NPS-AM-23-001

ACQUISITION RESEARCH PROGRAM
SPONSORED REPORT SERIES

Analysis of the Acquisition Approach for the Next-Generation Special Operations Forces Personal Equipment Advanced Requirements (SPEAR) Loadout for SEALs

December 2022

LCDR Michael J. Zecca, USN

Thesis Advisors: Dr. Ryan S. Sullivan, Associate Professor
Dr. Robert F. Mortlock, Professor

Department of Defense Management

Naval Postgraduate School

Prepared for the Naval Postgraduate School, Monterey, CA 93943

ACQUISITION RESEARCH PROGRAM
DEPARTMENT OF DEFENSE MANAGEMENT
NAVAL POSTGRADUATE SCHOOL

The research presented in this report was supported by the Acquisition Research Program of the Department of Defense Management at the Naval Postgraduate School.

To request defense acquisition research, to become a research sponsor, or to print additional copies of reports, please contact the Acquisition Research Program (ARP) via email, arp@nps.edu or at 831-656-3793.

Acquisition Research Program
Department of defense management
Naval Postgraduate School

ABSTRACT

Special Operations Forces Personal Equipment Advanced Requirements (SPEAR) is the U.S. Special Operations Command's program for outfitting Special Operations Forces with advanced clothing and equipment. However, a 2021 survey indicated that much SPEAR gear goes unused, and a majority of U.S. Navy sea, air, and land (SEAL) operators personally procure commercial gear to supplement their loadout. This study examines two of the 10 functional areas of Naval Special Warfare's (NSW) next-generation SPEAR loadout, the Load Carriage System and Body Armor Vest, to determine user adherence (gear utilization), the amount of gear SEALs personally procure, and whether the new SPEAR loadout is reducing SEALs' out-of-pocket expenses. Quantitative extrapolations from an electronic fielding questionnaire revealed that while the new loadout has mostly favorable user adherence, it has a 58% projected cost-efficiency, which equates to $1.6 million in unused gear. Additionally, experienced SEALs spent close to $3,000 on personally procured gear, on average, in 2022 dollars. The new loadout will reduce out-of-pocket expenses for 34% of SEALs, showing recent program improvement, yet over two-thirds of SEALs still feel SPEAR does not meet operational requirements. Recommendations for modification to NSW's acquisition strategy include transferring a portion of SPEAR sustainment funding to SEALs in the form of an advanced equipment allowance to minimize SEALs' out-of-pocket expenses and reduce waste.

THIS PAGE INTENTIONALLY LEFT BLANK

ABOUT THE AUTHOR

LCDR Michael Zecca is a native of Bridgewater, NJ and is a graduate of the United States Naval Academy, Annapolis MD, where he also received his commission in 2008. Following completion of Basic Underwater Demolition School Class 272 and SEAL Qualification Training Class 273 in 2009, he served at the following operational commands: SEAL Team SEVEN, Naval Special Warfare Unit ONE, SEAL Team ONE, and the Combined Joint Special Operations Task Force Iraq. Shore assignments included the Naval Special Warfare Group TEN Cultural Engagement Unit, Special Boat Team TWELVE, Naval Special Warfare Group ONE Logistics Support Unit. He is married to Keeley Zecca from San Diego, CA. They have two children, Jackson and Brooke. LCDR Zecca has follow-on order to the US Special Operations Command Headquarters in Tampa, Florida.

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

Unless the Lord builds a house, its builders labor over it in vain.

—Psalm 127:1, *Holman Christian Standard Bible*

I thank God for giving me the insight to pursue this project, and I'm proud to say that we built this house together. I also owe a debt of gratitude to Dr. Ryan Sullivan, Dr. Robert Mortlock, and Dr. Alan Ballard, who provided outstanding guidance and mentorship from their fields of study to make this project relevant to the academic and acquisition communities. To my brothers in Naval Special Warfare—especially Mr. Joey Goward, Chief Scotty Bender (SEAL), and Senior Chief Joe Doty (SEAL)—this project could never have gotten off the ground without your subject matter expertise and willingness to assist. Finally, I would like to acknowledge my wife, Keeley, who encouraged and enabled me to put in the time to make this happen. My sincerest thanks go out to everyone involved.

THIS PAGE INTENTIONALLY LEFT BLANK

NPS-AM-23-001

ACQUISITION RESEARCH PROGRAM
SPONSORED REPORT SERIES

Analysis of the Acquisition Approach for the Next-Generation Special Operations Forces Personal Equipment Advanced Requirements (SPEAR) Loadout for SEALs

December 2022

LCDR Michael J. Zecca, USN

Thesis Advisors: Dr. Ryan S. Sullivan, Associate Professor
Dr. Robert F. Mortlock, Professor

Department of Defense Management

Naval Postgraduate School

Prepared for the Naval Postgraduate School, Monterey, CA 93943

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

AoA	Analysis of the Alternatives
BAV	Body Armor Vest
BALCS	Body Armor/Load Carriage System
DAU	Defense Acquisition University
DoD	Department of Defense
JPC	Jumpable Plate Carrier
LCS	Load Carriage System
MOE	Measure of Effectiveness
MMAC	Multi-Mission Armor Carrier
NSW	Naval Special Warfare
SEAL	Sea, Air, and Land (Operators, Platoons, or Teams)
SOF	Special Operations Forces
SPEAR	Special Operations Forces Personal Equipment Advanced Requirements
SWCC	Special Warfare Combatant Crewman
USSOCOM	United States Special Operations Command
WARCOM	Naval Special Warfare Command

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

When it comes to operational gear, U.S. Navy Sea, Air, and Land (SEAL) operators are extraordinarily particular. The SEAL community thrives on performance and innovation; as such, if a SEAL can identify a marginal advantage by utilizing one piece of equipment over another, they will likely take it. SEALs are taught to take advantage of every opportunity, however small, because the stakes are high in combat. The difference in the amount of time it takes to operate a piece of equipment—for example, manipulating a pouch to change a magazine during a firefight—can mean the difference between life and death on the battlefield. Given this context, it is understandable why SEALs insist on having the best operational equipment money can buy.

U.S. Special Operations Command (USSOCOM), the organization that oversees the SEAL Teams, saw value in outfitting its service members with the best gear and generated a program to meet that need. Special Operations Forces Personal Equipment Advanced Requirements (SPEAR) is USSOCOM's program for outfitting Special Operations Forces (SOF) with state-of-the-art clothing and equipment to enable them to conduct the full range of Special Operations missions (U.S. Special Operations Command [USSOCOM], 1996). Consisting of 10 functional categories of equipment, SPEAR gear is highly specialized to meet the demands of the modern SOF warrior and generally comes with a higher price tag than general purpose military equipment (USSOCOM, 2010).

Unfortunately, the SPEAR program has not been universally accepted among SEALs. A 2021 survey of a portion of Naval Special Warfare (NSW), the naval contingent of USSOCOM that includes the SEAL Teams, indicated the possibility that a significant portion of SPEAR gear goes completely unused and that a majority of SEALs personally procure commercial gear to supplement their loadout (Naval Special Warfare Group ONE Logistics Support Unit, 2021). In other words, the gear that is purchased appears to be inadequate and/or ineffective, so SEALs use their own funds to procure commercial items.

In response, NSW modified the next-generation SPEAR loadout, updating models and drastically reducing the amount of gear issued. However, it is unclear whether this new loadout of items will be utilized by SEALs or whether it will reduce the amount of commercial non-SPEAR gear that SEALs personally procure to conduct operations. Therein lies the problem statement for this research.

The following research questions guide the course of this study. How effective is this new loadout in terms of user adherence (gear utilization)? How much gear are SEALs personally procuring on the commercial market to supplement or replace SPEAR gear, and why do they feel it is necessary to buy it? Has this new loadout changed the amount of money SEALs are spending out-of-pocket on operational gear? Is there a correlation between the amount of gear SEALs personally procure and their rank or role in a SEAL platoon? Should NSW modify its SPEAR loadout acquisition strategy to accommodate current demand for commercial items, and how could it be done to maximize effectiveness while minimizing cost?

This study examines two of the 10 functional categories of NSW's next-generation SPEAR loadout, the Load Carriage System (LCS) and Body Armor Vest (BAV). A background and literature review describe the SPEAR family of programs and detail relevant historical precedence for commercial equipment in military units. Next, methodology is addressed, starting with the design of an electronic fielding questionnaire for SEALs to determine user adherence of the next-generation SPEAR loadout, the amount and type of personally procured commercial non-SPEAR gear for any given SEAL, and the reasons for these purchases. Additionally, principles and research from the fields of military acquisitions, economics, statistics, and finance relevant to the study are discussed. Analysis is then conducted on the results of the fielding questionnaire and quantitative extrapolations are made to illustrate community-wide impact. This is followed by conclusions and recommendations which inform how NSW could proceed with SPEAR modernization efforts and the SPEAR loadout acquisition strategy. Finally, potential research ideas are suggested for follow-on studies.

II. BACKGROUND AND LITERATURE REVIEW

To best understand the SPEAR family of programs, a historical review of the acquisition program including relevant operational requirements documents is required. Additionally, this chapter examines the widespread adoption of non-issued commercial equipment into military units. Finally, a review of analytical approaches to measure program effectiveness informs the design of this study.

A. USSOCOM'S CUTTING EDGE SOLUTION FOR PERSONAL EQUIPMENT

The SPEAR family of programs was born in 1996 with a directive from Rear Admiral Irve C. LeMoyne, the USSOCOM deputy commander (USSOCOM, 1996). According to this directive, SPEAR was created to "enhance Army Special Operator performance in the eight core tasks comprising the Special Operations Forces' Strike Engagement missions." Army Special Forces initially had the lead on the development effort, but SPEAR would benefit all USSOCOM elements, including NSW (SEAL Teams). The directive goes on to state that SPEAR will address "USSOCOM's Technology Development Objective number two: Lightweight, low-volume survival, sustainment, and personnel equipment" (USSOCOM, 1996, p. 1), and "will keep Army Special Operators technologically advanced into the 21st Century [by] rapidly [fielding] successive lightweight and advanced SOF unique components" (p. 1). It made a bold distinction between SPEAR and other similar programs that were in existence at the time: "SPEAR is, and shall remain significantly different from existing Army Soldier System programs in concept, scope, and execution" (p. 1). Reading between the lines, USSOCOM seemed to imply that similar Department of Defense (DoD) acquisition programs had failed to meet SOF's expectation for personal equipment development and fielding. In contrast, SPEAR would be different—it would not just consist of different gear but would employ a new kind of acquisition strategy to improve gear modernization at a faster rate to keep SOF on the cutting edge of warfare. The directive goes on to state,

> The SOF operator will use SPEAR as a list of capabilities and will focus on increasing survivability, lethality, mobility and operator performance by tailoring a mission specific ensemble. The SOF operator will be able to

> select and wear appropriate clothing and equipment based on mission requirements, thus achieving the optimum mission package while reducing weight, bulk and heat stress. (USSOCOM, 1996, p. 2)

The SPEAR family of programs was an ambitious undertaking and would evolve over the following decades through a series of follow-on program directives in the form of annexes.

An overarching philosophy guided SPEAR development efforts: the equipment needed to be "modular" (capable of easy modification to accommodate various attachments) and "scalable" (could be made smaller and lighter to allow for increased speed of operator movement). In a recent review of body armor modernization in the *Veritas Journal of U.S. Army Special Operations History*, Howard (2020) stated,

> Absent a breakthrough in lighter-weight materials, "scalable" and "modular" have become the go-to concepts in the past decade. Through its SPEAR program, USSOCOM led the way for modular body armor. … "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 soldier, however, it provides the soldier greater mobility, which may result in greater survivability in some terrains or combat situations" (*Soldier and Marine Equipment for Dismounted Operations*, 2011). He was acknowledging that there are situations on the modern battlefield where speed of movement still provides the best security. (p. 28)

The philosophy of "modular and scalable" ran counter to conventional thinking at the time but became widely accepted in the SOF community as a best practice. According to congressional testimony from Army Colonel Kevin S. Noonan of the Program Executive Office for SOF Warrior Programs, "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" (*Department of Defense Body Armor Programs*, 2007).

By 2006, USSOCOM was deeply entrenched in full-scale conflicts in Afghanistan and Iraq (Coalition Information Centers, 2022). The Global War on Terror had changed the nature of warfare, and SPEAR was poised to adapt. Vice Admiral Eric T. Olson, the USSOCOM deputy commander, released Annex B to the SPEAR Operational

Requirements Document to refine the requirements for SPEAR's Body Armor/Load Carriage System (BALCS; Olson, 2006). Annex B stated that BALCS would improve survivability and mobility of SOF operators

> by maximizing ballistic protection, buoyancy compensation and load carry capacity, while minimizing the burdens of weight, bulk and heat stress. It will also provide an ergonomically designed modular load carrying system that will also be modular with the body armor, and provide increased ballistic protection against increasingly lethal munitions. (Olson, 2006, p. 1)

BALCS capabilities outlined in the annex included

- Modular system design to allow each operator to tailor the system based on mission and preference
- Neutral buoyancy of all items for specified minimum time frames in salt water
- Detailed specifications regarding ballistic protection
- Ability to allow free range of motion in various body positions and environments

Some of these requirements could be objectively determined. However, with repeated use of phrases like "in the opinion of the SOF operator," this document made it clear that the preference, or personal opinion, of each individual SOF operator was paramount in determining the effectiveness of this gear. In doing so, USSOCOM recognized the inherent importance of user satisfaction when it came to evaluating gear, however subjective it might be. Over time, this would prove to be one of the SPEAR methodology's biggest strengths, but would also prove to be one of the SPEAR program managers' biggest challenges.

By 2015, a new requirements document regarding BALCS emerged, this time from the project manager for Special Operations Forces Survival, Support, and Equipment Systems (PM-SOF SSES; Germain, 2015). Now known separately as BAV and LCS components of SPEAR, this new requirements document was tailored specifically for NSW maritime operations. The NSW-specific vest was named the Maritime Body Armor Vest (MBAV), and the associated equipment was named the Maritime Load Carriage System (MLCS). The non-negotiable performance requirements (key performance parameters, or KPPs) for the MBAV included quick release capability

and streamlined "donning and doffing," a shorthand way of saying that it needed to be able to be put on and taken off quickly and easily. Important but less critical performance requirements (key system attributes, or KSAs) for MBAV and MLCS included the following:

- Made of lightweight, highly durable material
- Are simple, easy, and intuitive to use
- Provide maximal comfort, full range of dynamic anatomical motion, and maximal agility
- Minimize water retention, maximize drainage, and minimize drying time
- Allow operators to easily use and adjust while wearing wet suit, contact, or cold-weather gloves
- Allow the operator to bring and maintain all weapons to a good firing position or adjust firing position while fully loaded
- Not hinder or significantly interfere with the operator entering or exiting SOF vehicles (HMMWV, FMTV, ATV, boats), impeding movement through hatches or doorways, and must maximize comfort while riding on SOF/service mobility platforms
- Integrate with a low-profile, integrated modular floatation system with an easy-to-install and removable bladder capable of providing no less than 70 lb (32 kg) of positive buoyancy when inflated on the surface and 40 lb (18 kg) at 1 ATM [atmospheric pressure] (101 kPa)
- Provide adequate area of material for carrying mission-essential equipment and ammunition tailored to duty position—shall be compatible with other existing load bearing items
- Are quickly and easily adjustable for fit, in minimally and maximally loaded configurations
- Provide equal weight distribution, be configurable for additional load carriage, and provide shoulder–hip distribution capabilities
- Have adequate locations and capability to integrate buoyancy-increasing materials or capabilities without reducing area to place pockets or interfere with any of the above attributes
- Minimize bulk, retain necessary equipment, and allow easy access for removal or replacement of equipment into the pocket or pouch

With so many performance demands, trade-offs needed to be made. How can a manufacturer "minimize bulk" while providing "adequate area of material for carrying mission essential equipment and ammunition," all while providing "maximum comfort"? How much is too much, and how much is too little? The answers to these questions are extremely subjective. In a 2008 study of Land Warrior Soldier Systems, Former Assistant

Secretary of the Army for Acquisition, Logistics, and Technology Lieutenant General Joe Yakovac captured the problem well:

> First, trade-offs are going to happen with any system throughout the early part of the acquisition process. The key is to identify what is important to the warfighters, prioritize their requirements and conduct trade-offs accordingly. This requires talking to the warfighters—not just the combat developer and acquisition communities. It requires understanding the current and future fight and prioritizing capabilities in a manner that will address gaps in capability accordingly. It also indicates a fundamental and endemic shortcoming with the requirements process. Analysis is done at the "front-end" to determine capability gaps. However, that cannot be the end of the story. Some agency is needed to continue to track requirements and to make adaptations as necessary. (Clifton & Copeland, 2008, p. 96)

Yakovac understood the complexity of the requirements and acquisition process. Not only is it difficult to make trade-offs in requirements, but once that is complete, a continual process of adapting those requirements to current needs ensures that the job is never really done. He went on to discuss the importance and difficulty of creating buy-in with the end users, the warfighters:

> Obtaining buy-in is always going to be a hard one … as the community … is often split. The Infantry community has different needs because it has several subcommunities—light, heavy, airborne and SOF. Rarely do these communities all speak with one voice. This fact makes getting buy-in from the Infantry community as a whole infinitely harder. (Clifton & Copeland, 2008, p. 96)

Unfortunately, agreement is just as hard to come by within SOF. Clifton and Copeland (2008) concluded this discussion succinctly,

> The soldier is the most difficult "system" to interface to. One size never fits all, and everyone has an opinion as to what is best. What is acceptable to one group of users is unlikely to be acceptable to all, and because no two users think alike, they cannot normally agree to what is good enough. (p. 101)

When it came to NSW, no matter how modular or tailorable SPEAR systems were, there seemed to remain a section of the population that was unsatisfied with the products. As successful as SPEAR may have been at meeting operational requirements, for some SEALs, it was never good enough.

B. TAKING MATTERS INTO THEIR OWN HANDS: MILITARY GEAR IN THE COMMERCIAL MARKET

At some point, for certain low-tech products, NSW lost its competitive advantage to the commercial sector. When it came to developing and fielding such products, the speed of military acquisitions became outpaced by the commercial market. The newest and best products became more likely to show up on the shelf of a local tactical outfitter such as T3 well before they were issued to any SEAL. That delay proved to be months or years, and sometimes NSW never caught up due to cost constraints—the marginal increase in performance of the item was not always justified given the marginal cost increase of the item. This problem was not just isolated within NSW—it made national headlines for the DoD.

With armed conflict raging in Iraq, the DoD found itself unable to provide the most basic life-saving equipment to its front-line soldiers: body armor and BAVs. In March 2005, the *New York Times* reported that a body armor order took 167 days from the time of purchase to receipt of materiel, with fulfillment times for thousands of soldiers taking months longer (Moss, 2005). This same article stated that allied nations fighting alongside U.S. forces in Iraq recognized the same need for personal ballistic protection and placed an order directly with a U.S. manufacturer in Michigan; to the utter embarrassment of U.S. leaders, allies began receiving armor within 12 days. Personal procurement of military equipment began to look like an attractive option.

The logistical crisis in Iraq was not isolated to body armor but extended to other items as well. The gear shortage prompted individual service member responses as well as congressional action. Since the DoD could not provide a timely materiel solution to the need for vital combat equipment, soldiers began buying their own. Marines preparing to deploy to Iraq were quoted on ABC News in 2006 as having bought their own "goggles, backpacks, magazine pouches, and gloves" (Garvin, 2006). The article stated that the commercial equipment was actually better than what was issued. Marine Sergeant Nick Medina was quoted saying, "They gave us the stuff that we need, but we need more as well. So, we go ahead and buy it ourselves." ABC News went on to credit a member of the House Armed Services Committee, Representative John Larson (D-CT), with introducing a bill that called for government repayment to those service members and

their families who bought their own combat gear. Larson stated, "It's time to step up and do the right thing and reimburse all those individuals, who because of the care and concern that they have for our men and women overseas, their loved ones have gone into their pocket to assist them" (Garvin, 2006).

According to NBC News, Senator Christopher Dodd (D-CT) contributed to this legislation and expressed frustration concerning the matter: "Outrageously we've seen that (soldiers) haven't been getting what they need in terms of equipment and body armor. That's totally unacceptable, and why this directive by the Pentagon needs to be scrutinized in much greater detail" (Associated Press, 2006). By early 2006, there were reports of at least 29 claims for reimbursement under the new program (Engber, 2006).

Unfortunately, minimum quality standards were not met on certain commercial body armor, prompting the Army to ban the use of privately bought body armor in 2006 (Associated Press, 2006). The most notable of these items was the Dragon Skin ballistic vest made by Pinnacle Armor, which was advertised as "a flexible vest that allow [ed] a wide range of motion" and supposedly could "absorb high numbers of hits compared to other armors used by the military" (Moore, 2022). Despite this setback, personal procurement of military equipment skyrocketed across the DoD.

According to industry sources cited in the *Christian Science Monitor* in 2008, "Since 9/11, the market for tactical war gear has expanded from nearly nonexistent to nearly $150 million in sales each year, which includes sales directly to soldiers as well as to the Pentagon" (Jonsson, 2008). The article also stated, "The Army and Air Force Exchange Service reports that sales of tactical gear to units have climbed from $60 million in 2005 to $90 million in 2007."

USSOCOM has not been isolated from these trends. In 2016, the *Navy Times* reported that Navy SEALs had told Representative Duncan Hunter (R-CA) that they were "under-equipped and forced to spend their own money on combat gear" (Myers, 2006).

However, some believe that despite modernization and logistics challenges, the DoD has taken important steps in the right direction. Logan Coffey, the founder of Tactical Tailor, a commercial military equipment manufacturer, said that the DoD's mindset has begun to change in a positive way when it comes to leveraging the

commercial sector for reducing gear procurement times and improving modernization efforts (Jonsson, 2008). Specifically mentioned agents of change in the areas of improved quality and supply chains were Program Executive Office (PEO) Soldier, the Soldier Battle Lab, and the Soldier Systems Center. The SPEAR family of programs falls under the purview of the Soldier Systems Center. This research seeks to partner with the Soldier Systems Center and NSW stakeholders to continue the upward trend of expediting modernization efforts and improving acquisition strategy.

III. METHODOLOGY

The methodology for this research includes the design of an electronic fielding questionnaire, acknowledges collaboration from advisors and contributors, discusses statistical concepts used, and concludes with how to translate user adherence values into a cost-efficiency metric.

A. DESIGNING A SPEAR FIELDING QUESTIONNAIRE FOR SEALS

This research draws from military acquisition best practices for equipment analysis. *Analysis of the Alternatives* (AoA) is defined as an

> assessment of potential materiel solutions to satisfy [a] capability need. … It focuses on identification and assesses potential materiel solutions, key trades between cost and capability. … The AoA will inform and be informed by affordability analysis, cost analysis. … It supports a decision on the most cost-effective solution that has a reasonable likelihood of providing the validated capability requirement(s). (Defense Acquisition University [DAU], n.d.)

Another source defines AoA as

> a crucial stage in the process of acquiring new systems for the Department of Defense. AoA is essentially a multicriteria decision process that involves several stakeholders. An AoA is an analytical comparison of the operational effectiveness, cost, and risks of proposed materiel solutions to gaps and shortfalls in operational capability. (Golany & Kress, 2020, p. 63)

AoA, which is sometimes synonymous with the term *cost-effectiveness analysis*, provides a robust framework by which to evaluate various pieces of equipment and compare performance and cost aspects.

Unfortunately, these analysis methods come with their limitations. In attempts to quantify subjective criteria, assumptions can be made that lead to biased conclusions. In a critique of the AoA process, Golany and Kress (2020) argued that various methods have been proposed, but often leave themselves open for criticism based on "shaky mathematical foundations" (p. 64) or use of "arbitrary rules and veto thresholds" (p. 64).

Even their proposed model is subject to criticism since the weighting of their evaluation criteria is inherently subjective.

Lindop (1998) stated that when conducting a cost-effectiveness analysis,

> the difficulty lies, not with determining the Whole Life Cost (WLC) of procuring and operating a piece of military equipment, but with placing a financial value on the material benefit and hence return on the investment, which should be provided by the equipment. The problem is, how do you determine the financial benefit provided by a new class of equipment? (p. 15-3)

In other words, how does one quantify in dollars a subjective performance increase? Exactly how much is a marginal performance gain from better equipment worth?

To answer this question, three terms must be utilized. In military acquisitions, a *measure of effectiveness* (MOE) is defined by the Defense Acquisition University (DAU) as "the data used to measure the military effect (mission accomplishment) … needed to accomplish an end-to-end mission in combat" (DAU, n.d.). Central to any AoA, the MOE is how the government "establishes metrics associated with the military worth of each alternative" (DAU, 2019). DAU further defines *threshold value* as the "minimum performance required to achieve the required operational effect. … Performance below the threshold value is not operationally effective or suitable or may not provide an improvement over current capabilities." Finally, in tandem with the threshold value, DAU (n.d.) defines *objective value* as the

> value of an attribute that is applicable when a higher level of performance delivers significant increased operational effect, or decreased operational risk, if it can be delivered at an affordable life-cycle cost. The objective value is the desired operational goal that is achievable but at a higher risk in life-cycle cost, schedule, and technology. Performance above the objective does not justify additional expense.

Therefore, MOEs measure performance, while threshold and objective values are the designated lower and upper bounds, respectively, for performance.

In a perfect world, all military acquisition programs would achieve their objective value, delivering the maximum level of performance to our warfighters. However, in a cost-constrained environment, senior leaders and decision-makers may more often than not be incentivized to select materiel options at the threshold value, ones that are "good

enough" to meet stated requirements. This is because, as Lindop (1998) mentioned previously, it is difficult to quantify and allocate cost values to incremental performance increases above the threshold value. As a result, the end users may find themselves with a piece of gear that is acceptable but not ideal.

Mankiw (2012) stated in economics terms that "rational people think at the margin. … [They] systematically and purposefully do the best they can to achieve their objectives, given the available opportunities" (p. 6). Unfortunately, in terms of military acquisitions, marginal thinking can lead people to different conclusions based on differing motivations. The acquisition decision-maker, motivated to reduce cost, may see marginal gains in cost reduction (and as a result, a reduction in performance) as an overall benefit. Additionally, there is a "point of diminishing return on investment" (Joint Staff, 2018, p. D-17), where improving a product beyond this point meets "fewer or lesser requirements" (p. D-17), and proceeding is no longer cost-effective. On the other hand, the end user, training for a combat scenario and motivated by self-preservation, will likely only think of marginal gains in terms of improved performance. Both are thinking on the margins, but neither is often satisfied with the results. Consequently, the end user is furnished with equipment that meets the threshold value but not the objective value, and the decision to pursue better gear (or not) then rests on that end user. The end user may then be motivated to seek a marginal advantage, while the program office in charge of the acquisition process may not be, depending on other constraints.

At this point, what recourse does the end user have? As shown previously, many warfighters turn to the commercial market to improve their performance advantage. In a discussion of SOF acquisition issues, Lessley (1995) stated that sometimes

> valid needs can be met with only minor modifications to items readily available on the commercial market. Work gloves, flashlights, skis, knives, handguns, and rucksacks are among such examples. In most all cases, the relatively small dollar value and "low technology" simplicity of each item—considered in isolation from all the other items—have allowed development and procurement to occur outside of the major system framework. (p. 12)

Additionally, Lindop (1998) stated that when conducting a cost-effectiveness analysis, "the range of alternatives may include … procur [ing] or leas [ing] new equipment with improved capability off-the-shelf" (Lindop, 1998, p. 15-4).

Given that end users are often faced with two options—take what is issued or buy it themselves—I have structured the design of this research around measuring the degree to which SEAL operators choose one side over the other. In my opinion, the degree to which a military member feels the need to purchase commercially available equipment to supplement their military loadout is a direct measure of the effectiveness of an acquisition program. Heymont et al. (1965) insisted that that cost-effectiveness analysis does not just consist of quantitative analysis between alternatives, but qualitative analysis as well: "[Cost-effectiveness analysis] assists in providing increased insight into the problem and as much relevant information as possible in order that the decision maker can concentrate on those areas where judgment must be applied, particularly in consideration of qualitative aspects" (p. 3). As a result, in the following analysis of the effectiveness of the SPEAR acquisition strategy, I have chosen "user adherence," the degree to which SEALs actually use the gear they are issued, as the central measure of effectiveness for this study. This is a departure from a traditional cost-effectiveness analysis or AoA, which requires the researcher to compare various products/options and rank them quantitatively. I attempt to evaluate program success without quantitatively comparing SPEAR products to any other products directly. In the language of military acquisitions, program success is determined based on user adherence to issued equipment, the defined measure of effectiveness.[1]

According to Neely et al. (1995) in their study on performance measurement design,

> Traditionally quality has been defined in terms of conformance to specification and hence quality-based measures of performance have focused on issues such as the number of defects produced and the cost of quality. … With the advent of total quality management (TQM) the

[1] Even though I have chosen to use user adherence as the primary MOE for this study, user adherence is inherently a secondary MOE and is only intended to be utilized to evaluate equipment that has already met all other requirements defined in the operational requirements document (i.e.: the primary MOEs). The only reason I can use user adherence as a primary MOE is because all the items being evaluated in this study have already passed through a formal requirement vetting process.

> emphasis has shifted away from "conformance to specification" and towards customer satisfaction. As a result, the use of customer opinion surveys and market research has become more widespread. (p. 84)

Thus, in the language of commercial operations and production management, the measure of user adherence appears to be a suitable one. Neely et al. (1995) went on to state, "Effectiveness refers to the extent to which customer requirements are met, while efficiency is a measure of how economically the firm's resources are utilized when providing a given level of customer satisfaction" (p. 80). In terms of my research, user adherence captures both effectiveness (customer satisfaction) and efficiency (reduction of waste). If the gear is effective, SEALs will use the gear, and there will be little waste or unused gear (high program efficiency). If the gear is ineffective, SEALs will not use the gear, and there will be more waste or unused gear (low program efficiency). Thus, under the TQM model, we would define *user adherence* as the performance measure that quantifies efficiency and effectiveness of action.

Additionally, user adherence directly addresses Maskell's (1989) principles of performance measurement as cited by Neeley et al. (1995) in his research on manufacturing, namely that a performance measure "should be simple and easy to use" (p. 98), "provide fast feedback" (p. 98), and "be designed so that it stimulates continuous improvement rather than simply monitor [ing]" (p. 98). User adherence is extremely simple in concept and can be communicated by the customer in seconds without any preparation, and the goal of using it is to provide continual program improvement over the life of the SPEAR program.

> When you can measure what you are speaking about, and express it in numbers, you know something about it. ... [Otherwise] your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in thought advanced to the stage of science. (Kelvin, 1889, as cited in Neeley et al., 1995, p. 80)

Despite the inherently qualitative approach of this research, I made an attempt to quantify data to facilitate trend analysis. According to *The Measures Handbook*,

> There are four general levels of measurement: nominal, ordinal, interval, and ratio. The levels of measurement range in sophistication from low (nominal) to high (ratio). Data associated with nominal and ordinal levels of measurement are commonly referred to as qualitative data, while data

> associated with interval and ratio levels of measurement are referred to as quantitative data. … The analysis should strive to use the highest levels of measurement that are possible and suitable. (Office of Aerospace Studies, 2014, p. 4)

I employed expanded Likert scales throughout the fielding questionnaire to help bridge this gap between qualitative and quantitative analysis. Huiping and Shing-On (2017) argued that Likert scales are not effective in generating interval-level data unless they contain a high number of points (11 being ideal), concluding that "more Likert scale points will result in a closer approach to the underlying distribution, and hence normality and interval scales" (p. 527). Consequently, I chose a 9-point Likert scale where applicable in the fielding questionnaire, the highest number that I perceive could reasonably be viewed on a mobile device to facilitate mobile user participation. Additionally, user adherence trends were extrapolated to illustrate potential cost waste in terms of dollars of unused gear.

To determine significance, initial threshold and objective standards must be established (Office of Aerospace Studies, 2016). Since NSW has not defined standards for user adherence, inferences must be made. The objective value for SPEAR user adherence should be 100%, meaning that in a perfect world, every SEAL would use the gear they are issued. The threshold value is considerably more subjective, but to err on the conservative side, I have chosen the value 60%, meaning that if less than 60% of SEALs are using the gear that they are issued, there may be a problem with the program.

Finally, the scope of this research must be addressed. As can be seen in the SPEAR Catalog, there are unique loadouts tailored specifically for each different SOF branch (Army, Air Force, Marine Corps, Navy; USSOCOM, 2020). To further complicate matters, each branch contains different kinds of SOF operators, which each require unique loadouts. For example, NSW consists of SEALs and Special Warfare Combatant Crewmen; each is issued different SPEAR loadouts. Given the diverse functionalities of SOF as a whole and NSW in particular, the scope of this research has been focused on only SEAL operators. Additionally, of the 10 functional categories of SPEAR gear, only two were analyzed (BAV and LCS). With a narrow and manageable

scope, I have attempted to control as many factors as possible in this research to isolate trends and extrapolate meaningful conclusions

B. LEVERAGING A TEAM OF EXPERTS

Complex projects require the insight of a team of experts. Pulling information from various disciplines—ranging from tactical special operations to high-level program management best practices—this research has been informed by military and civilian personnel with decades of cumulative experience. The following individuals assisted in developing and/or interpreting the results of the SPEAR Fielding Questionnaire:

- Ryan Sullivan: Primary Thesis Advisor, Associate Professor of Economics, Naval Postgraduate School
- Robert Mortlock: Thesis Co-Advisor, Professor of the Practice, Defense Acquisition and Program Management, Naval Postgraduate School
- Marcus (Alan) Ballard: Assistant Professor of Operations and Logistics Management, Naval Postgraduate School
- Deputy, Combat and Survival Programs, Naval Special Warfare Command[2]
- Joey Goward (Master Chief Petty Officer, U.S. Navy SEAL, Ret.): N41, Materiel Management, Naval Special Warfare Command
- Scotty Bender (Chief Petty Officer), U.S. Navy SEAL: Requirements Modernization, Naval Special Warfare Command
- Joe Doty (Senior Chief Petty Officer), U.S. Navy SEAL: ONE Troop Senior Enlisted Advisor, SEAL Team FIVE
- Rick Pangelinan (Master Chief Petty Officer, U.S. Navy SEAL, Ret.): Program Manager, SOF Survival, Support, and Equipment
- (Myself) Michael Zecca (Lieutenant Commander), U.S. Navy SEAL: Student, Naval Postgraduate School

[2] Prefers to remain unnamed.

C. STATISTICS AND SAMPLING METHODS

Statistics best practices were reviewed and applied to make this fielding questionnaire successful. In her study of sampling methods, Berndt (2020) defined the population as "the complete set of individuals, events, or objects that exhibit the behaviors and/or possess the characteristics of interest to the researcher" (p. 224). The target population for this study is U.S. Navy SEALs. In her guide, *How to Sample in Surveys*, Fink (2003) defined eligibility and exclusion criteria, and emphasized the importance of establishing these elements clearly: "Eligibility or inclusion criteria are the characteristics a person must have in order to be eligible for participation in the survey; exclusion criteria are those characteristics that rule out certain people" (p. 6). Inclusion criteria for this study are that participants must be active-duty SEALs between the ranks of E-3 to O-5 and currently serving at a SEAL Team. Exclusion criteria for this study are that participants must have completed at least one full workup and deployment with a SEAL Team and have been issued the Multi-Mission Armor Carrier (MMAC) 2019 BAV to be able to provide a hands-on evaluation of the product. These criteria are vital to prevent uninformed responses from non-SEALs, junior SEALs who have not been exposed to the full breadth of NSW deployable missions, or overly senior SEALs who do not have current tactical experience with the products of interest.

However, talking to every SEAL who meets these criteria is infeasible and impractical. Facing a similar problem in their research, Shorten and Moorley (2014) concluded,

> Given the sheer size of this population, the researcher could not possibly access [every individual]. Instead, the researcher would need to devise a strategy to identify a representative subgroup … called a sample, and the process of selecting this subgroup from the population is the sampling method. (as cited in Berndt, 2020, p. 224)

The goal of selecting a sound sampling method is to "minimize error and bias and to enhance maximum representativeness" (Tyrer & Heyman, 2016, as cited in Berndt, 2020, p. 224). The most objective sampling methods are quantitative probability-based sampling. However, depending on the research questions, survey population, the type of information that is being obtained, and the legal, administrative, or ethical restrictions

involved, probability-based sampling may not be possible. Berndt (2020) admitted, "Qualitative research questions are limited to non-probability sampling methods" (p. 225).

Further analyzing which sampling method is most appropriate, we must consider the concept of representativeness. In her guide, *How to Sample in Surveys*, Fink (2003) stated,

> A good sample is a miniature version of the population of which it is a part—just like it, only smaller. The best sample is representative, or a model, of the population. A sample is representative if important characteristics (e.g., age, gender, health status) of those within the sample are distributed similarly to the way they are distributed in the larger population. (p. 1)

Selecting a sampling method that can obtain a representative sample will provide the best results. However, due to administrative restrictions on sampling with respect to human subject research in the academic environment, it is difficult to obtain a truly representative sample in an unbiased manner. The Naval Postgraduate School Institutional Review Board application form concerning human subject research states that all subjects who participate in a survey must do so strictly on a voluntary basis. These regulations state that senior leaders cannot be involved in the recruitment of subjects to prevent undue influence or coercion. Therefore, in order to keep the study voluntary, all participants must choose to participate, and thus, participation is not random and will likely not be representative of the true population. Consequently, a certain degree of self-selection bias is inevitable, which skews results (Laerd Dissertation, n.d.).

Continuing in the discussion of representativeness, arguably the most important distinction between SEALs for the purposes of this study is rank. Since the exact proportions of each rank of SEALs within NSW is known, it is possible to compare the rank proportions of the respondents to the true population rank proportions in NSW writ large. This comparative information about variance between the study's rank representativeness and the true population rank proportions is used to further qualify results and resultant conclusions.

Because this research is a qualitative study, I have employed a non-probability sampling method called self-selection sampling. This method involves publicizing a need for participants and ensuring participants meet inclusion/exclusion criteria (Laerd Dissertation, n.d.). Non-probability sampling is also referred to as convenience sampling, as the responsibility for choosing to participate in the study rests on each eligible individual at their convenience (Fricker, 2017). As such, my fielding questionnaire was delivered
via email, and participants chose whether or not they would like to participate by clicking a link.

Self-selection sampling is not a perfect method. In a study of electronic sampling methods, Fricker (2017) criticized non-probability sampling, stating that the bias inherent in this method

> has the potential to be much greater [than probability sampling], since it is likely that those who opt in are not representative of the general population. Furthermore, in non-probability surveys there is often no way to assess the potential magnitude of the bias, since there is generally no information on those who chose not to opt in. (p. 7)

The reason why this matters becomes clear when trying to generalize conclusions to the greater population that did not participate in the study. This process of generalization, or extrapolation of results, is called statistical inference. Fricker (2017) defined *statistical inference* as the ability "to make quantitative statements about the unobserved population statistic" (p. 1). Fricker went on to advise that probability-based sampling methods should be employed when a study ventures to apply statistical inference, and that non-probability surveys "generally do not support formal statistical inference" (p. 7). However, he also admitted that non-probability sampling does, in fact, provide useful data that is "unlikely to be collected in any other way" (p. 18).

In fact, there are distinct advantages to self-selection sampling. Laerd Dissertation (n.d.) stated that this type of sampling is inexpensive and can reduce the amount of time required to collect data, which can be beneficial for a graduate student lacking research funding, like myself. Additionally, Berndt (2020) argued that "persons who choose to participate are more likely to be committed to the research and likely to provide more

truthful responses" (p. 5). The individuals who participate may be motivated by strong positive or negative feelings, and want to send a message up the chain of command (Laerd Dissertation, n.d.). These individuals may actually provide the most detailed qualitative feedback. The data obtained may not translate into the most accurately generalizable data, but it is a starting point.

> Another factor to consider is the sample size.
>
> The Central Limit Theorem states that regardless of the underlying probability density function of the population data, the theoretical distribution of the means of samples from the population will be normally distributed. In essence, this says that the mean of a sample should be treated like an observation drawn from a normal distribution. The Central Limit Theorem only holds if the sample size is "large enough" which has been shown to be only 30 observations or more. (Statistics LibreTexts, 2021, p. 1)

As this study endeavors to leverage statistical inference (albeit with imperfect data), the minimum sample size required is 30. The quantitative data are then organized and examined using statistical methods, including summary charts, regression analysis, and hypothesis testing (Christensen, 2018).

D. TRANSLATING USER ADHERENCE INTO COST-EFFICIENCY

User adherence was determined by summing all responses of SEALs that indicated they had at least some likelihood of using a particular SPEAR item and half of the responses of SEALs that indicated that they were undecided on whether they would use a particular item. This value was then divided by the total number of responses, yielding a percentage.

Once user adherence values were determined for each item, these data could be used to easily calculate cost-efficiency. Cost-efficiency, for the purposes of this study, is how many dollars of equipment are used divided by the total cost of the gear. This process was repeated for each item on the fielding questionnaire and summed to create an overall cost-efficiency for all 10 basic SPEAR BAV and LCS items. This represents what percentage of dollars of gear are actually being utilized by SEALs.

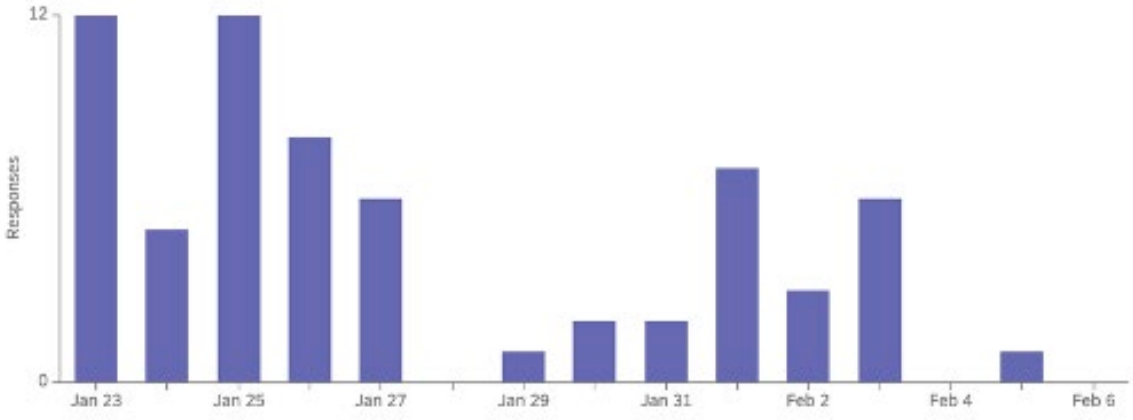
Inherent in these data is another value of interest, the dollar value of equipment not used. This value was used to determine a viable amount of funds to transfer to support the purchase of commercial items, reducing both SPEAR waste as well as out-of-pocket expenses for SEALs.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. DATA AND ANALYSIS

On January 24, 2022, I launched a Qualtrix-based electronic SPEAR Fielding Questionnaire consisting of 15 questions via the "ALL-SEAL" unclassified email distributions to SEAL Teams ONE, FOUR, FIVE, and EIGHT (Appendix). These teams were identified as the only SEAL Teams that had been issued the MMAC 2019 BAV. The fielding questionnaire remained open for 2 weeks (closing February 7, 2022) and generated 65 responses (Figure 1). Current estimates for the available population of eligible SEALs within those four SEAL Teams is 60 per team, making the overall response rate 27%. This figure is well over the 30 samples needed to assume that the Central Limit Theorem is valid for the sample population, allowing it to be treated as a normal distribution. Additionally, the sample population proportion rank demographics have a 95% correlation to actual population proportions by rank, meaning that this sample is representative of the population in terms of rank distribution (Table 1). These facts provide grounds for applying regression analysis and statistical inference to draw conclusions about the population. Figures 2, 3, and 4 provide additional demographic information on respondents.

Figure 1. Responses by Date



Note. 65 responses were collected between January–February 2022 from SEAL Teams ONE, FOUR, FIVE, and EIGHT.

Table 1. Demographic Comparison

Rank	Actual Population	Population Proportion	Sample Population	Sample Population Proportion
E3-E6	1710	51%	50	77%
E7-E9	768	23%	6	9%
CWO2-CWO5	96	3%	1	2%
O1-O3	471	14%	7	11%
O4-O5	303	9%	1	2%
Total	*3348*	*100%*	*65*	*100%*

Correlation of sample proportion to population proportion
95%

Note. Population data provided by Naval Special Warfare Command, January 2022. This sample is representative of the SEAL population.

Figure 2. What Is Your Rank?

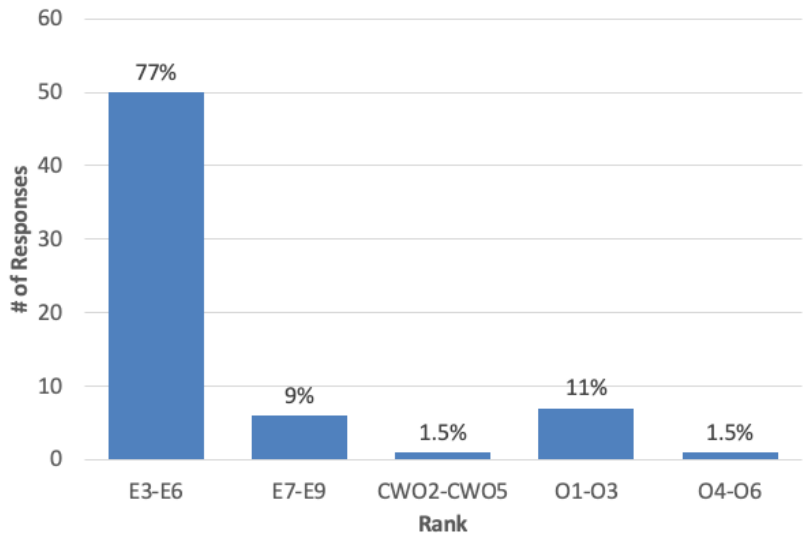


Figure 3. How Many Years Have You Served as a SEAL?

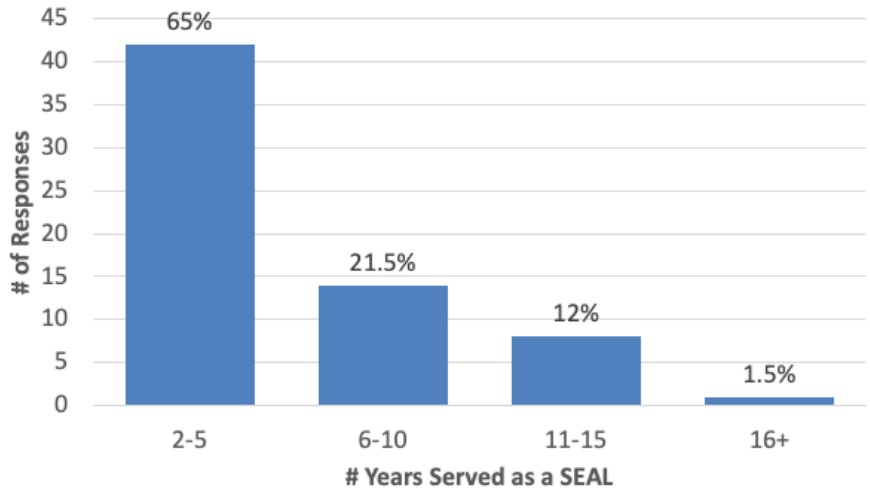
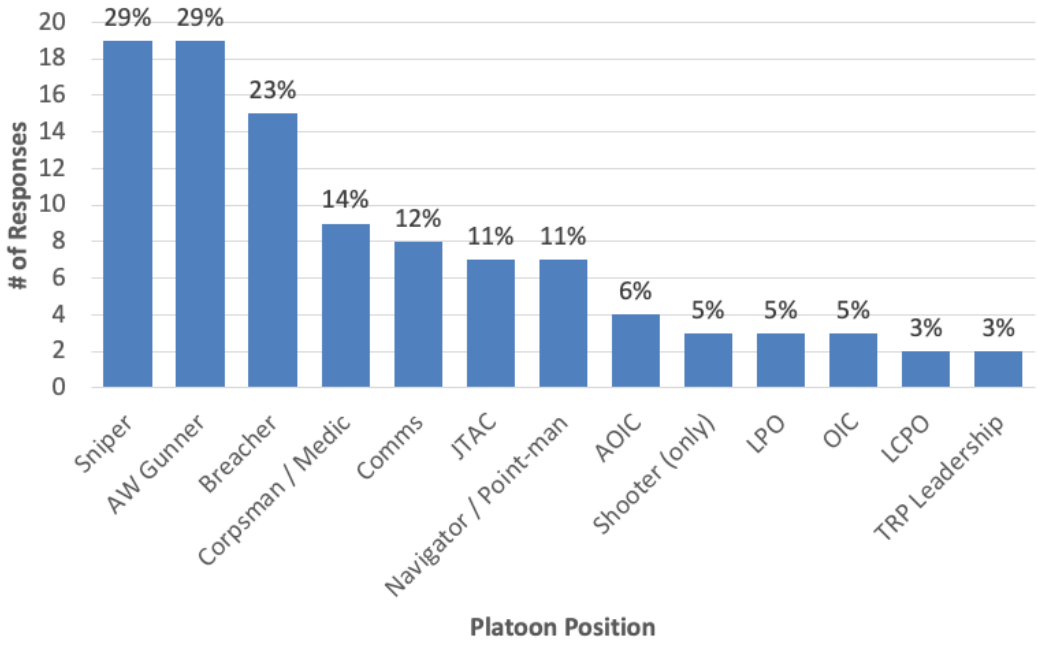


Figure 4. What Was/Is Your Main Role in Your Most Recent Platoon? (Click all that apply.)



A. SUMMARY OF RESULTS

User adherence was mostly favorable (over 60%) for eight out of the 10 BAV and LCS items (Figure 5, Table 2). Unfortunately, the most expensive item in the group, the MMAC 2019 BAV, received the lowest user adherence score (37%) of all the items (Figures 6, 7, and 8; Table 2). Consequently, the extrapolated cost-efficiency for these items was 58%, equating to $1.6 million in unused gear (Table 3).

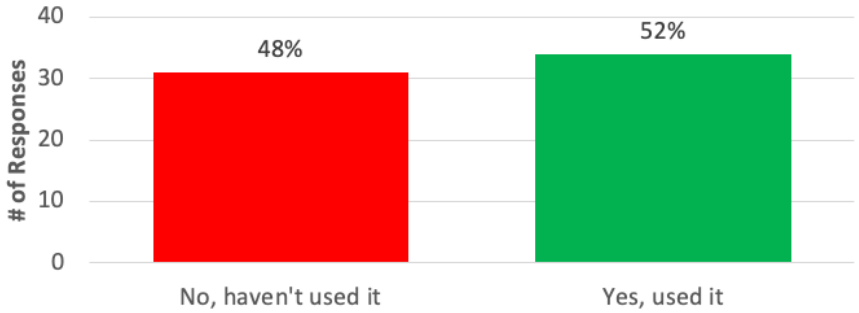
Figure 5. Next-Generation SPEAR BAV and LCS Basic Kit for SEALs: The 10 Items That Appeared in the Fielding Questionnaire. Source: USSOCOM (2020).

Table 2. Projected User Adherence

SPEAR BAV/LCS Items	User Adherence *% of SEALs who will use item*
MMAC 2019	37%
M4 Single Mag Pouch	85%
M4 Single Double Mag Pouch	71%
Pistol Double Mag Pouch	45%
Smoke Grenade Pouch	60%
Frag Grenade Pouch	68%
Strip Charge Pouch	84%
Utility/SSE Pouch	90%
Dump Pouch	85%
Beaver Tail Assault Pack	62%

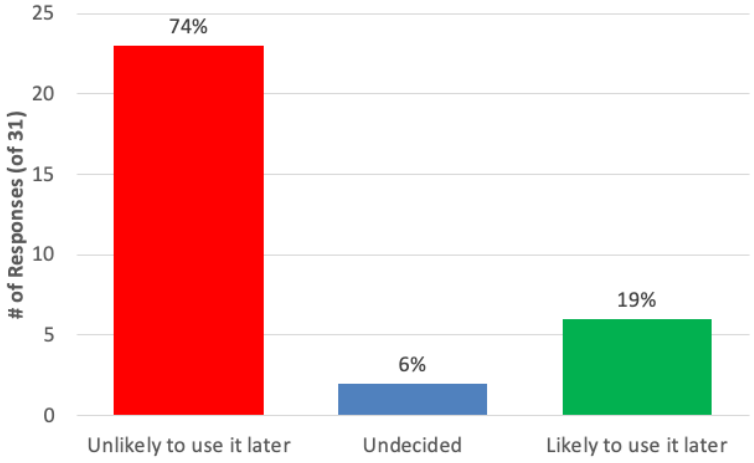
Note. Predicted user adherence for the above items is mostly favorable. Values of over 60%—indicating acceptable user adherence—are highlighted in green. LCS combined user adherence (all but MMAC 2019) is 72%. Number of responses indicating future use plus half of "undecided" responses were summed to generate these figures.

Figure 6. Have You Used the New SPEAR MMAC 2019 Body Armor Vest?



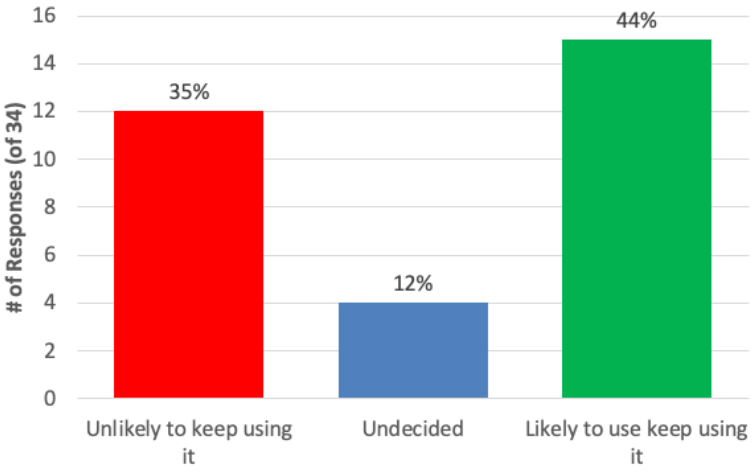
Note. Approximately half of the SEALs who were issued the MMAC 2019 have used it.

Figure 7. For Those Who Were Issued the MMAC 2019 but Haven't Used It, Indicate Your Likelihood of Future Use of the MMAC 2019.



Note. The majority of SEALs who have been issued the MMAC 2019 but have not transitioned to using it yet are unlikely to ever use it.

Figure 8. For Those Who Have Used the MMAC 2019, Indicate Your Likelihood of Future Use of the MMAC 2019.



Note. The MMAC 2019 has mixed reviews from SEALs who have used it, with 35% of SEALs indicating that they will seek an alternative BAV solution.

Table 3. Projected Cost-Efficiency of New SPEAR BAV/LCS Loadout

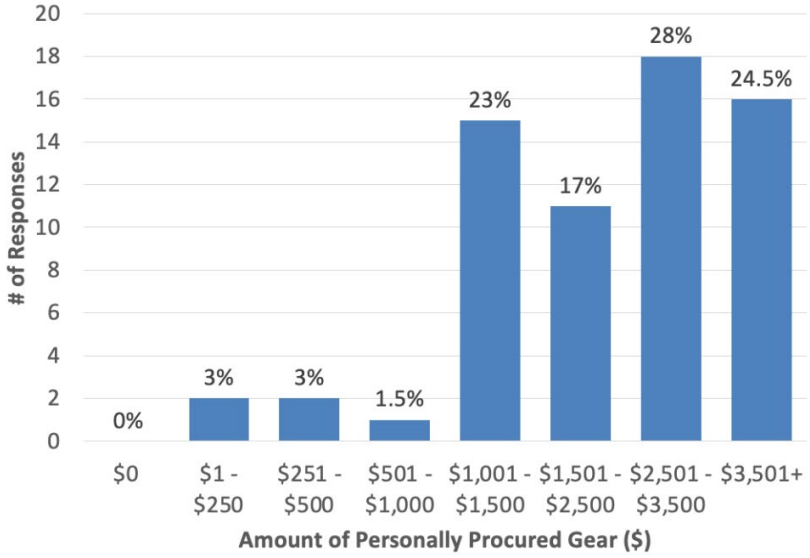
Item	NSN	Cost	# Items Issued	Total Cost	% Used	$ Value Used	$ Value Unused
MMAC 2019 BAV	8465-01-682-8272	$652.22	1	$652.22	37%	$241.32	$410.90
LCS, POUCH, M4 MAG, SINGLE, MARITIME MC, V4	8465-01-689-7775	$34.94	3	$104.82	85%	$89.10	$15.72
LCS, POUCH, M4 MAG, SINGLE DOUBLE, MARITIME, GRY, V4	8465-01-691-5545	$40.84	3	$122.52	71%	$86.99	$35.53
LCS, POUCH, UNIVERSAL PISTOL MAG, DOUBLE, ADJUSTABLE, MC	8465-01-682-6791	$30.30	1	$30.30	45%	$13.64	$16.67
LCS, POUCH, SMOKE GRENADE, SINGLE, MC	8465-01-682-6897	$37.48	2	$74.96	60%	$44.98	$29.98
LCS, POUCH, FRAG GRENADE, SINGLE, MARITIME, MC, V4	8465-01-689-7778	$38.44	2	$76.88	68%	$52.28	$24.60
LCS, POUCH, STRIP-CHARGE, SINGLE, MC, V4	8465-01-689-7783	$60.77	2	$121.54	84%	$102.09	$19.45
Pouch M60 Ammo 100 Rounds	8465-01-575-0117	$70.82	1	$70.82	90%	$63.74	$7.08
LCS, POUCH, MAG DUMP, ROLL UP, MC	8465-01-575-3390	$51.08	1	$51.08	85%	$43.42	$7.66
Beaver Tail Assault Pack	8465-01-575-3584	$300.12	1	$300.12	62%	$186.07	$114.05
			Total cost per SEAL:			**$924**	**$682**
			Total Estimated Cost for SEALs E3-O5, Beyond First Tour			**$2,187,135**	**$1,614,121**

Notes: Figures use estimate of 2,368 SEALS E3-O5 beyond their first tour for extrapolation.

Note. SPEAR BAV/LCS has a cost-efficiency of 58%, equating to approximately $1.6 million in unused gear.

The data confirmed that all SEAL respondents purchased their own gear to some degree and that over 90% of respondents spent more than $1,000 (Figure 9). The average amount of personally procured gear was $2,469, before adjusting for the time value of money (Tables 4 and 5). Leveraging statistical hypothesis testing, this sample indicates that the entire population of SEALs (E3–O5 beyond their first tour) has spent over $2,200 on personal gear, on average, within a 95% confidence interval (Table 6). Figure 10 illustrates which items SEALs most commonly purchase.

Figure 9. Estimate How Much Commercial (Non-SPEAR) Gear You Have Personally Procured, in Dollars, Over the Course of Your Career.



Note. Over 90% of SEALs spend more than $1,000 on personal gear.

Table 4. Average Amount of Personally Procured Gear by Rank and Position

Category	$ Value	# of Responses
Overall		
	$2,469	65
Rank		
E3-E6	$2,340	50
E7-E9	$3,667	6
CWO2-O5	$2,389	9
Platoon Position		
Shooter (only)	$3,000	3
Navigator / Point Man	$2,893	7
Breacher	$2,633	15
Leadership	$2,607	14
Sniper	$2,447	19
Joint Terminal Attack Controller (JTAC)	$2,286	7
Communicator	$2,094	8
Automatic Weapons Gunner	$2,000	19
Medic	$1,917	9

Note: Some respondents indicated multiple Platoon Positions

Note. SEALs, on average, spent $2,469 on personally procured gear. E7–E9s buy more gear than the other demographics by almost $1,300. Shooters (no unique qualifications), Navigators/Point Men, and Breachers spend the most on personally procured gear compared to other positions in the platoon.

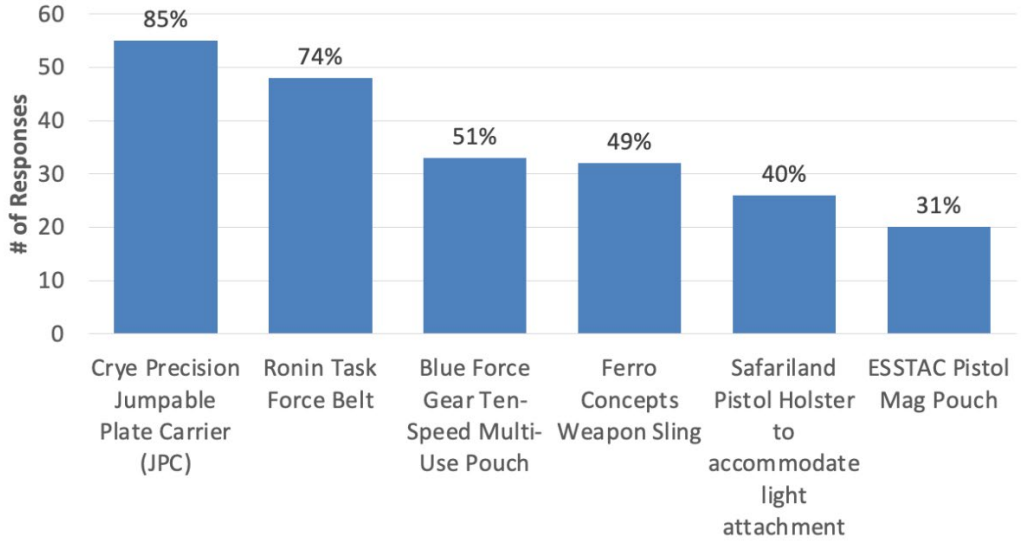
Table 5. Hypothesis Testing (Upper Tail, Sigma Unknown)

Parameter	Value
Sample Size	65
Sample Mean	$2,469
Meu_o	$2,200
Sample Standard Deviation	$1,186
Sample Standard Error	147
Alpha (represents 95% CI)	0.05
Ho (null hypothesis)	SEALs spend less than $2,200 on gear
Ha (alternative hypothesis)	SEALs spend more than $2,200 on gear
Test Statistic t	1.83
Degrees of Freedom	64
p-Value UPPER	0.0359
Critical Value UPPER	1.6690
Conclusion:	reject Ho, accept Ha

Note. The entire population of SEALs (E3–O5, beyond their first tour), on average, spends more than $2,200 on personally procured gear (defined within a 95% confidence interval).

[a] Sensitivity Analysis: Using the first quartile within the range of values of personally procured gear instead of the average value in the range yields a value of $2,000 (vice $2,200), within the same 95% confidence interval.

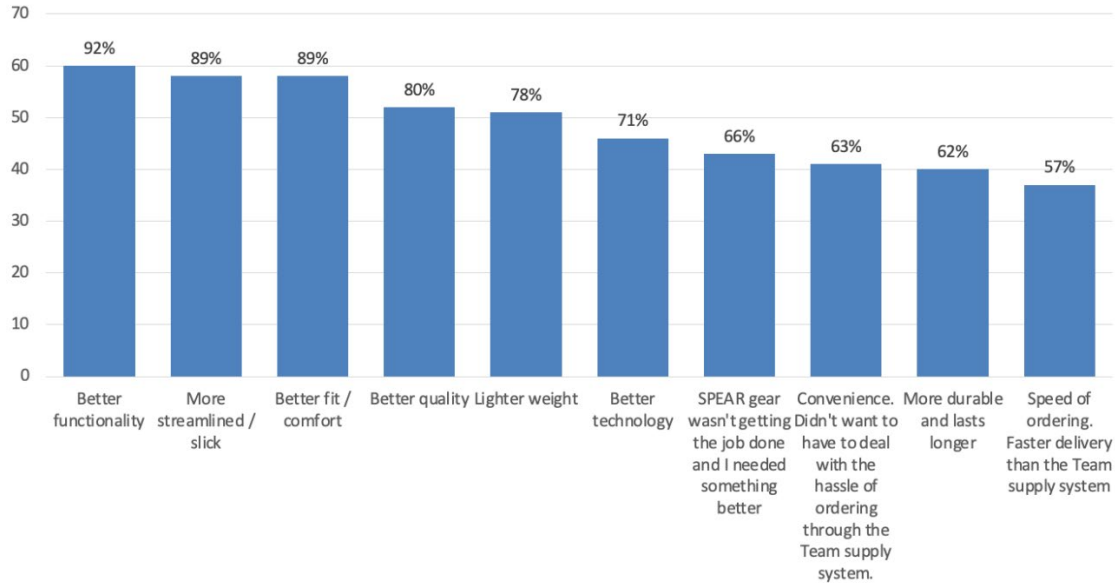
Figure 10. What Items Have You Personally Procured?



Note. The JPC and Ronin Task Force Belt are the most widely purchased BAV/LCS items.

The most common reasons respondents cited why they chose to buy their own gear were improved functionality, less bulk, and better fit and comfort than issued SPEAR gear (Figure 11). 73% of respondents stated that these reasons coincided with both operational needs and personal preferences (Figure 12). Figure 13 shows SPEAR items that SEALs felt did not meet performance expectations, though this question was open-ended and difficult to quantify.

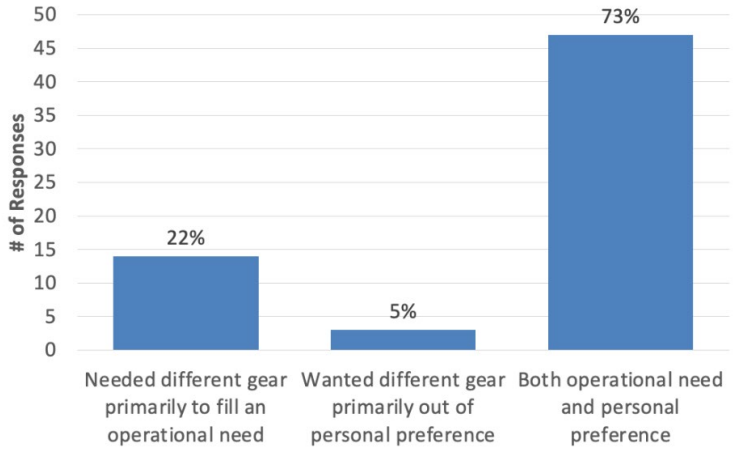
Figure 11. Please Elaborate on Why You Personally Procured Commercial Gear



Note. Values below 50% were truncated.

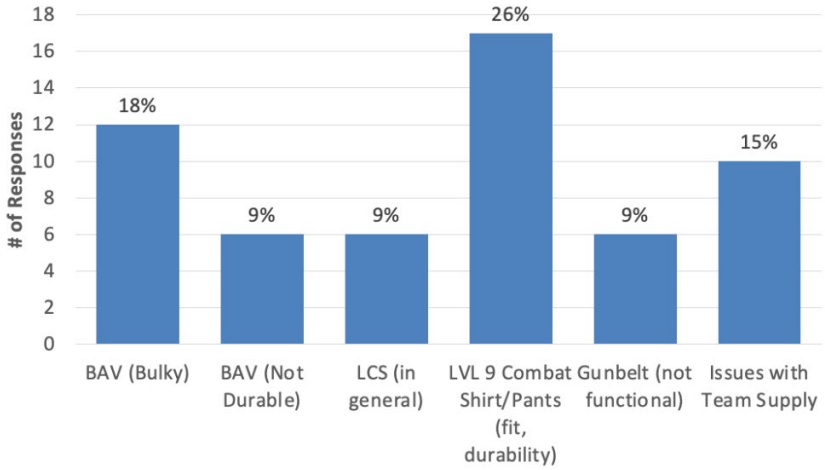
[a] 89% or more of SEALs cited these reasons why they bought their own gear: commercial gear had better functionality, was more streamlined, and had better fit/comfort.

Figure 12. Generally Speaking, Did You Buy Your Own Gear to Fill an Operational Need That SPEAR Was Lacking, or to Satisfy Personal Preference?



Note. The majority of SEALs buy their own gear to meet operational needs and personal preference.

Figure 13. Which SPEAR Items Did Not Meet Performance Expectations and Why?



Note. Lower frequency issues were truncated

[a] The most common complaint with the MMAC 2019 BAV was bulkiness.

[b] Though not within the scope of this project, 26% of SEALs expressed concerns with the LVL 9 combat shirt/pants, and 15% stated that their team supply department was an impediment to getting issued the SPEAR gear they needed.

Notable comments from anonymous respondents included

> "The newer kit is a vast improvement, but at this point I don't think I would ever use another kit because I like mine so much."

> "An operator who is uncomfortable in his gear will not be fully focused on the task in front of him. Sure, guys will suck it up, but is that what we want for the guys who are there to get us home safe? The one size/piece of gear fits all mentality does not work with the type of ask that U.S. SOF forces operate under. Our work requires complex body movement paired with split-second decision-making. An operator who, because of his equipment, does not have the dexterity or range of motion to perform, or is focused on the pain of a raw piece of skin due to rubbing, is not the operator I want next to me on the battlefield. It was so in the past and is very likely in the future, that my life depends on how proficient and focused the operator next to me is. We are expected to be the best; the support and equipment we receive should be the best, not just adequate. The new uniform and plate carrier is a huge step in the right direction."

> "The biggest miss here is that operators have been almost exclusively training with Crye equipment, for better or worse. When you throw a new style kit in, this changes everything, and since more senior members already paid for their own personal equipment, they are not able to pass lessons learned to more junior members that are the operators more likely to use the new gear."

There is a statistically significant correlation between the amount of personally procured gear, rank, and platoon position (Table 6). The E7–E9 demographic spent $3,667 on average, almost $1,300 more than the other rank group, which equates to approximately $4,500 in 2022 inflation-adjusted dollars.[3] Medics spent $1,917 on average, the lowest amount of all platoon positions (Table 7). It is also likely that these averages are lower-than-actual since 24.5% of respondents selected the upper limit option on the questionnaire of "$3,500+," leading me to believe that some individuals would have selected even higher values if the option were available (Figure 9).

[3] The average years of experience for E7–E9 respondents was 12. The Consumer Price Index was 216.7 in February 2010 and 283.7 12 years later in February 2022 at the time the questionnaire closed, a 30.9% increase (U.S. Bureau of Labor and Statistics, 2010, 2022). Therefore, if a SEAL purchased $3,667 of gear in February 2010 it would be worth $4,800 in February 2022, an increase of $1,133. It should be assumed that the real total value is closer to $4,500 since it is likely that not all gear was purchased in 2010.

Table 6. Regression Analysis in Terms of Dollars of Personally Procured Gear

	(1)	(2)	(3)
Years of Experience	-29	80	7
	(60)	(69)	(71)
Rank			
E7-E9	**1551****		**1984*****
	(678)		(736)
CWO2-O5	204		479
	(525)		(617)
Platoon Position			
Shooter (only)		-88	186
		(831)	(799)
Sniper		-309	-124
		(453)	(437)
Breacher		-15	219
		(444)	(430)
Automatic Weapons Gunner		-731	-580
		(451)	(433)
Medic		**-816***	**-847***
		(478)	(453)
Communicator		8	-3
		(538)	(509)
Joint Terminal Attack Controller (JTAC)		-145	-42
		(513)	(487)
Navigator / Point Man		512	590
		(582)	(552)
Leadership		-855	-1043
		(718)	(732)

*Notes: ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively. Independent variables are Years of Experience, Rank, and Platoon Position; "E3-E6" is the largest demographic and serves as the baseline control group for (1) and (3). Dependent variable is Dollars of Personally Procured Gear.*

Note. E7–E9s spent a statistically significant amount more than junior enlisted or SEAL officers on personally procured gear. Medics spent a statistically significant amount less than all other positions in a SEAL platoon on personally procured gear.

Table 7. Summary Statistics in Terms of Dollars of Personally Procured Gear

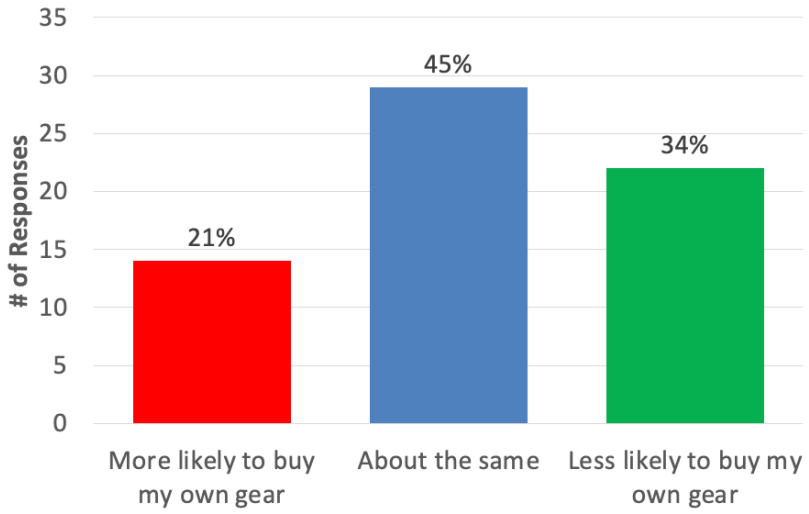
	Observations	Mean	Standard Deviation	Minimum	Maximum
Dollars of Personally Procured Gear	65	$2,469	$1,186	$125	$4,000
Years Experience	65	5.9	3.7	3.5	18.0
Rank					
E3-E6	50	$2,340	$1,115	$375	$4,000
E7-E9	6	$3,667	$516	$3,000	$4,000
CWO2-O5	9	$2,389	$1,510	$125	$4,000
Platoon Position					
Shooter (only)	3	$3,000	$1,000	$2,000	$4,000
Sniper	19	$2,447	$1,070	$1,250	$4,000
Breacher	15	$2,633	$1,004	$1,250	$4,000
Automatic Weapons Gunner	19	$2,000	$1,136	$375	$4,000
Medic	9	$1,917	$984	$1,250	$4,000
Communicator	8	$2,094	$812	$1,250	$3,000
Joint Terminal Attack Controller	7	$2,286	$1,334	$1,250	$4,000
Navigator / Point Man	7	$2,893	$999	$1,250	$4,000
Leadership	14	$2,607	$1,343	$125	$4,000

Notes: Some SEALs claimed multiple Platoon Positions

Note. Almost every category of SEAL had at least one individual who spent over $3,500 on personally procured gear (represented by $4,000 point estimate).

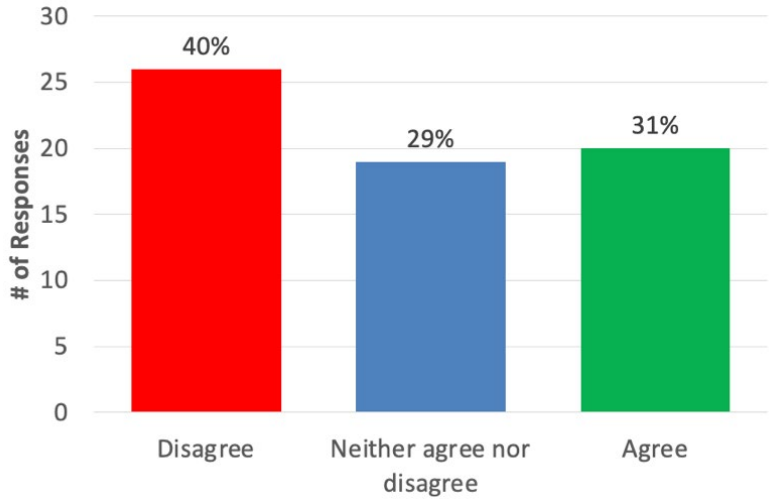
This next-generation SPEAR loadout is projected to reduce out-of-pocket expenses for a significant minority of SEALs (34%; Figure 14). Based on this and other information from the questionnaire, it appears that opinions of the SPEAR program have just recently started to shift in a positive direction for this portion of SEALs, indicating recent program improvement. However, despite these improvements, less than one-third of respondents indicated that the new BAV/LCS SPEAR loadout meets minimum operational requirements (Figure 15). This shows that SEALs believe more progress is still needed for the SPEAR program. Figure 16 indicates that the majority of SEALs believe they should have access to commercially available gear to supplement their SPEAR loadout *without* having to pay out-of-pocket for the items.

Figure 14. Does the New SPEAR Loadout You Saw Previously Make You More or Less Likely to Personally Procure Gear in the Future?



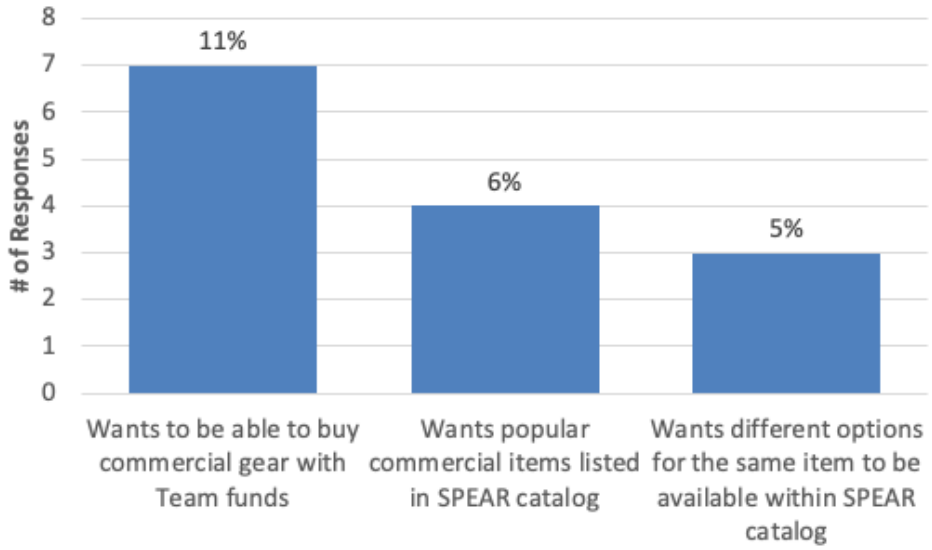
Note. A significant minority of SEALs (34%) believe that the new SPEAR loadout will reduce how much gear they buy in the future.

Figure 15. The New SPEAR Loadout Provides Me What I Need to Accomplish the Missions It Is Designed to Equip Me For (Agree or Disagree)



Note. Despite recent improvements, less than one-third of respondents indicated that the new SPEAR loadout for BAV/LCS meets minimum operational requirements.

Figure 16. Please Provide Any Additional Information Regarding Your Answers to the Previous Questions



Note. In general, SEALs want commercially available gear without having to pay out of pocket for it.

When comparing overall SPEAR satisfaction (Figure 15) to the amount of personally procured gear purchased (Figure 9) for each response, having a positive opinion of the SPEAR program did *not* equate to lower amounts of personally procured gear. Those who responded positively and negatively for the question in Figure 15 purchased roughly the same amount of gear on average ($2,600). In other words, as of the last SPEAR loadout, all respondents thought equally negatively of the SPEAR program based on the amount of gear that they bought with their own money. Now, however, after seeing the next-generation SPEAR loadout, some of those same SEALs feel differently. The only thing that has changed are the recent modernization efforts that culminated in the next-generation loadout. In my opinion, this indicates that the perception of the SPEAR program has just recently started to shift in a positive direction for many SEALs. Given this information, proving a numerical correlation between "User Adherence" and "Amount of Personally Procured Gear" will not be possible until after a series of years of successful modernization efforts and influx of new SEALs to NSW.

B. DATA LIMITATIONS

The following information should be considered when drawing conclusions from these results. First, the total population of SEALs *beyond their first tour*, E3–O5, is 71% of the total population of SEALS E3–O5. In other words, this survey targeted only 71% of SEALs in tactical-level ranks, also known as "old guys." By comparison, "new guys"—defined as SEALs who have not yet completed their first workup and deployment at a SEAL Team—comprise the other 29%. It is possible and even likely that "new guys" have higher user adherence levels than "old guys" since they are less likely to be biased against the SPEAR program; they had no choice but to use the new gear during SEAL pipeline training and give it a "fair shake." However, the data presented here give no insight into user adherence levels for first-tour SEALs.

Second, when designing the questionnaire, estimates for the average amount of personally procured gear ($2,469) turned out to be too low for a few reasons. One reason is that 24.5% of respondents chose "$3,500+" as the amount of gear they bought (Figure 9). In a normal distribution, there is a small minority of responses on either side of the "bell curve." However, the questionnaire overly restricted responses on the high end and

made identification of this curve more difficult. It would have been more appropriate to add additional categories of $3,500–$4,500, $4,500–$6,000, and $6,000+. A precise adjustment cannot be accurately determined based on the existing data, but I suggest a conservative adjustment (increase) of at least $100, or 4%. The other reason the personally procured gear average is low is because these values are not inflation-adjusted. It can be safely assumed that individuals who participated in this questionnaire did not purchase thousands of dollars of commercial equipment immediately prior to taking the questionnaire, with 2022 dollars. They most likely frontloaded much of their purchasing in the beginning of their careers, meaning that the majority of dollars they used were past-years' dollars, not 2022 dollars. If the average amount of personally procured gear were adjusted for inflation it could increase as much as $485, or 19.7%.[4] For these reasons, the estimate for the average amount of personally procured gear is likely lower than it should be by approximately 23%, meaning that the actual value is closer to $3,000. Accordingly, the $3,000 figure is the one that is used to draw further conclusions.

C. OTHER CONSIDERATIONS

In an unconstrained environment, a few obvious solutions become apparent but warrant discussion. One option is to completely abandon an acquisition strategy for SPEAR BAV and LCS components and adopt a supply-based approach. This would mean that NSW would simply buy whatever is commercially available, since that appears to be what many SEALs are already doing anyway. Yet this is problematic for at least two reasons. First, prospective SEALs in pipeline training (BUD/S and SQT) have no idea what kind of gear they need and require a basic, standardized initial issue such as SPEAR provides. Second, in a strictly supply-based approach, there is little to no ability to influence industry to meet NSW's requirements—NSW would only be able to choose from whatever industry happened to produce. NSW would not be able to drive industry to meet NSW's maritime-specific requirements like it currently does with an acquisition-based approach.

[4] The average years of experience for questionnaire respondents was six. The Consumer Price Index was 237.1 in February 2016 and 283.7 six years later in February 2022 at the time the questionnaire closed, a 19.7% increase (U.S. Bureau of Labor and Statistics, 2016, 2022). Therefore, if a SEAL purchased $2,469 of gear in February 2016 it would be worth $2,954 in February 2022, an increase of $485.

Another option is for SPEAR to select the most popularly used items and bring them under contract for the program. The most obvious example would be to get rid of the MMAC 2019 (37% user adherence) and replace it with the Crye Precision Jumpable Plate Carrier (JPC), which 85% of respondents claim to own. Unfortunately, this is not practical. According to the Naval Special Warfare Command (WARCOM) SPEAR Modernization lead, a maritime version of Crye Precision's plate carrier (JPC 2.0) was actually fielded through SPEAR between 2015 and 2019 under the name "MARBAV," and the chief complaint was lack of durability. While it minimized bulk and maximized comfort and functionality in a maritime environment, it was unable to hold up during land warfare, a particularly grueling part of training. The MMAC 2019 is "bulky" in comparison to the JPC, but that is because it is better able to transition between both maritime and land warfare environments. Additionally, popular commercial items cannot always replace SPEAR items—they do not always meet critical safety standards (e.g., ballistic protection), interoperability requirements with other required items (e.g., body armor plates properly fitting inside a BAV), or government requirements (e.g., Berry Amendment compliance). Commercial items that meet these standards are placed on an "Authorized Purchase List" that is maintained by WARCOM; however, these items are not fielded by SPEAR.

THIS PAGE INTENTIONALLY LEFT BLANK

V. CONCLUSION AND RECOMMENDATIONS

This study observed that NSW made significant changes to the next-generation SPEAR loadout for SEALs. The research problem, however, is that it is unclear if these changes would prompt higher gear utilization (user adherence) or reduce out-of-pocket expenses for SEALs.

To address this, I will revisit my original research questions. How effective is the next-generation loadout for basic BAV and LCS items in terms of user adherence? On an item-by-item basis, user adherence is mostly favorable, but the item with the lowest user adherence (BAV) is also the most expensive, resulting in an overall cost-efficiency of 58% and $1.6 million in unused gear (Tables 2 and 3).

How much gear are SEALs personally procuring on the commercial market to supplement or replace SPEAR gear, and why do they feel it is necessary to buy it? SEALs, on average, spent approximately $3,000 out-of-pocket in 2022 inflation-adjusted dollars on commercial gear to support their operations and training. The most common reasons they cited for these purchases were that commercial gear has better functionality, is more streamlined, and provides better fit and comfort than SPEAR gear (Figures 9 and 11; Tables 4, 6, and 7).

Has this new loadout changed the amount of money SEALs are spending out-of-pocket on operational gear? 34% of SEALs said that the next-generation SPEAR loadout for BAV and LCS would reduce their out-of-pocket expenses, showing that this new loadout is a significant improvement from previous generations of SPEAR loadouts (Figure 14).

Is there a correlation between the amount of gear SEALs personally procure and their rank or role in a SEAL platoon? According to statistical analysis, the answer is yes. SEALs in the ranks of E7–E9 out-spent all other rank categories by almost $1,300 prior to inflation adjustments, equating to an inflation-adjusted average of $4,500 (Tables 4, 6, and 7). When focusing on platoon position, Shooters with no unique qualifications, Point Men, and Breachers spent the most on personally procured gear. On the other end

of the spectrum, Medics spent the least out-of-pocket of all SEALs in a platoon (Tables 4, 6, and 7).

Should NSW modify its SPEAR loadout acquisition strategy to accommodate current demand for commercial items, and how could it be done to maximize effectiveness while minimizing cost? Yes, based on analysis of all questionnaire responses I believe NSW should modify its SPEAR loadout acquisition strategy.

In summary, the next-generation SPEAR loadout for BAV and LCS is a vast improvement from previous generation loadouts, yet it is not maximizing effectiveness or minimizing cost, and only a minority of SEALs believe that SPEAR gear meets minimum operational requirements (Figure 15). Whether it is truly justified or not, the overwhelming majority of SEALs pay excessive sums of their own money to obtain gear that they feel the SPEAR program should be providing them. This is a widespread problem that should not be ignored. Given these facts, NSW should consider modifying its acquisition strategy to accommodate demand for commercial items, aiming to reduce SEALs' out-of-pocket expenses.

A. RECOMMENDATIONS: A HYBRID APPROACH

An alternative acquisition approach should take into account a rapidly adapting and robust commercial market for tactical gear, an understanding that one size will never fit all, and the potential cost savings that could be achieved with a more flexible approach. However, when factoring in purchase, sustainment, and delivery considerations, it is not feasible to offer multiple options of like-items in the SPEAR system; there will inevitably be either waste (too much) or stock-outs (too little). Furthermore, if a single option is chosen, it tends to quickly fall out of favor, which then perpetuates the cycle of SEALs buying their own gear before acquisition professionals can catch up.

The optimal acquisition approach for BAV and LCS components may be a hybrid acquisitions and supply-based approach. As stated previously, an acquisition-based approach is required to be able to outfit SEAL pipeline trainees and drive industry to meet SEAL-specific maritime requirements. However, a supply-based approach has the

potential to meet the needs of many experienced SEALs who prefer more specialized equipment solutions than SPEAR can provide and reduce their out-of-pocket expenses.

1. Leveraging the Authorized Purchase List

Some changes would have to be made to ensure the effectiveness of a hybrid approach. WARCOM would have to aggressively pursue inclusion of popular commercial items on the Authorized Purchase List, which would require increased investment in testing for critical safety and interoperability standards. Commercial industry would bear these testing costs and NSW would simply have to review their test data to ensure compliance with standards. This list would be regularly updated and distributed to subordinate commands, serving as a common reference point for SEALs seeking to purchase their own gear. The most conservative approach would be to only allow non-critical safety items on the Authorized Purchase List, ensuring that all critical safety items such as ballistic plates and helmets were issued through military channels. Furthermore, unlike conventional forces, uniformity is not important to SOF, so having a variety of different items available for purchase is appropriate.

2. Shifting Funding to Support a Supply-Based Approach

Another change required by the hybrid approach is that SPEAR sustainment funding would need to shift to allow SEALs to purchase commercial gear. The dollar amount of funds available for transfer could be determined in two ways. The first would require an additional user adherence–focused questionnaire that encompasses the other eight functional areas of SPEAR. The methodology used to determine the dollar amount of unused gear in this study for BAV and LCS could be repeated to include other programs within SPEAR, which would give a reasonable starting point for an acceptable level of funds to transfer.[5] Dividing that figure by the number of SEALs with standing (2,368 estimated by this study) would yield a total amount to be transferred to individual SEALs. Just using the BAV/LCS data yields one-time individual payouts of $682 per

[5] This methodology would only be valid for SPEAR programs that are actively procuring new equipment items. As of May 2022, some SPEAR programs are only issuing legacy items to draw down existing stock—as such, these legacy items represent a sunk cost and should not be factored into future investment decisions.

SEAL. The second way to determine this number is by using the average amount of personally procured gear as adjusted previously ($3,000); however, it cannot be determined from this study alone if the value of unused SPEAR gear from all 10 functional categories can cover this cost. These funds could then be distributed to eligible SEALs as an "Advanced Equipment Allowance" in their monthly pay, akin to the Basic Allowance for Subsistence or Basic Allowance for Housing. If it were determined that eligibility for this allowance covered the first 10 years of every SEAL's career, this would equate to only a $25 per month ($300 per year) increase to pay in 2022 dollars.

3. Optional SPEAR Issue of Non-critical Safety Items

If these funds were transferred, less SPEAR gear would be available for sustainment. However, if SPEAR modernization updates were no longer mandatory for non-critical safety items like LCS and BAV and SEALs could choose to upgrade to the next-generation SPEAR gear or not, there would be less demand on the system. If a holistic SPEAR-wide user adherence questionnaire were successfully administered, the decrease in demand for SPEAR should be equal to the amount of money transferred out of SPEAR to cover the Advanced Equipment Allowance. An added benefit of this approach would be smaller inventories of SPEAR items, which should reduce the time between version upgrades, making the SPEAR program more adaptable and relevant in the long run while reducing waste.

4. An Imperfect Solution

A downside to a hybrid approach is that it is not entirely equitable—not all the right people will be getting extra funds to personally procure gear. Since the numbers used represent the average amount of personally procured gear, there will be many people who pay more for personally procured gear than they will be paid through the allowance, and there will be an equal number who profit from the allowance who do not need it. Another potential flaw is that it may invite unwanted scrutiny from higher headquarters by calling into question NSW's stewardship of funds. If the personal allowance funds are seen as a duplication of effort (i.e., buying the same thing twice, or buying something that has already been provided), it could lead to those funds being cut, leaving everyone

worse off. A final consideration is what might happen if the SPEAR program continues to improve to the point where every SEAL decides to use every item of SPEAR gear but NSW is still budgeting based on outdated user adherence values. In this situation, SPEAR would run out of funds and be unable to issue sustainment gear to every SEAL for future generations of SPEAR gear, which could create short-term operational deficiencies.

B. FUTURE RESEARCH

One recommendation for future research is to design a more comprehensive questionnaire, administered annually, to collect user adherence data for all relevant SPEAR programs. This data would help gauge program effectiveness as well as determine the most accurate cost transfers for the Advanced Equipment Allowance. It would also be useful to determine the precedence and legality of establishing such an allowance for equipment-related issues.

Another recommendation for future research is to analyze NSW's requirement generation process to determine the most effective way to capture the equipment needs of SEAL operators. In acquisitions, the end product is only as good as the input requirements. If the requirements are not accurate or detailed enough going into a project, it is unreasonable to expect the end product to be successfully fielded to the force. Too often the *real* requirements are discovered only after a given product has been fielded to the end users. To holistically improve SPEAR in NSW, more research is required in this area.

Additionally, it would be useful to confirm the practice of SOF operators purchasing commercial gear with personal funds to see if this is an NSW-peculiar issue or a SOCOM-wide trend.

Lastly, more research is needed to determine if it is responsible for NSW leaders to allow SEALs to use unvetted commercial items during operations and training, especially if they pose a safety risk.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX. SPEAR FIELDING QUESTIONNAIRE

1. What is your rank?
   - E3–E6
   - E7–E9
   - CWO2–CWO5
   - O1–O3
   - O4–O6

2. How many years have you served as a SEAL?
   - 2–5
   - 6–10
   - 11–15
   - 16+

3. What is your primary role at the SEAL Team?
   - Shooter
   - AW Gunner
   - Comms
   - Corpsman / Medic
   - JTAC
   - Navigator / Point-man
   - Sniper
   - Breacher
   - LPO
   - LCPO
   - AOIC
   - OIC
   - TRP Leadership
   - Other / Staff

4. The new SPEAR Body Armor Vest (MMAC-2019) is shown here. Have you used it?
   a. No, haven't used it
   b. Yes, used it

Source: USSOCOM (2020).

5. *(Linked from NO answer to Q4)* On a scale of 1–9, indicate your likelihood of future use of the MMAC-2019.
    1. Very unlikely to use it later
    5. Undecided
    9. Very likely to use it later

6. *(Linked from YES answer to Q4)* On a scale of 1–9, indicate your likelihood of continued use of the MMAC-2019.
    1. Very unlikely to keep using it
    5. Undecided
    9. Very likely to keep using it

7. The items below constitute the new basic loadout for SEALs, focusing on the Load Carriage System (LCS) component of SPEAR (i.e., does not include clothing, armor, etc., or position specific gear). On a scale of 1–9, indicate which items you intend to use once they are issued to you.
    1. Very unlikely to use it
    5. Undecided
    9. Very likely to use it

Source: USSOCOM (2020).

Source: USSOCOM (2020).

Source: USSOCOM (2020).

8. Please estimate how much commercial (non-SPEAR) gear have you personally procured, in dollars, over the course of your career. *(if $0, skip to Q13)*
   - $0
   - $1–$250
   - $251–$500
   - $501–$1,000
   - $1,001–$1,500
   - $1,501–$2,500
   - $2,501–$3,500
   - $3,501+

9. Generally speaking, did you buy your own gear to fill an operational need that SPEAR was lacking, or to satisfy personal preference?
   - Needed different gear primarily to fill an operational need
   - Wanted different gear primarily out of personal preference
   - Both operational need and personal preference

10. Briefly describe which SPEAR items did not meet performance expectations and explain why in terms of operational requirements, including relevant conditions and mission profile.
    a. *(FREE RESPONSE)*

11. Please elaborate on why you personally procured commercial gear. (click all that apply)
    - Better functionality
    - Lighter weight
    - More durable and lasts longer
    - Better quality
    - Better appearance in general
    - Better camouflage pattern
    - More streamlined / slick
    - Better fit / comfort
    - Better technology
    - New capability. Does something that issued gear doesn't

Convenience. Didn't want to have to deal with the hassle of ordering through the Team supply system
Speed of ordering. Faster delivery than the Team supply system
Just wanted to try something different
SPEAR gear wasn't getting the job done and I needed something better
Peer pressure from the Platoon or other Team Guys
Other *(write in)*

12. What items have you personally procured? (click all that apply, *to include like items*)
    Crye Precision Jumpable Plate Carrier (JPC)
    Ronin Task Force Belt
    ESSTAC Pistol Mag Pouch
    Blue Force Gear Ten-Speed Multi-Use Pouch
    Safariland Pistol Holster to accommodate light attachment
    Ferro Concepts Weapon Sling
    Other LCS or BAV-related items *(write in)*

13. On a scale of 1–9, answer the following: Does the new SPEAR loadout you saw previously make you *more or less likely* to personally procure gear in the future?

    1. Definitely less likely to buy my own gear
    5. About the same
    9. Definitely more likely to buy my own gear
    *Not sure

14. On a scale of 1–9, answer the following: The new SPEAR loadout provides me what I need to accomplish the missions it is designed to equip me for.
    1. Strongly disagree
    5. Neither agree nor disagree
    9. Strongly agree

15. Please provide any additional information regarding your answers to the previous questions.
    a. *Free response*

LIST OF REFERENCES

Associated Press. (2006). Army bans use of privately bought body armor. *NBC News*. https://www.nbcnews.com/id/wbna12088141

Berndt, A. E. (2020). Sampling methods. *Journal of Human Lactation*, *36*(2). https://doi.org/10.1177/0890334420906850

Christensen, R. (2018). *Analysis of variance, design, and regression: Linear modeling for unbalanced data* (2nd ed.). Chapman and Hall/CRC.

Clifton, N. L., Jr., & Copeland, D. W. (2008). *The Land Warrior Soldier System: A case study for the acquisition of soldier systems* [MBA professional report, Naval Postgraduate School]. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/38046

Coalition Information Centers. (2022, January). *The Global War on Terrorism: The first 100 days*. U.S. Department of State Archive. https://2001-2009.state.gov/s/ct/rls/wh/6947.htm

Defense Acquisition University. (n.d.). *Defense Acquisition University glossary*. Retrieved April 5, 2022, from https://www.dau.edu/glossary

Defense Acquisition University. (2019). *Defense acquisition guidebook*.

Department of Defense body armor programs: Hearing before the Committee on Armed Services, 110th Cong. (2007) (testimony of Kevin S. Noonan). https://www.govinfo.gov/content/pkg/CHRG-110hhrg37812/html/CHRG-110hhrg37812.htm

Engber, D. (2006). Can soldiers buy extra gear? *Slate*. https://slate.com/news-and-politics/2006/01/can-soldiers-buy-extra-gear.html

Fink, A. (2003). *How to sample in surveys* (2nd ed.). Sage Publications.

Fricker, R. D. (2017). Sampling methods for online surveys. In N. G. Fielding, R. M. Lee, & G. Blank (Eds.), *The SAGE handbook of online research methods* (pp. 162–183). SAGE Publications. https://doi.org/10.4135/9781473957992.n10

Garvin, K. (2006, January 7). *Some U.S. soldiers forced to buy own gear*. ABC News. https://abcnews.go.com/WNT/story?id=129227&page=1

Germain, S. (2015). *Releasable Maritime Body Armor Vests (MBAV)/Maritime Load Carriage System (MLCS)*. Natick Soldier Systems.

Golany, B., & Kress, M. (2020). *Measuring readiness and sustainment within Analysis of Alternatives in military systems acquisition*. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/66371

Heymont, I., Bryk, O., Linstone, H., & Surmeier, J. (1965). *Guide for reviewers of studies containing cost-effectiveness analysis*. Defense Technical Information Center. https://doi.org/10.21236/AD0618892

Howard, C. E. (2020). "This vest may save your life!": U.S. Army body armor from WWII to present. *Veritas Journal of U.S. Army Special Operations History*, *16*(1). https://arsof-history.org/articles/19oct_body_armor_page_1.html

Huiping, W., & Shing-On, L. (2017). Can Likert scales be treated as interval scales?: A simulation study. *Journal of Social Service Research*, *43*(4), 527–532. https://doi.org/10.1080/01488376.2017.1329775

Joint Staff. (2018, August 31). *Charter of the Joint Requirements Oversight Council (JROC) and implementation of the Joint Capabilities Integration and Development System (JCIDS)* (CJCSI 5123.01H). https://acqnotes.com/wp-content/uploads/2018/11/CJCSI-5123.01H-Charter-of-the-Joint-Requirements-Oversight-Council-JROC-and-Implementation-of-the-JCIDS-31-Aug-2018.pdf

Jonsson, P. (2008, March 6). U.S. troops buy own gear for safety, style in battle. *Christian Science Monitor*. https://www.csmonitor.com/USA/Military/2008/0306/p03s06-usmi.html

Kelvin, L. (1891). *Popular lectures and addresses* (Vol. 1). Macmillan and Company.

Laerd Dissertation. (n.d.). *Self-selection sampling*. Retrieved April 5, 2022, from https://dissertation.laerd.com/self-selection-sampling.php

Lessley, D. W. (1995). *Special operations and the Soldier System: Critical acquisition issues* [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/23773

Lindop, A. J. (1998). *Cost effectiveness in UK defence procurement: The COEIA*. United Kingdom Ministry of Defence.

Mankiw, G. N. (2012). *Principles of economics* (6th ed.). Cengage Learning.

Maskell, B. H. (1989). Performance measures for world class manufacturing. *Journal of Strategic Performance Measurement*, *71*, 32–33. https://www.bibsonomy.org/bibtex/2148c516dc28476b27f730c4bec5fc7c#export

Moore, C. (2022). *Dragon skin body armor: Why was it banned by the U.S. Army?* HowChimp.com. https://howchimp.com/dragon-skin-body-armor/

Moss, M. (2005, March 7). Many missteps tied to delay in armor for troops in Iraq. *New York Times*. https://www.nytimes.com/2005/03/07/world/middleeast/many-missteps-tied-to-delay-in-armor-for-troops-in-iraq.html

Myers, M. (2006, March 2). Lawmaker questions why some Navy SEALs buy their own gear. *Navy Times*. https://www.navytimes.com/news/your-navy/2016/03/02/lawmaker-questions-why-some-navy-seals-buy-their-own-gear/

Naval Special Warfare Group ONE Logistics Support Unit. (2021). *LOGSU-1 to NSW-West Survey Comments*.

Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design: A literature review and research agenda. *International Journal of Operations & Production Management*, *15*(4), 80–116. https://doi.org/10.1108/01443579510083622

Office of Aerospace Studies. (2014). *The measures handbook*. Air Force Materiel Command.

Office of Aerospace Studies. (2016). *Analysis of Alternatives (AoA) handbook*. Headquarters Air Force.

Olson, E. T. (2006). *Body armor/Load Carriage System Annex B to SOF personal equipment advanced requirement operational requirements document revision #4*. U.S. Special Operations Command.

Shorten, A., & Moorley, C. (2014). Selecting the sample. *BMJ Publishing Group Limited*, *17*(2), 32–33. https://ebn.bmj.com/content/ebnurs/17/2/32.full.pdf

Soldier and Marine equipment for dismounted operations: Hearing before the Subcommittee on Tactical Air and Land Forces of the Committee on Armed Services, 112th Cong. (2011) (testimony of Peter N. Fuller). https://www.govinfo.gov/content/pkg/CHRG-112hhrg65594/pdf/CHRG-112hhrg65594.pdf

Statistics LibreTexts. (2021, July 28). *The central limit theorem for sample means*. https://stats.libretexts.org/Bookshelves/Applied_Statistics/Book%3A_Business_Statistics_(OpenStax)/07%3A_The_Central_Limit_Theorem/7.01%3A_The_Central_Limit_Theorem_for_Sample_Means

Tyrer, S., & Heyman, B. (2016). Sampling in epidemiological research: Issues, hazards and pitfalls. *British Journal of Psychiatry Bulletin*, *40*(2), 57–60. https://doi.org/10.1192/pb.bp.114.050203

U.S. Bureau of Labor and Statistics. (2010, March 18). *Consumer Price Index News Release.* https://www.bls.gov/news.release/archives/cpi_03182010.pdf

U.S. Bureau of Labor and Statistics. (2016, March 16). *Consumer Price Index News Release.* https://www.bls.gov/news.release/archives/cpi_03162016.htm#

U.S. Bureau of Labor and Statistics. (2022, March 10). *Consumer Price Index News Release.* https://www.bls.gov/news.release/archives/cpi_03102022.htm#

U.S. Special Operations Command. (1996). *SOF personal equipment advanced requirements (SPEAR) operational requirements document*.

U.S. Special Operations Command. (2010). *SPEAR overarching business rules and processes*.

U.S. Special Operations Command. (2020). *SPEAR equipment catalog*.

Acquisition Research Program
Naval Postgraduate School
555 Dyer Road, Ingersoll Hall
Monterey, CA 93943

www.acquisitionresearch.net