs').
- 45 Kenneth Horn, Kimberlie Biever, Kenneth Burkman, Paul DeLuca, Lewis Jamison, Michael Kolb, Atif Sheikh, *Lightening Body Armor: Arroyo Support to the Army Response to Section 125 of the National Defense Authorization Act of Fiscal Year 2011*, (Santa Monica, CA: RAND Corporation, 2012), 21, hereafter Horn, et.al, *Lightening Body Armor*, page number.
- 46 Horn, et.al, *Lightening Body Armor*, iii.
- 47 Hearing before the Subcommittee on Tactical Air and Land Forces of the Committee on Armed Services, House of Representatives, "Soldier and Marine Equipment for Dismounted Operations," 17 March 2011, 93, hereafter HASC hearing, "Soldier and Marine Equipment for Dismounted Operations," page number.
- 48 HASC hearing, "Soldier and Marine Equipment for Dismounted Operations," 93.
- 49 Horn, et.al, *Lightening Body Armor*, 10.
- 50 Horn, et.al, *Lightening Body Armor*, 10: **The study echoed BG Fuller's testimony from the year prior, recognizing that the most expedient method of reducing the weight of body armor was to adjust 'body armor protection levels,' or BAPL, but acknowledging the inherent risk of this practice (36).**
- 51 U.S. Army, Program Executive Office Soldier, "Equipment Portfolio: FY17" <https://www.peosoldier.army.mil/portfolio/>.
- 52 KDH Defense Systems, "Magnum TAC-1 Soldier Plate Carrier System," no date, www.KDHdefensesystems.com; HASC hearing, "Soldier and Marine Equipment for Dismounted Operations," 7, 22, 91. **As of 2011, the Army requirement was for 85,000 Soldier Plate Carrier Systems (SPCS).**
- 53 Todd South, "New in 2018: Army to issue new body armor to soldiers," *Army Times*, 1 January 2018, <https://www.armytimes.com/news/your-army/2018/01/01/new-in-2018-army-to-issue-new-body-armor-to-soldiers/>.
- 54 2nd Security Force Assistance Brigade deployed in early 2019 with the "Integrated Head Protection System," which is part of the overall SPS.
- 55 Committee on Armed Services, House of Representatives, *Department of Defense Body Armor Programs*, 6 June 2007, (Washington, DC: U.S. Government Printing Office, 2008), 113. **In 2007, Army Colonel (COL) Kevin S. Noonan, U.S. Army PEO for SOF Warrior Programs, U.S. Special Operations Command, explained SOF body armor requirements to the House Armed Services Committee as follows: "USSOCOM requires the ability for the individual operator to tailor his protection and load to meet various mission profiles while maintaining the necessary agility, mobility, and range of motion to meet SOF mission standards." COL Noonan also assured the committee that SPEAR body armor had "saved the lives of SOF operators in combat."**
- 56 "Operational Requirements Document for SOF Personal Equipment Advanced Requirements (SPEAR)," 15 April 1996, copy in USASOC History Office Classified Files, Fort Bragg, NC.
- 57 U.S. Army Special Forces Command (Airborne), Assistant Chief of Staff G7 – Force Integration, "Materiel Modernization Master Plan, FY 03-09," March 2003, Slides 1-3 and 1-6. **Combat support and combat service support troops were issued standard Army body armor (the IBA, and later the IOTV).**
- 58 **This method was known as 'cascading,' through it, the highest priority SOF soldiers received the most modern body armor, and previous versions 'cascaded' to those in support roles.**
- 59 Email from Program Manager Special Operations Forces – Survival, Support, and Equipment Systems (PM-SOF SSES) to Christopher E. Howard, "SUBJECT: RE: Body Armor Questions," 26 August 2019, USASOC History Office Classified Files, Fort Bragg, NC, hereafter PM-SOF-SSES email, date. **According to the PM-SOF-SSES program office, Natick Soldier Support Center scientists and engineers provide technical expertise "in the development, testing, and evaluation of all SPEAR generations of ballistic plates and helmets."**
- 60 Email from Chief of Public Affairs, U.S. Army Combat Capabilities Development Command Soldier Center to Christopher E. Howard, "SUBJECT: FW: Body Armor Questions," 26 August 2019, USASOC History Office Classified Files, Fort Bragg, NC.
- 61 United States Army Special Operations Command, "USASOC Annual Command History, Calendar Year 2014," 167, copy in USASOC History Office Classified Files, Fort Bragg, NC. **Through SPEAR, USASOC also fields Clandestine Body Armor, the SOF alternative to the Army's Ultra-Low Visibility Concealable Body Armor.**
- 62 PM-SOF-SSES email, 26 August 2019; U.S. Army John F. Kennedy Special Warfare Center and School (USAJFKSWCS), *ARSOFF Next: A Return to First Principles* (Fort Bragg, NC: USAJFKSWCS, 2015), 71. **The Family of Tactical Body Armor (FTBA) was approved by U.S. Special Operations Command in August 2014. The system is described, in *ARSOFF Next*, as being "modular and scalable to enable operators to prepare for various mission requirements and to minimize the operator's load while maximizing the operator's survivability."**
- 63 Lauren Fish and Paul Scharre, "The Soldier's Heavy Load," Center for a New American Security, 26 September 2018, <https://www.cnas.org/publications/reports/the-soldiers-heavy-load-1>. **The report addressed the impact of heavy fighting loads on soldiers. It referenced eight separate studies, reports, or doctrinal publications that placed the recommended fighting load for a soldier between 35 and 51 pounds. Body armor worn in recent conflicts in Afghanistan and Iraq often weighed 30 or more pounds, leaving no more than 20 pounds for all other combat necessities, such as ballistic helmet, primary weapon, ammunition, water, night vision devices, radio, and first aid kit. Thus, it found that fighting load guidelines were routinely violated, out of necessity**
- 64 HASC hearing, "Soldier and Marine Equipment for Dismounted Operations," 93.

U.S. Army Combat Capabilities Development Command Soldier Center Endnotes

- 1 Email from Chief of Public Affairs, U.S. Army Combat Capabilities Development Command Soldier Center to Christopher E. Howard, "SUBJECT: RE: Body Armor Questions," 28 August 2019, USASOC History Office Classified Files, Fort Bragg, NC.