

SUSTAINMENT IN THE ARMY 2020: USING THE ARMY'S SUSTAINMENT
PRINCIPLES TO IDENTIFY AND MITIGATE
RISKS ASSOCIATED WITH ORGANIZATIONAL CHANGE

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

SUSTAINMENT IN THE ARMY 2020: USING THE ARMY'S SUSTAINMENT PRINCIPLES TO IDENTIFY AND MITIGATE RISKS ASSOCIATED WITH ORGANIZATIONAL CHANGE, by MAJ Paul W. Smith, 155 pages.

The United States Army is going through a force structure change because of a decreased operational tempo and fiscal constraints emplaced by the Budget Control Act of 2011. This change is referred to as the Army 2020 and in this new structure; the sustainment capabilities within the ABCT are being reduced. The capabilities to conduct water purification, bulk fuel delivery, and provide transportation are being moved from the Brigade Support Battalions to the Combat Service Support Battalions located within the Sustainment Brigades. This reallocation of assets created an increased reliance on units operating outside the command and control of the division. The primary purpose of this study was to identify the risks associated with these organizational changes and provide DOTMLPF recommendations to reduce risk and enhance capabilities of the sustainment force. The research identified qualitative differences between the Army's current modular force and the Army 2020 construct using the Army's sustainment principles as evaluation criteria. To validate the qualitative findings, the researcher conducted a quantitative analysis of the reduction of fuel assets within the BSB. To further validate the outcome of this model the researcher created an experiment using the operational parameters established in 3rd Infantry Division's operations in Operation Iraqi Freedom I to establish the control variables, the change in fuel capabilities as the independent variable, and the effect on operational endurance as the dependent variable. This provides a definitive example of the impacts of the Army 2020 changes in sustainment force structure. The results from this study show assigning the sustainment brigades and CSSBs to the division negates several of the negative impacts of the Army 2020 changes. It also proposes changes at the BSB staff level to increase efficiency in operations.

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ACRONYMS

ABCT	Armored Brigade Combat Team
AoE	Army of Excellence
BCT	Brigade Combat Team
BSA	Brigade Support Area
BSB	Brigade Support Battalion
CASCOM	Combined Arms Support Command
CSSB	Combat Service Support Battalion
DISCOM	Division Support Command
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities
EAB	Echelons Above Brigade
FSB	Forward Support Battalion
FSC	Forward Support Company
MSB	Main Support Battalion
QLET	Quick Logistics Estimation Tool
SPO	Support Operations Officer
TRADOC	Training and Doctrine Command
TSC	Theater Sustainment Command

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CHAPTER 1

INTRODUCTION

Background

Logistics comprises the means and arrangements which work out the plans of strategy and tactics. Strategy decides where to act; logistics brings the troops to this point.¹

— Jomini

In the Army of Excellence (1984 to 2005), the division was the lowest level organization to truly incorporate combined arms maneuver. A heavy division included an engineer brigade in addition to an aviation brigade. Every echelon from Army group to maneuver battalion had its own sustainment organization.² The Army of Excellence was intended to fight a numerically superior opponent, which led logisticians to plan for high consumption rates and the need to prepare large stockpiles of supplies within the division's area of operation.

With the fall of the Berlin Wall in 1989 and the subsequent collapse of the Soviet Union, the United States military sought to redesign itself to be better suited to a post Cold War world. In 2008, the Army established the brigade combat team as the primary basic unit of force for tactical combat under "Modularization." Modular units provided the brigade commander with the maximum amount of combined firepower across warfighting functions thereby ensuring a lethal and agile force below the division level.

¹ Naval Supply Systems Command (NAVSUP), "Logistics Quotations," accessed May 18, 2015, http://www.au.af.mil/au/awc/awcgate/navy/log_quotes_navsup.pdf.

² Department of the Army, Field Manual Interim (FMI) 3-0.1, *The Modular Force* (Washington, DC: Government Printing Office, 2008), 1-2.

The modular brigade combat team (BCT) represented a shift in design for sustainment forces as well. The BCT had to become more agile, rapidly deployable and expeditionary; the concept of sustainment had to adapt to properly support this new force. Part of that adaptation was a force structure change that included the elimination of the corps and division support commands and resulted in the creation of the sustainment brigades, the brigade support battalion (BSB), and the forward support companies (FSC).³

The BSB is the only sustainment organization with a command relationship with maneuver units within the modular division, and reports to the BCT commander for guidance and integration into operations planning. The BSB plans, coordinates, synchronizes, and executes replenishment operations in support of brigade operations. It distributes supply classes I, II, III, IV, V, VII, VIII and IX (see figure 1 for an explanation of each class of supply); provides food service; medical care, as well as field maintenance and recovery. It maintains visibility of the distribution network within their area of operations, synchronizing the flow of throughput into the brigade's operational area.⁴ The BSB, under Modularization, had the assets, manpower, and facilities necessary to provide two combat loads worth of support (one combat load at the FSC, and one within the BSB, a third combat load was carried on the Soldier or individual weapon system) thereby extending the operational reach of the BCT.

³ Ibid., 29.

⁴ Department of the Army, Army Techniques Publication (ATP) 4-90, *Brigade Support Battalion* (Washington, DC: Government Printing Office, 2014), 1-3.



CLASSES AND SUBCLASSES OF SUPPLY			
Symbol	Classes	Description	Subclasses
	CLASS I	Rations	A - Nonperishable C - Combat Rations R - Refrigerated S - Non-Refrigerated W - Water
	CLASS II	Individual Equipment & General Supplies	A - Air B - Ground Support Material E - General Supplies F - Clothing G - Electronics M - Personal Weapons T - Industrial Supplies
	CLASS III	Fuel, POL	A - POL for Aircraft P - Package POL W - POL for Surface Vehicles
	CLASS IV	Engineer & Barrier Material	A - Construction B - Barrier
	CLASS V	Ammunition	A - Air Delivery W - Surface Weapons
	CLASS VI	Sundry, Personal Demand	A - Personal Demand M - Mail, Personal & Official P - Ration Supplementary Sundry Pack
	CLASS VII	Major End Items	A - Air / Aviation B - Ground Support Material D - Administrative Vehicles J - Tanks, Packs, Adaptors, & Pylons (USAF) L - Missiles M - Weapons N - Special Weapons T - Industrial Material X - Aircraft Engines
	CLASS VIII	Medical Supplies	A - Medical Material, including medical peculiar repair parts B - Blood/ Blood Products
	CLASS IX	Repair Parts	A - Air B - Ground Support Material D - Administrative Vehicles G - Electronics L - Missiles M - Weapons N - Special Weapons T - Industrial Material
	CLASS X	Material for Nonmilitary Programs	K - Tactical Vehicles
LEGEND: POL = Petroleum, Oil, and Lubricants // USAF = United States Air Force			

Figure 1. Classes and Subclasses of Supply

This figure provides a description of all classes of supply within the Army supply system. The BSB is responsible for providing all classes of supply, except CL VI in support of operations. The chart indicates how integral the BSB is to the warfighter.

Source: Department of the Army, Field Manual (FM) 4-95, *Logistics Operations* (Washington, DC: Government Printing Office, 2014), 1-7.

The Army is modifying its force structure again following the completion of operations in Iraq, and the presumed completion of combat operations in Afghanistan. However, operational tempo is not the sole driver behind the reorganization of forces. The Army is also responding to fiscal constraints imposed by Congress in the Budget Control Act of 2011 as mandatory cuts in defense spending force leaders to prioritize funding for force structure, training, future acquisitions, and much more.

In response to the Budget Control Act, the Army determined to reduce its structure from a wartime high of 570,000 soldiers in the active component to no more than 490,000, with possible reductions to 420,000 if current discretionary cap reductions remain in place.⁵ This represents a total Army end-strength reduction of 26 percent in the active Army. It also causes a 45 percent reduction in active Army brigade combat teams.⁶ The need to reduce the number of overall brigades on active duty while maintaining the lethality of the Army led to the inactivation of several brigades and the restructuring of the remaining brigade combat teams.

This Army's latest restructuring effort is referred to as the Army 2020, and in addition to the reduction in the overall number of BCT headquarters the Army sought to maximize the tactical capability of the remaining brigades. To do this, each of the surviving brigade combat teams received a third maneuver battalion. These changes to the BCT structure, along with the transition of the brigade special troops battalion (BSTB) to a brigade engineer battalion (BEB) and FSCs in the stryker brigade combat team (SBCT), caused significant growth in the number of personnel and equipment in the BCTs.

In order to maintain the active component force at 490,000 personnel, with the ability to reduce further if needed, the Army identified sustainment capabilities that could be moved out of the BCT: water purification, bulk fuel distribution, bulk fuel storage, and

⁵ *Hearing before the House Armed Services Committee on Planning for Sequestration in Fiscal Year 2014*, 113th Cong., 1st sess., September 18, 2013, 3.

⁶ *Ibid.*

troop movement capability in the infantry brigade combat team (IBCT).⁷ These capabilities have been consolidated at echelon above brigade (EAB) within the combat sustainment support battalion (CSSB), moved to the Army Reserve or National Guard, or eliminated. The consolidation of these capabilities and corresponding personnel is part of the effort to reduce the end strength of the Army.

Problem Statement

As the Army shifts from the Modular force to the Army 2020 force structure, it reduced the sustainment capability within the ABCT and increased the reliance on EAB support units to mitigate the risks associated with these actions. At the fundamental level, these changes appear to contradict several of the principles of sustainment. By not using doctrinal command and support relationships between the EAB sustainment units and the division, the Army has created possible friction points in establishing priorities of support during combat operations by increasing the dependency on sustainment organizations that exist outside the direct command of both the BCT and division commander. These EAB organizations are tasked to sustain multiple units simultaneously, which creates competing demands for already limited assets potentially culminating offensive action if sustainment priorities are not properly nested within the concept of operations. The purpose of this study is to determine risks associated with this organizational change and to suggest mitigation strategies.

⁷ Robert Hatcher, Jeffrey A. Martin, and Karl F. Davie Burgdorf, "Sustainment for the Army of 2020," *Army Sustainment* (May-June 2014), accessed November 14, 2014, http://www.army.mil/article/125006/Sustainment_for_the_Army_of_2020.

Significance of the Study

Under the Army 2020 design, significant sustainment assets have been removed from the BCT and assigned to the CSSB and are no longer under the command of the brigade commander. Unless the effects of this force structure change are fully realized by sustainment and operations planners, proper coordination for support assets from echelons above the brigade may not occur. Historically, the lack of proper sustainment has had a negative impact on military operations. This research provides a qualitative and quantitative examination of current and future BCT sustainment capabilities to identify the risks associated with organizational changes and provide DOTMLPF recommendations to reduce risk and enhance capabilities of the sustainment force.

Primary Research Question

How should the Army mitigate risk that may be created through increased reliance on EAB sustainment during ABCT operations in the Army 2020 force structure?

Secondary Research Questions

1. What are the fundamental principles of sustainment upon which the Army bases its sustainment doctrine?
2. How has the Army conducted brigade level sustainment historically?
3. What effects have the changes in sustainment force structure had across the principles of sustainment?
4. What sustainment risks has the Army 2020 force structure change created for ABCT operations?

Assumptions

The Modular Army reduced the strain of multiple deployments on U.S. forces during the Global War on Terror. Limitations imposed by sequestration and a reduction of forces deployed to Iraq, Afghanistan, and Europe have required senior military leaders to adapt the Army's force structure once again. It appears that the Army will modify its current structure, as demands for deploying troops decrease, to focus on a near peer threat as it did following Vietnam.⁸ The focus of this research is to determine the impacts of sustainment force structure changes in a war with a near peer threat and to suggest mitigating strategies that address the risks associated with these changes. A final assumption is that any proposed solutions must be applied within the constraints established by the Budget Control Act of 2011 and any additional limitations imposed by the Army's senior leaders.

Limitations

The principle limitations of this study are time and the fluidity of the Army 2020 construct. The study was conducted over an eight-month period by a sole researcher. During the research period, the Army continued to address Army 2020 shortfalls, and future revisions to the concept of support may limit the applicability of changes proposed in this study.

⁸ Richard J. Dunn III, "The Impact of a Declining Defense Budget on Combat Readiness," The Heritage Foundation, 2013, accessed February 7, 2015, http://www.heritage.org/research/reports/2013/07/the-impact-of-a-declining-defense-budget-on-combat-readiness#_ftn6.

Delimitations

The research in this paper is limited to military operations conducted in the period from 1985 to 2015, to include the period in which the Army of Excellence, the Modular Army, and the Army 2020 organizational concepts were used. By limiting the timeline to this specific era, the research focuses on relevant current and future applications of logistics capabilities. The primary focus of the research is sustainment operations at the brigade level. This includes command and support relationships within the brigade and with elements above the brigade level. This focus narrows the scope of research to identify changes in sustainment capabilities and relationships created by recent force structure changes. The quantitative data for this study focuses on fuel assets within the Brigade Support Battalion in the Modular Army and the Army 2020. Fuel was chosen due to its importance in offensive operations and it is a capability that is easily translated to military and civilian applications. Bulk fuel is one of the most critical commodities required to sustain the BCT's operational tempo and is worthy of additional research.⁹

Conclusion

The Army has undergone several force structure changes in the past 30 years and is in the middle of transitioning from the Modular Army to the Army 2020. As part of these revisions, the Army's sustainment force structure will change the sustainment assets available to a brigade commander by removing capabilities from the BSB and assigning them to the CSSB. This research provides a qualitative and quantitative examination of current and future BCT sustainment capabilities to identify the risks associated with these

⁹ Department of the Army, Field Manual (FM) 4-90, *Brigade Support Battalion* (Washington, DC: Government Printing Office, 2010), 1-2.

organizational changes. The researcher addresses the risk identified and provides DOTMLPF recommendations to reduce them and enhance the capabilities of the sustainment force.

The Literature Review provides current information regarding sustainment theory as well as a synopsis of the Army of Excellence, the Modular Army, and the Army 2020. A summary of command relationships and operations in Operation Iraqi Freedom (OIF) I is also included. This data provides the reader with a basic understanding of the Army's current transition as well as a historical analysis of previous force structures. This information is necessary to understand this study's research methods.

CHAPTER 2

LITERATURE REVIEW

A sound logistics plan is the foundation upon which a war operation should be based. If the necessary minimum of logistics support cannot be given to the combatant forces involved, the operation may fail, or at best be only partially successful.¹⁰

— Admiral Raymond A. Spruance

Introduction

The purpose of this study is to recommend changes that the Army should implement to mitigate the sustainment risks created by force structure changes for Army 2020. To do this requires a familiarity with the topic of sustainment and the business practices that influenced its implementation in the military. This chapter presents theory regarding commonly accepted distribution management principles, how the Army includes them in its sustainment principles, and how sustainment is linked to a military commander's freedom of action during operations. The chapter reviews the development of the Army of Excellence, the Modular Army, and the Army 2020. It also addresses the sustainment forces and procedures available in each force structure, providing specific information regarding bulk fuel operations. This paper presents information regarding Operation Iraqi Freedom and the sustainment in support of operations leading to the fall of the Iraqi regime. Finally, Army command and support relationships are presented to provide the reader an understanding of the differences in each and how they are applied

¹⁰ Naval Supply Systems Command (NAVSUP), "Logistics Quotations."

to sustainment operations. This information builds the knowledge base necessary to apply the researcher's methods discussed in chapter 3.

Problem Statement

As the Army shifts from the Modular force to the Army 2020 force structure, it reduced the sustainment capability within the ABCT and increased the reliance on EAB support units to mitigate the risks associated with these actions. At the fundamental level, these changes appear to contradict several of the principles of sustainment. By not using doctrinal command and support relationships between the EAB sustainment units and the division, the Army has created possible friction points in establishing priorities of support during combat operations by increasing the dependency on sustainment organizations that exist outside the direct command of both the BCT and division commander. These EAB organizations are tasked to sustain multiple units simultaneously, which creates competing demands for already limited assets potentially culminating offensive action if sustainment priorities are not properly nested within the concept of operations. The purpose of this study is to determine risks associated with this organizational change and to suggest mitigation strategies.

Commonly Accepted Logistics Principles

To understand the foundations of sustainment, it is important to understand models established for the business world and not just those used by the military. Historically, the term logistics as we know it today, originated as a military term in the

works of French General Antoine-Henri Jomini.¹¹ In Jomini's writings in the 1860s, it appears that he is the first to propose that logistics be a separate field of study in order to improve the military's ability to sustain its armies. In the years since, logistics has grown into a science recognized by the civilian sector as crucial to operating an effective business.

One of the leading civilian logistics organizations, SOLE (the International Society of Logistics), defines logistics as a professional discipline that supports a product throughout its life. From design engineering to manufacturing and materials, packaging and marketing, and distribution and disposition, logistics involves every possible phase of the product support process.¹² Peter Drucker, a renowned management consultant, argued that logistics is essentially a last frontier along the road to overall efficiency of the business organization.¹³ The concept of efficiency is the driving force behind the current principles of logistics.

The drive for efficiency brought about better management of companies' physical distribution networks. Competition in retail in both pricing and product lines resulted in higher demands for efficiency in the distribution process in terms of lower costs and increased convenience.¹⁴ The need to integrate systems to achieve these goals spread

¹¹ Peter Klaus and Stefanie Müller, eds., *The Roots of Logistics* (Berlin: Springer, 2012), 6.

¹² SOLE: The International Society of Logistics, "Your Window into Logistics," accessed January 29, 2015, <http://www.sole.org/info.asp>.

¹³ Peter F. Drucker, "The Economy's Dark Continent," *Fortune*, April 1, 1962, 103.

¹⁴ Martin Christopher and Gordon Wills, *Marketing Logistics and Distribution Planning* (London: Halsted Press, 1972), 335.

throughout all aspects of logistics leading to a systematic approach to distribution management. These systems existed to facilitate the coordination of movement, inventory, information processing, and related areas of supply.¹⁵ As this approach grew in popularity, five overarching logistics principles were proposed by Roy Voorhees and Merrill Sharp in the late 1970s to address the need for maintaining profitability in ever-competitive markets.¹⁶

The first principle is that high levels of customer service require high levels of inventory.¹⁷ This principle has two themes that must be addressed before progressing on to the second. First, in order to meet demand quickly, sufficient stocks must be kept at high levels or managers risk having items on back order when demand is high. Conversely, managers must understand that with large stocks come higher inventory costs. Therefore, it is important that business leaders identify acceptable levels of risk with customer satisfaction to properly maintain inventory.

The second principle is that increased inventory locations require increased inventories and costs to maintain customer service levels.¹⁸ This ties directly to the previous principle stating that if businesses increase their stock levels to maintain high levels of customer service then storage costs increase as well. However, if a business lowers its customer service level, for example, it increases the amount of time for a

¹⁵ Ibid., 338.

¹⁶ Roy Dale Voorhees and Merrill Kim Sharp, “The Principles of Logistics Revisited,” *Transportation Journal* 18, no. 1 (Fall 1978): 69-84, accessed February 5, 2015, <http://connection.ebscohost.com/c/articles/8503271/principles-logistics-revisited>.

¹⁷ Ibid., 71.

¹⁸ Ibid., 75.

product to reach stores, this creates the option to reduce inventory locations and save costs on additional facilities.

The third logistics principle is that the shorter the order cycle the less stocks required.¹⁹ There are three components to this principle; time required to transmit and order from the customer to the firm, time for the firm to process the order, and the time it takes for the firm to deliver the item to the customer. A short order cycle reduces the need for mass inventory and thereby reduces inventory costs. In the 1970s, companies tightened oversight on their distribution networks to ensure their products arrived at the right time. One of the implications of this principle was what became known, in the army, as “just in time logistics.” The Army moved towards distribution-based logistics following Desert Storm and reduced their dependence on large stockpiles of goods as the ability to track items throughout the supply chain improved.²⁰

The fourth logistics principle is that standardized products reduce logistics costs.²¹ Inventory requirements increase as the number of brands in a product line grows over time, this carries both monetary and resource costs. Ignoring this principle negatively affected the German Army in 1941 during Operation Barbarossa as they

¹⁹ Ibid., 77.

²⁰ Laurel K. Myers, “Eliminating the Iron Mountain,” *Army Logistician* 36, no. 4 (July-August 2004), accessed March 16, 2015, http://www.alu.army.mil/alog/issUEs/JulAug04/C_iron.html.

²¹ Voorhees and Sharp, 82.

invaded Russia using over 2,000 different vehicle types.²² The need to maintain those vehicles as well as conduct normal resupply overwhelmed their logistics system.

The final principle of logistics is that discrete logistics management effort is necessary.²³ Logistics managers are responsible for integrating these principles using the elements listed in figure 2 to inform top management how to maximize their distribution network in order to reduce costs or increase customer service levels. These logisticians are analytical specialists that present logistics solutions while still incorporating the company's mission to support its customer base. The Army has long recognized the need for logistics managers, in fact, the Quartermaster Corps that is primarily responsible for supporting the Army, was created on the 16th of June, 1775 just two days after the Continental Congress authorized the creation of the Army.²⁴

²² Robert J. Kershaw, *War Without Garlands Operation Barbarossa 1941/42* (Shepperton, Surrey: Ian Allan Publishing, 2000), 165.

²³ Voorhees and Sharp, 83.

²⁴ Quartermaster Corps, "Quartermaster History," Quartermaster Corps Official Website, last modified August 12, 2013, accessed March 16, 2015, http://www.quartermaster.army.mil/qm_history.html.

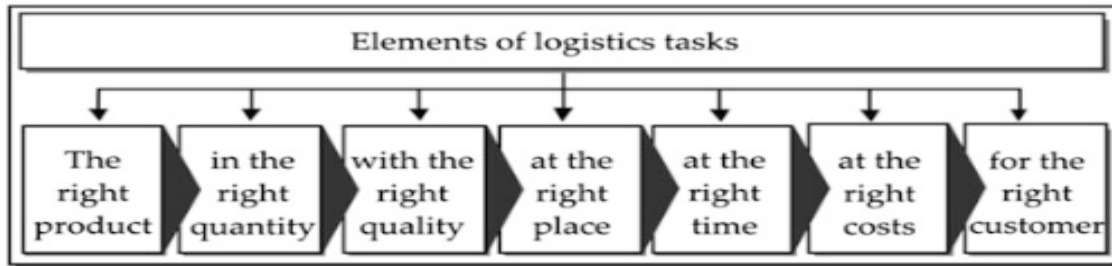


Figure 2. The Elements of Logistics Tasks

This figure shows key concepts in ensuring customer satisfaction while limiting costs, the Army integrated these concepts into its sustainment processes.

Source: Harald Gleissner and Christian Femerling, *Logistics: Basics - Exercises - Case Studies* (Switzerland: Springer International Publishing, 2013), 5.

The performance of logistics systems can be measured in many ways including total cost, reliability, productivity, innovation, organizational harmony, and planning effectiveness.²⁵ Logisticians use these measures in their never-ending search for efficiencies to increase the revenue of their businesses. To continue building knowledge of sustainment, the research sought to identify how these commonly accepted business principles applied within the Army. To do this, it was necessary to identify how the Army views sustainment as part of their warfighting mission and determine the principles used in executing sustainment operations.

Army Sustainment

The Army has grouped its capabilities into six warfighting functions, each function formed by personnel, tasks, and systems that share a common purpose. The functions are mission command, movement and maneuver, fires, protection, intelligence,

²⁵ John J. Coyle and Edward J. Bardi, *The Management of Business Logistics*, 3rd ed. (St. Paul, MN: West Publishing Company, 1984), 427.

and sustainment.²⁶ The sustainment warfighting function is comprised of all tasks and systems that support a commander's freedom of action, operational reach, and endurance during operations.²⁷

This sustainment warfighting function encompasses the totality of the U.S. Armed Forces' sustainment concept and is vital in understanding the differences between logistics in business and in the military. In business, an efficient supply system leads to increased revenue and profits, while an inefficient system may lead to bankruptcy. In the military, effectiveness and efficiency battle for supremacy as efficiency can reduce budget and force structure while effectiveness grants commanders the ability to execute maneuvers in accordance with their operational art.

The sustainment warfighting function provides sufficient support to extend operational reach and prolong endurance.²⁸ In fact, a unit's endurance in operations is inextricably linked to its ability to continuously receive sustainment. A commander's freedom of action is affected by enemy actions but his capability to conduct sustained operations is determined by his ability to logistically support those attacks over time.

The Army defines sustainment as the provision of logistics, personnel services, and health service support necessary to maintain operations until successful mission

²⁶ Department of the Army, Army Doctrinal Reference Publication (ADRP) 3-0, *Unified Land Operations* (Washington, DC: Government Printing Office, 2012), 3-2.

²⁷ Ibid., 3-4.

²⁸ Department of the Army, Army Doctrinal Publication (ADP) 3-0, *Unified Land Operations* (Washington, DC: Government Printing Office, 2012), 14.

completion.²⁹ Before progressing further, it is imperative to understand the principles on which the Army sustains itself. The Army identified eight sustainment principles that are essential in ensuring combat power, enabling operational reach, providing enduring to the warfighter, and link to the universal sustainment principles. The principles are integration, anticipation, responsiveness, simplicity, economy, survivability, continuity, and improvisation. Each principle is independent, however, they are also interrelated.³⁰

Integration is defined as the combining of all the elements of sustainment into the operations process, and in the process ensuring a unity of effort.³¹ This ties back to the business principle of discrete logistics management. By having sustainment planners involved in the operations process, logisticians ensure they have the right products at the right place at the right time. To do this, sustainment has to be integrated into operational plans from the very beginning. Integrating sustainment with joint and multinational partners enables planners to limit redundancies thereby reducing the logistics footprint in an area of operations, enabling operational reach by reducing infrastructure in rear echelons.³²

Sustainers must anticipate the requirements associated with operations and plan accordingly to provide support. Anticipation helps identify equipment needed to support an operation, shortens the order cycle, and reduces the overall stocks required in theater.

²⁹ Department of the Army, Army Doctrinal Publication (ADP) 4-0, *Sustainment* (Washington, DC: Government Printing Office, 2012), 1.

³⁰ Department of the Army, Army Doctrinal Reference Publication (ADRP) 4-0, *Sustainment* (Washington, DC: Government Printing Office, 2012), 1-2.

³¹ Department of the Army, ADP 4-0, *Sustainment*, 3.

³² Department of the Army, ADRP 4-0, *Sustainment*, 1-2.

This helps provide the right product in the right quantity to the right customer.

Logisticians do this using personal experiences, educated staffs, and estimation tools.³³

There is a common saying in the sustainment world that, “logistics is a math problem,” and by being integrated in the planning process, logisticians are able to infer the inputs required to begin formulating requirements.

Support has to be responsive enough to meet the commander’s needs in ever changing conditions on the battlefield. Using integration and anticipation, logisticians attempt to ensure that the right supplies are available at the right time for any mission their supported unit is undertaking.³⁴ When successful, responsive sustainment allows commanders the freedom of maneuver needed to accomplish the mission.

Responsiveness is key in maintaining high levels of customer service. The Army does this by having multiple levels of sustainment organizations creating increased inventory locations and shortening the order cycle while maintaining accurate in transit visibility of goods throughout the supply chain.

Sustainment planners minimize the complexity of their operations by keeping their processes and procedures simple. Clearly identified tasks, standardized procedures, and defined command and support relationships all contribute to simplicity. Simplicity enables economy and efficiency in the use of resources, while ensuring effective support of forces.³⁵ In addition to the orders process, the Army achieves simplicity by using standardized products across its inventory. This standardization links to the fourth

³³ Ibid., 1-3.

³⁴ Ibid.

³⁵ Ibid.

business principle and reduces overall costs while ensuring the right products are available at the right place.

Economy is providing sustainment resources in an efficient manner that enables the commander to employ all assets to the greatest effect possible.³⁶ To ensure economy without negatively affecting capabilities requires logistics management. Sustainment planners ensure that sufficient forces are available to provide the necessary balance between capabilities and the anticipated requirements. Planners consider host nation assets as well as contracting solutions to fill some requirements.³⁷ As planners design operations, they need to balance forces across multiple theaters or mission sets and eliminate redundancies. Proper use of economy ensures services are received at an acceptable level of risk while maintaining minimal insurance stockages.

Sustainment planners must consider the survivability of logistics assets in the area of operations. The survivability principle is focused on the protection of assets includes everything from convoy security arrangements to properly dispersing high value assets within the logistics support areas in theater. Survivability affects the selection of sustainment sites, additional forces being allocated for security, and must be considered when planning force packages. There is often friction between the survivability and economy principles as planners request more capability than requirements dictate to mitigate the risk of losing sustainment assets to hostile actions.³⁸ This same friction exists with survivability and the commonly accepted business principles' drive for efficiency.

³⁶ Department of the Army, ADRP 4-0, *Sustainment*, 1-3.

³⁷ Ibid.

³⁸ Ibid.

Survivability does, however, enable Army sustainers to provide high levels of customer service by establishing multiple sites and maintaining sufficient stocks to support the war effort thereby satisfying both the first and second universal principles.

Continuity is the uninterrupted flow of sustainment across the theater.³⁹ The principle of continuity is directly linked to several of the universal sustainment principles. To ensure continuity, sustainers must maintain sufficient stocks, establish multiple distribution locations, maintain visibility of commodities in the supply chain, and provide logistics solutions to the commander. Sustainment planners provide continuity by working at all levels of warfare to ensure that the U.S. industrial base as well as joint and multinational partners provide the acceptable level of capabilities to the combatant commander. When sustainers provide continuity capable of distributing supplies from the strategic to the tactical level, it allows commanders the operational reach needed to accomplish their objectives.

Improvisation is the ability to adapt sustainment operations due to a change in mission or unexpected action is vital any sustainment planner or leader. Logisticians must be capable of linking operational art to tactical execution in order to respond to the situation at hand.⁴⁰ Improvisation is often needed to find or create resources to meet an unplanned requirement. The ability of sustainers and their distribution networks to improvise in the face of changing environments allows them to deliver the right product, in the right quantity, with the right quality, at the right place, at the right time, and at the right costs for the right customer.

³⁹ Ibid.

⁴⁰ Ibid.

Much like corporations, Army logisticians strive for efficiency in their operations. In interwar periods, the United States seeks to trim logistics functions and personnel in pursuit of efficiency, sometimes at the expense of the effectiveness of the supply chain.⁴¹ At times, the need for effectiveness contradicts business principles that seek efficiency. This is due to the different nature of Army sustainment versus corporate logistics. In *Velocity Management in Logistics and Distribution: Lessons from the Military to Secure the Speed of Business* Joseph L. Walden states, “that methods that prove efficient in peacetime will not necessarily succeed under the far more demanding conditions of war. For example, the ability of a parcel service to deliver a package anywhere in the world in a matter of hours is based on the assumption that no one is shooting at the aircraft carrying the package.”⁴² Corporations may have to consider delivering their wares through a war zone, but that is the exception and not the norm. Army logisticians must ensure to balance efficiency and effectiveness and always keep in mind that the systems built in peacetime must be sufficient to meet the commander’s demands during battle.

The Army’s sustainment principles are the foundation for logistics force structure, planning, and execution. The principles of sustainment were revised in 2012 and included changes to what had been known as combat service support characteristics, these changes reflect the revisions to the concept of sustainment in updated doctrine.⁴³ The term

⁴¹ Joseph L. Walden, *Velocity Management in Logistics and Distribution: Lessons from the Military to Secure the Speed of Business* (Boca Raton, FL: Taylor and Francis, 2006), 256.

⁴² Ibid.

⁴³ Department of the Army, Field Manual (FM) 4-0, *Combat Service Support* (Washington, DC: Government Printing Office, 2003), 1-9.

sustainment itself is relatively new to Army logisticians, and was introduced to Army doctrine in the 2008 version of FM 3-0 and reflects the addition of personnel services and health service support to the logistics field.⁴⁴ These two services, managed by soldiers with personnel and medical military occupation specialties still fall under separate commands. However, recent force restructuring added the responsibility for integrating these capabilities underneath logistics officers within the BSB.

The BSB is part of the Army's operating forces; these units are designed to participate in combat.⁴⁵ In order of levels of responsibility, the operating forces consist of the Army Service Component Command (ASCC), the Corps, the Division, the Brigade Combat Team, and the Battalion. The Theater Sustainment Command, the Sustainment Brigade, the CSSB, and the BSB support these commands logistically. These units form the backbone of sustainment at the operational and tactical level for today's army.

There have been significant changes in command relationships, organization, and capabilities in the operating forces in the period between 1985 and 2015. The next few sections of this chapter discuss the history of the three most recent force structures of the Army, how these forces were sustained, and finally an in depth look at bulk fuel processes for each force. This information provides answers to several of the secondary research questions and builds a general knowledge base of sustainment, fuel operations, and capabilities that are key to this study's methodology.

⁴⁴ Jeffrey C. Brlecic, "Logistics, CSS, Sustainment: Evolving Definitions of Support," *Army Sustainment* 41, no. 5 (September-October 2009), accessed September 24, 2014, http://www.alu.army.mil/alog/issues/SepOct09/pdf/asust_septOct_09.pdf.

⁴⁵ Department of the Army, ADRP 4-0, *Sustainment*, 2-8.

The Army of Excellence (AoE)

Following Vietnam, the U.S. Army sought to redefine itself as fighting an unpopular war had long lasting negative impacts on the entire force. By 1980 only 50 percent of the force had graduated from high school and the rates for soldiers with a drug addiction, unauthorized absence, or criminal activities was remarkably high.⁴⁶ This was particularly troublesome when analysts looked at the results of the October 1973 Arab-Israeli War. The fighting, which could almost be viewed as a proxy fight to demonstrate the lethality of the modern military equipment found in the U.S. and Soviet armories, was intense and demonstrated a need for excellence in personnel, training, doctrine and equipment.⁴⁷

The Army began their efforts to improve the force by revising their doctrine to create a shared understanding of how the army would fight its next war. From this came the concept of Air Land Battle, the tactics designed to counter the Soviet goliath in Eastern Europe. This doctrine focused on deep strikes to prevent reinforcements at the front allowing a well-trained and equipped force to fight and win while outnumbered.⁴⁸ However, revised doctrine was just one of the items needed to go from Vietnam to the Army of Excellence.

⁴⁶ Robert H. Scales, *Certain Victory: The US Army in the Gulf War* (Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 1994), 16.

⁴⁷ Ibid., 9.

⁴⁸ John L. Romjue, *The Army of Excellence: Development of the 1980s Army* (Fort Monroe, VA: Office of the Command Historian, U.S. Army Training and Doctrine Command, 1997), 9.

In order to conduct the Air Land Battle concept, the Army needed new equipment. This led to the development of the “Big Five” the nickname given to the five combat systems primarily designed to execute the Army’s new doctrine. General Creighton Abrams drove the acquisition of the M1 Abrams Tank, the AH-64 Apache, the UH-60 Blackhawk, the M2/M3 Bradley Fighting Vehicle, and the Patriot missile.⁴⁹ These vehicles, still in use today, served as the materiel foundation for the AoE.

The generals that led the Army during the 1970s and 1980s had combat experiences in World War II, Korea, and Vietnam and they all noted that units in each fight suffered extremely high casualty rates during their first exposures to actual combat.⁵⁰ In order to counter this, the Army sought to copy the success the Navy had found in training pilots during the Vietnam War. The Navy created training commonly referred to as Top Gun, a training center focused on providing realistic combat scenario based training prior to deployment. The Army created the National Training Center (NTC) in Fort Irwin, California that provided the opportunity for units to be tested against an opposing force (OPFOR) well versed in Soviet doctrine. The experience at NTC was brutal as the OPFOR was more numerous, familiar with their terrain, and highly skilled. However, with each successive rotation the U.S. forces increased their ability to survive and win in combat.⁵¹ Finally, after years of reinventing itself, the Army had the skills, equipment, and soldiers needed to dominate on the field of battle.

⁴⁹ Scales, 19.

⁵⁰ Ibid., 20.

⁵¹ Ibid., 21.

Army planners took these components and revised the entire force structure of the Army's Light Infantry Division, the Airborne and Air Assault Divisions and the Heavy Divisions.⁵² These designs enabled the Army to excel against the primary focus of the Soviet threat in Europe but also provided light forces capable of responding to contingencies in the Middle East, Asia, and even Latin America.⁵³ Following several revisions to find the right balance of structure, modernization, lethality, and sustainability the Department of the Army officially directed phased restructuring to begin in Fiscal Year 1984 and the AoE was born.⁵⁴

⁵² Romjue, 45.

⁵³ Ibid., 27.

⁵⁴ Ibid., 56.

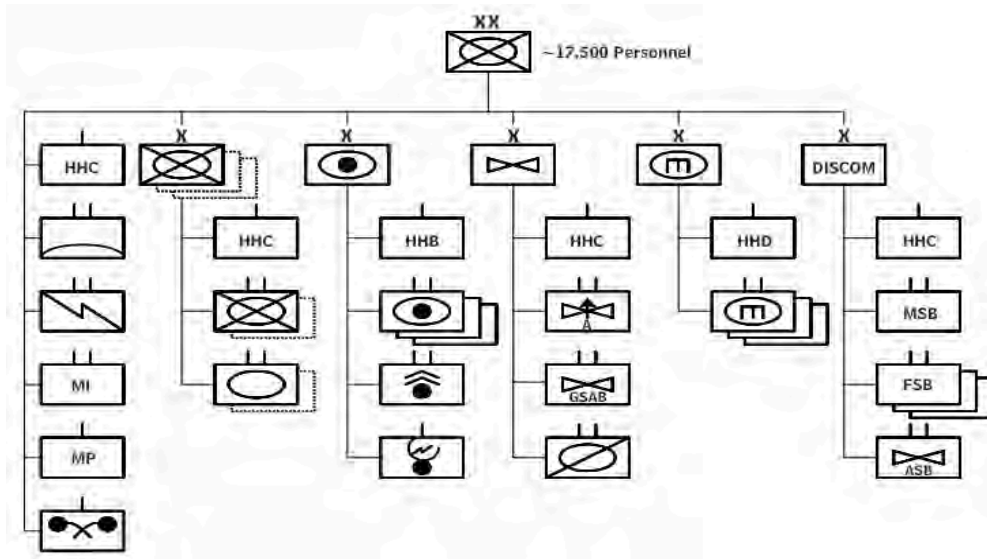


Figure 3. The Heavy Division in the Army of Excellence (AoE)
Of particular interest for this study is the Division Support Command (DISCOM) and its subordinate commands the Main Support Battalion (MSB) and Forward Support Battalions (FSB). In the AoE, each of these sustainment organizations were under the command and control of the division commander and were task organized to the maneuver brigades as part of the brigade combat teams.

Source: Adam Talaber, *Options for Restructuring the Army* (Washington, DC: Congressional Budget Office, 2005), 53.

In the AoE, the division was the Army's primary tactical formation.⁵⁵ The Heavy Division contained the elements most similar to today's divisions that contain the Armored Brigade Combat Teams. The Heavy Division came in two varieties the armored and the mechanized infantry, each consisting of three maneuver brigades with a mixture of armored and mechanized infantry battalions. In the AoE, the brigades were task organized into brigade combat teams for combat, meaning that support elements from the other brigades within the division were added to the maneuver brigade to maximize their

⁵⁵ Adam Talaber, *Options for Restructuring the Army* (Washington, DC: Congressional Budget Office, 2005), 51.

capabilities. The need for task organizing prior to combat was one of the factors the Army addressed in the creation of the Modular Army in the 2000s.

The AoE was a force designed to excel during the Cold War and like the formations that preceded it, planners sought ways maximize the Army's success against its most likely threat. The training, equipment, and focus on quality soldiers allowed the Army to reinvent itself following Vietnam. With an understanding of the historical basis for the AoE and its force structure at the division level and below, it is imperative to build that same knowledge base for its sustainment. This data identifies key components of sustainment and support relationships to compare and contrast with both the Modular Army and the Army 2020.

Sustainment in the Army of Excellence

The primary tactical fighting element of the AoE was the division, and as such, sustainment was focused on providing responsive support for division operations. In the AoE Division, there were three primary sustainment organizations the Division Support Command (DISCOM), the Main Support Battalion (MSB), and the Forward Support Battalion.⁵⁶ It is important to understand how these organizations functioned together to provide support at the brigade level.

In the AoE, the DISCOM provided division level logistics to all organic and attached elements of the division. The DISCOM and all its subordinate logistics elements fell under the command and control of the division commander. The fact that logistics units were directly integrated into the command and control system of the division

⁵⁶ Edward L. Andrews, "The Army of Excellence and the Division Support Command" (Essay, US Army War College, Carlisle Barracks, PA, 1986), 2.

allowed the division commander to shift his support efforts to ensure proper sustainment at critical moments to positively influence the outcome of battle.⁵⁷ The DISCOM commander served as the senior logistics operator in the division. He was responsible for advising the division commander and had full command authority over all organic logistics units.⁵⁸ The DISCOM commander also provided advice and planning priorities for the MSB and FSB that were responsible for providing all classes of supply, maintenance support, transportation assets, and more to the division units.⁵⁹

Each DISCOM had one organic MSB under its command and control. The MSB provided direct support to units in the division rear and was based in the division's support area.⁶⁰ Having the MSB organic to the DISCOM ensured that all logistics needs for the division were routed through the DISCOM staff. This enabled the DISCOM commander to have an accurate view of logistics within the division's area of operations. The MSB provided reinforcing support to the Forward Support Battalions but did provide direct support to the FSBs for supply, transportation, some field service functions, and reinforcement maintenance and medical support.⁶¹

⁵⁷ Department of the Army, Field Manual (FM) 63-21, *Main Support Battalion* (Washington, DC: Government Printing Office, 1990), 1-7.

⁵⁸ Department of the Army, Field Manual (FM) 63-2, *Division Support Command, Armored, Infantry, and Mechanized Infantry Divisions* (Washington, DC: Government Printing Office, 1991), 1-1.

⁵⁹ Department of the Army, FM 63-21, *Main Support Battalion*, 1-2.

⁶⁰ *Ibid.*, 1-3.

⁶¹ *Ibid.*, 2-3.

There were three FSBs within the AoE Heavy Division, one per brigade. The FSB staff and commander were the forward most logistics experts within the sustainment structure and were responsible for integrating themselves into the brigade planning process to ensure that the maneuver plans were logistically supportable. That being said, the FSB fell under the command and control of the DISCOM and was available for tasking to provide support to nondivisional units within the brigade area of operations.⁶² The FSB supported its brigade by providing or coordinating for all classes of supply, maintenance support, field services, transportation, and replenishes the unit's basic loads.⁶³ In its mission to provide or coordinate for all classes of supply the FSB was responsible for bulk fuel support for its BCT.

Bulk Fuel Support in the AoE

One of this study's delimitations was to provide an in depth look at bulk fuel support at the brigade combat team level. Fuel is the lifeblood of a mechanized force and its availability in the right place and in the right amount has a direct effect on an operation's endurance. In the AoE, the FSB played a pivotal role in providing fuel in support of its brigade. The FSB received fuel directly from the MSB or from corps support elements. The FSB typically provided fuel to its supported units using supply point distribution.⁶⁴ In this method of distribution, the supported units picked up their fuel using their own organic refueling equipment from designated fuel points within the

⁶² Department of the Army, Field Manual (FM) 63-20, *Forward Support Battalion* (Washington, DC: Government Printing Office, 1990), 2-2.

⁶³ *Ibid.*, 2-3.

⁶⁴ *Ibid.*, 7-13.

BSA. This process required careful coordination between the supported brigade's S4, the FSB support operations section, and DISCOM to ensure the delivery schedule was synchronized properly with brigade operations.

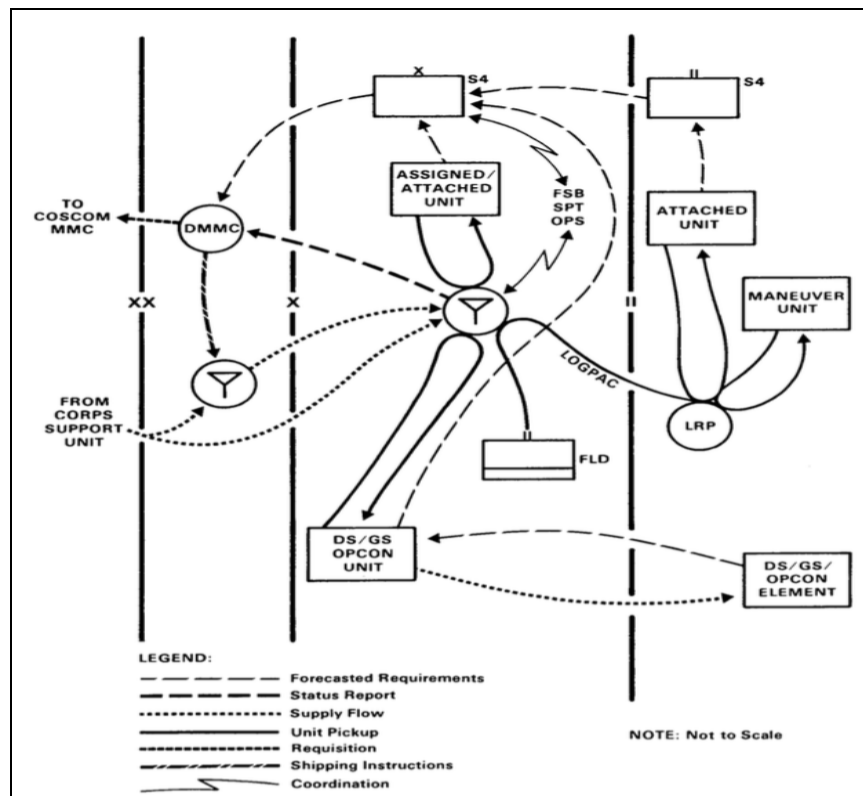


Figure 4. Bulk Fuel Support in the AoE

This figure displays the coordination, reports, and procedures used by the FSB to provide bulk fuel support to its supported units. The FSB typically conducted supply point distribution from the BSA but was capable of pushing fuel to a logistics release point (LRP) to provide support forward to a brigade element when necessary. The maneuver units used their internal refueling assets to obtain fuel either from the point in the BSA or at the LRP.

Source: Department of the Army, Field Manual (FM) 63-20, *Forward Support Battalion* (Washington, DC: Government Printing Office, 1990), 7-14.

The breakdown of refuel procedures demonstrates the depth of sustainment elements that were present in an AoE division. Each element of the organization had some sustainment assets included whether it was provided by the DISCOM or internal to a maneuver unit. This overabundance of support reflected the times and the opponent faced by the Army.

After the collapse of the Soviet Union, the Army had to change its mindset and force structure to become a more expeditionary force. The changing operational environment and a focus on global response demanded a lighter more rapidly deployable Army. These realities led to the creation of the Modular Army. This next sub chapter discusses changes between the AoE and the Modular Army to provide necessary insights to identify the changes in force structure and sustainment.

Modular Army

The Army began research to change its force structure from the Army of Excellence shortly after the end of the Cold War. The conversion process included Force XXI and the Army After Next. In June of 1999, General Eric Shinseki became the 34th Army Chief of Staff and he wanted a force that could deploy a brigade anywhere in the world within 96 hours, a division in five days, and a corps consisting of five divisions within a month.⁶⁵ The term Army Transformation was adopted to describe the work being done to meet these goals. Shinseki and other senior leaders stressed that Transformation was not just a refinement of existing forces but a radical departure from

⁶⁵ Richard W. Stewart, ed., *American Military History, Vol II. The United States Army in a Global Era, 1917-2008* (Fort Monroe, VA: Office of the Command Historian, U.S. Army Training and Doctrine Command, 2010), 455.

the existing Army structure and sought ways to flatten the layers of command without losing effectiveness.⁶⁶

The events of September 11, 2001 directly impacted the Army's Transformation by shifting the focus from fighting a near peer adversary to determining a force structure that would be capable of supporting a long-term fight in the Global War on Terror. By 2003, nearly three-quarters of the Army's combat troops were deployed overseas including commitments in Afghanistan, Iraq, Bosnia-Herzegovina, and Kosovo as well in addition to traditional overseas tours in Japan, South Korea, Germany, and the Sinai Peninsula.⁶⁷ In order to maintain the pace of operations, the Army had to find a way to relieve the strain that multiple deployments had on its soldiers. Modularity offered a solution by redesigning the Army's and providing the opportunity to expand the number of brigade combat teams. General Peter J. Schoomaker, the presiding Chief of Staff of the Army at the time, laid out three distinct goals for the conversion to modularity. Modular units had to be as capable as current units, they must be easier to deploy, and must be configured in a manner that could be duplicated without the need for an increase in overall strength of the Army.⁶⁸

Under the Army's transformation to modularity, the brigade combat team (BCT) became the largest fixed tactical formation in the army; all other organizations could be

⁶⁶ William M. Donnelly, *Transforming an Army at War: Designing the Modular Force 1991-2005* (Washington, DC: Center of Military History, United States Army, 2007), 13.

⁶⁷ Esther Schrader, "U.S. Will Begin Rotation Plan on Iraq Deployment," *Los Angeles Times*, July 24, 2003, accessed February 2, 2015, <http://articles.latimes.com/2003/jul/24/world/fg-troops24>.

⁶⁸ Donnelly, 25.

created using a plug and play approach with capabilities specifically engineered to support each mission.⁶⁹ By shifting to a modular brigade-based Army, the force was more responsive to geographic combatant commanders' (GCC) needs; better employed joint capabilities, facilitated force packaging and rapid deployment, and fought as self-contained units in non-linear, non-contiguous battlespaces.⁷⁰ Three types of BCTs were created in modularity, the heavy, infantry and stryker each consisting of maneuver, fires, reconnaissance, and sustainment subordinate battalions.⁷¹

In Modularity, the size of the brigades grew to reflect their focus on combined arms task organization instead of battalions of pure armor, infantry, and fires thus minimizing the need to create brigade sized task forces in order to conduct combat operations. In the AoE, divisional brigades rotating through the National Training Center (NTC) in Fort Irwin, California had to augment their units with divisional slice elements including transportation and maintenance assets, a military police platoon, signal assets, and more to be successful; under Modularity all these capabilities were organic.⁷² The heavy brigade combat team, the forefather of today's ABCT, contained organic reconnaissance capabilities, cannons and mortars, balanced combined arms battalions,

⁶⁹ Department of the Army, FMI 3-0.1, *The Modular Force*, vii.

⁷⁰ CASCOM, "Modularity Force," accessed March 18, 2015, <https://www.cascom.army.mil/private/esd/Mod/modularindex.html>.

⁷¹ Department of the Army, FMI 3-0.1, *The Modular Force*, 1-12.

⁷² Courtney L. Abraham, "Army Modularity and Command Relationships: 'Who's My Boss?'" (Master of Military Studies, U.S. Marine Corps Command and Staff College, Quantico, VA, 2011), 6.

and a robust sustainment capability.⁷³ The figures below provide a visualization of the force structure differences at the brigade level between the AoE and the Modular Army.

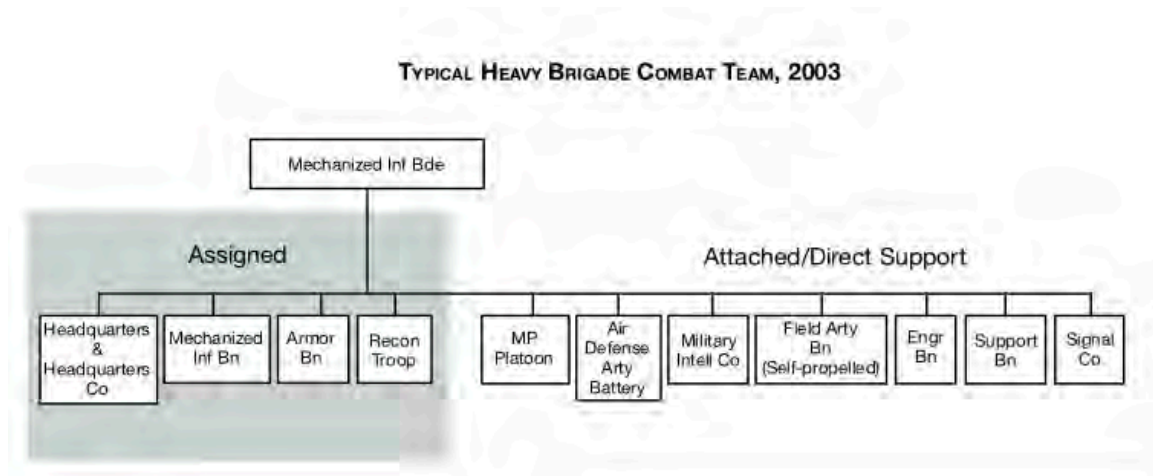


Figure 5. Heavy Brigade Combat Team in 2003

This figure depicts the traditional task organizing conducted the brigade level within the Army of Excellence. The creation of these ad hoc organizations was required in order to provide maximum capability to the brigade commanders both during NTC rotations and during combat operations. The practice became so common that divisions typically referred to their maneuver brigades as brigade combat teams.

Source: William M. Donnelly, *Transforming an Army at War: Designing the Modular Force, 1991-2005* (Washington, DC: Center of Military History, United States Army, 2007), 83.

⁷³ Department of the Army, Field Manual Interim (FMI) 3-90.6, *Heavy Brigade Combat Team* (Washington, DC: Government Printing Office, 2005), 2-9.

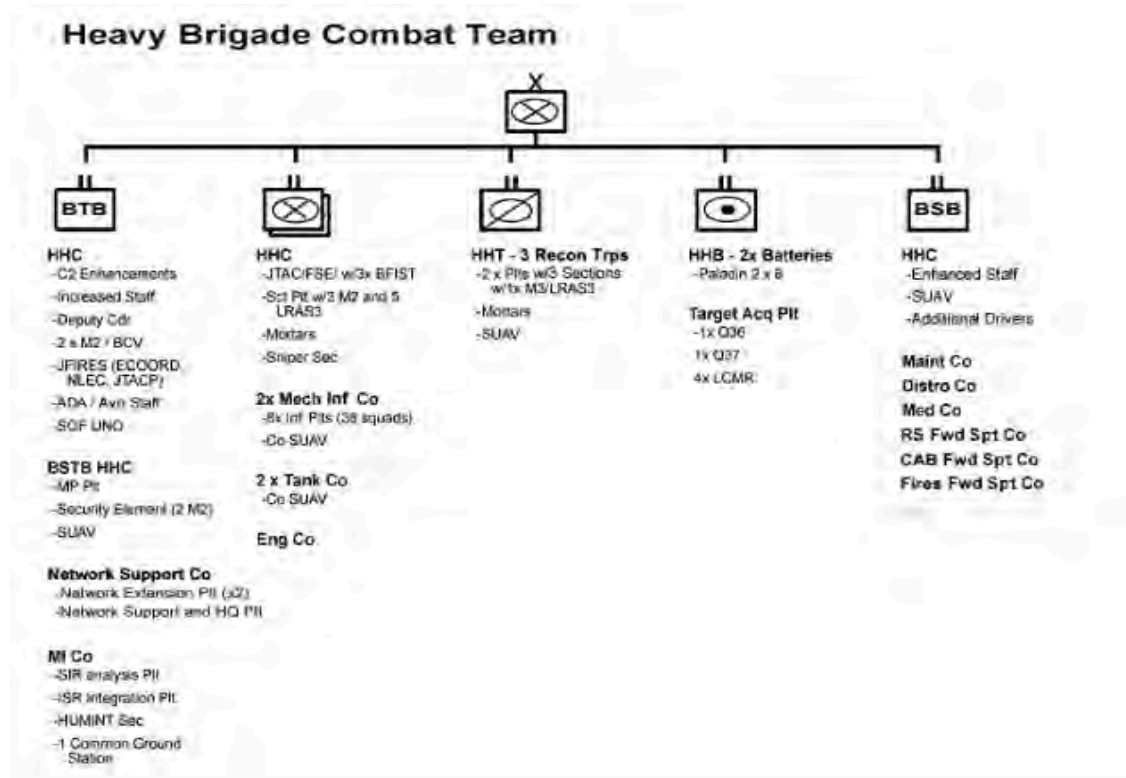


Figure 6. Modular Heavy Brigade Combat Team

In the Modular Army, the HBCT consisted of two combined arms battalions, a reconnaissance battalion, a fires battalion, the brigade troops battalion, and the brigade support battalion. This organization addressed many of the shortfalls found in the AoE design and gave the BCT commander the ability to conduct sustained combat operations without the need for augmentation from external units.

Source: Department of the Army, Field Manual Interim (FMI) 3-90.6, *Heavy Brigade Combat Team* (Washington, DC: Government Printing Office, 2005), 2-9.

One of the impacts of modularity, at the BCT level, was the loss of a maneuver battalion when compared to the AoE structure. Former BCT commanders expressed concerns about the lack of capability resulting from the loss of the maneuver battalion, but would not have chosen to lose enablers like the reconnaissance squadron to gain the

third maneuver battalion.⁷⁴ Threat assessments in the 2000s, stated that the U.S. military were likely to be used against irregular forces rather than a near peer adversary this reduced the risk of having only the two maneuver battalions and eased some concerns regarding the reduction in capability.⁷⁵

The switch to modularity enabled the Army to be more responsive and capable of handling a wide range of operational challenges.⁷⁶ It flattened the Army's command structures essentially creating units of action (brigades) and units of employment (operational level and higher tactical levels) as the building blocks for deployable forces. The restructuring allowed the Army to expand the number of BCTs in the force to reduce the strain of multiple deployments on its soldiers. Modularity also formalized the brigade combat teams providing them with greater capabilities than those inherent in the AoE and increased the ability for units to routinely train with their enablers. Modular forces were capable of conducting continuous, simultaneous combinations of offensive, defensive, and stability tasks.⁷⁷ The sustainment community adapted as well making dramatic changes to its force structure and command and control relationships within the division.

⁷⁴ Stuart E. Johnson, John E. Peters, Karin E. Kitchens, Aaron Martin, and Jordan Fischbach, *A Review of the Army's Modular Force Structure* (Santa Monica, CA: RAND Corporation, 2012), 40.

⁷⁵ Ibid., 39.

⁷⁶ Department of the Army, FMI 3-0.1, *The Modular Force*, vii.

⁷⁷ Department of the Army, ADRP 3-0, *Unified Land Operations*, 2-2.

Sustainment in the Modular Army

Sustainment organizations from the corps down reorganized as part of the flattening of the command structures directed by the Secretary of the Army White. The Theater Sustainment Command (TSC) replaced elements of the COSCOM and DISCOM formations. The Sustainment Brigade replaced the DISCOM, the CSSB replaced the MSB, and the BSBs replaced the Forward Support Battalions. Each of these organizations, with the exception of the BSB is a modular organization built around a headquarters element designed to provide mission command for a variety of interchangeable subordinate units.

In a theater of operations, the TSC has operational control of the sustainment brigades. The TSC communicates sustainment priorities from the ASCC to the sustainment brigade commander to ensure support is synchronized accordingly.⁷⁸ The sustainment brigade's capabilities are tailored to its mission set.⁷⁹ The traditional roles for a sustainment brigade include theater opening, theater distribution, and sustainment.⁸⁰ Sustainment brigades, in modularity, are attached to the TSC and provide general or direct support to divisions and their subordinate elements.

The CSSB is the building block for all sustainment brigade capabilities. Each CSSB can be augmented with up to seven companies dependent upon the mission. CSSBs provide area support and plan, prepare, execute, and assess logistics operations in

⁷⁸ Department of the Army, Army Training Publication (ATP) 4-93, *Sustainment Brigade* (Washington, DC: Government Printing Office, 2013), 1-7.

⁷⁹ *Ibid.*, 2-4.

⁸⁰ *Ibid.*, 2-1.

their area of operations.⁸¹ A CSSB can be tasked to provide direct support to various organizations, including a division. Before discussing sustainment within the brigade combat team, it is important to discuss the changes in command relationships for sustainment units above the brigade support battalion.

The modification in mission command for sustainment elements above the brigade (TSC, Sustainment Brigades, and CSSBs) is perhaps the most dramatic of the changes within the sustainment force structure in the Modular Army. In the AoE, the division commander controlled sustainment within his division through the organic DISCOM, MSB, and FSBs. If a brigade required additional sustainment capabilities, the requests were routed through the DISCOM to ensure that assets were applied according to the division commander's intent.⁸² In Modularity, the only organic sustainment in a division is the BSB within a brigade combat team. This separation of sustainment creates two reporting requirements. One reporting channel flows from the battalion through its command channels to the division and the other is via parallel coordination where BSBs submit requirements and forecasts to the sustainment brigade to get the required support.⁸³ Figure 7 provides a graphic depiction of the complexity created by this separation. To mitigate the risks associated in creating a complex sustainment relationship, the Army ensured the BSB contained a robust capability to support its BCT.

⁸¹ Ibid., 1-8.

⁸² Department of the Army, FM 63-21, *The Main Support Battalion*, 2-2.

⁸³ Department of the Army, ATP 4-93, *Sustainment Brigade*, 2-24.

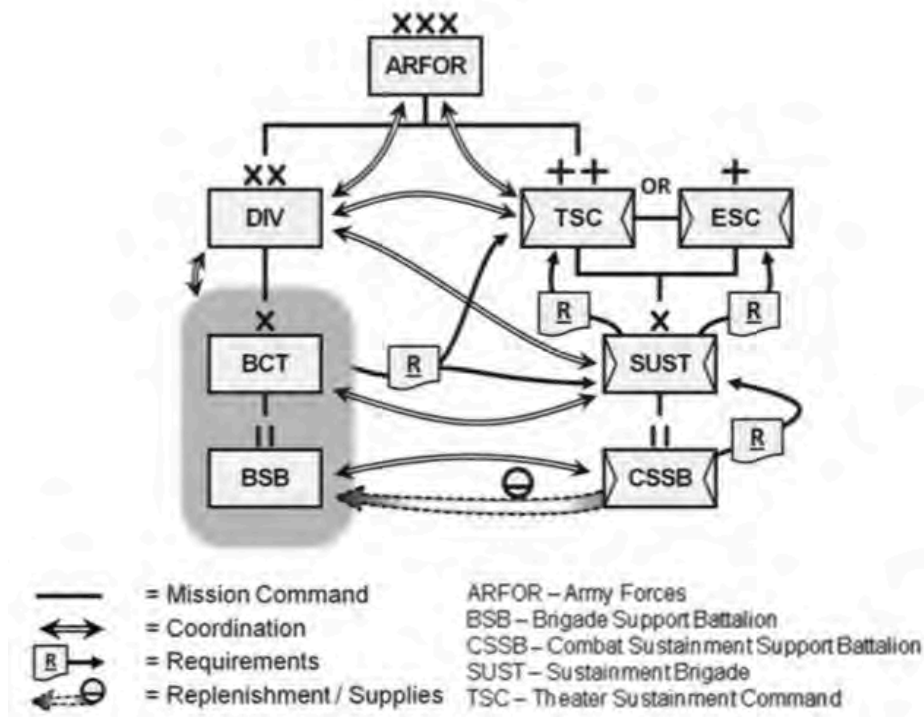


Figure 7. Sustainment Coordination in the Modular Army
 This figure depicts the sustainment reporting requirements created by removing the CSSB and Sustainment Brigade from the division. The BCT S4 submits requirements to the Division G4 as well as the Sustainment Brigade. The BSB also coordinates directly with the CSSB for replenishment and incorporates CSSB augmentation into the BSB concept of support.

Source: Department of the Army, Army Training Publication (ATP) 4-93, *Sustainment Brigade* (Washington, DC: Government Printing Office, 2013), 3-5.

In contrast to sustainment processes above the brigade, sustainment within a BCT was easier to coordinate than it had been in the AoE. As part of the shift from a division centric to a brigade centric force, the Army increased the sustainment capabilities at the brigade level. The BSB replaced the old FSB and is comprised of elements from the FSB, the DISCOM, and a majority of the sustainment capabilities once nested in the maneuver battalion headquarters companies. This consolidation of sustainment assets enabled the

brigade to be the Army's lowest level, self-sustaining, deployable force. In this case, self-sustaining is defined as an organization capable of operating without additional organizational augmentation for 72 hours (typically referred to as having three combat loads).⁸⁴ It also created one organization within a brigade that is responsible for providing all classes of supply except for Class VIII.

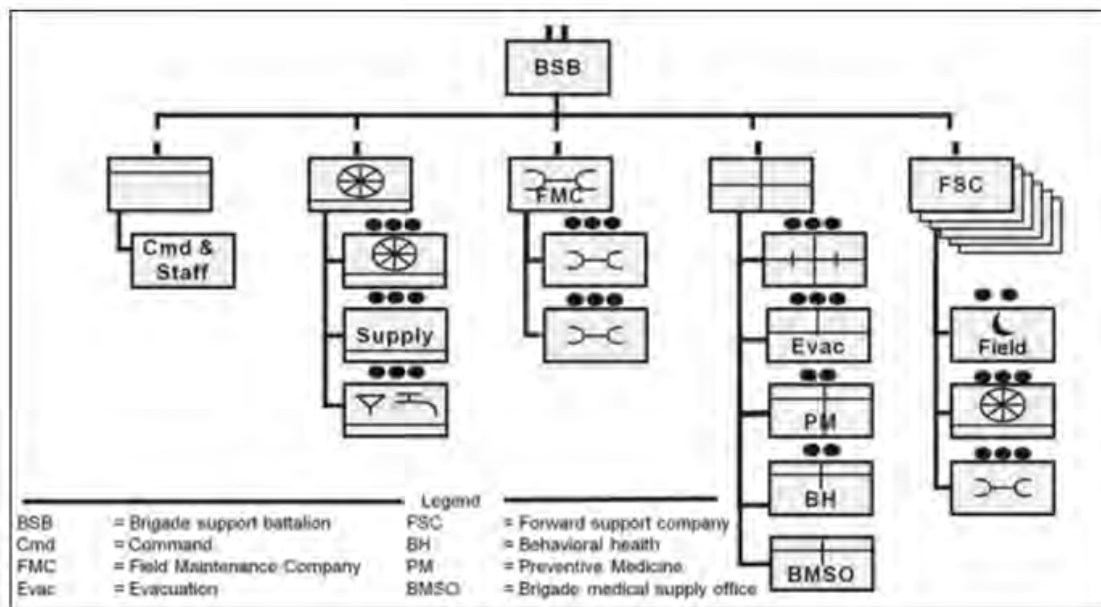


Figure 8. The Modular BSB

This figure shows the composition of the BSB in the Modular Army. The Distribution Company has the distribution platoon, the fuel and water platoon, and the supply platoon. The Field Maintenance Company (FMC) provides direct maintenance support to units in the brigade support area and augments the FSCs as needed. The Brigade Support Medical Company (BSMC) provides medical care in the BDE including behavioral health, preventative medicine, and more. The FSCs are direct support units designed to meet the sustainment needs for their maneuver battalions and have maintenance, distribution, and field service capabilities.

Source: Department of the Army, Army Techniques Publication (ATP) 4-90, *Brigade Support Battalion* (Washington, DC: Government Printing Office, 2014), 2-8.

⁸⁴ Steven M. Elkins, "Synchronizing Sustainment Operations" (Strategic Research Project, U.S. Army War College, Carlisle Barracks, PA, 2008), 9.

Each BSB was tailored to support a specific type of brigade (heavy, stryker, or light) but they were all designed with similar structure and capabilities.⁸⁵ The BSB commander became the senior logistician within the BCT and was responsible for ensuring that decisions, directives, and instructions for the BSB were implemented to fulfill the BCT commander's intent.⁸⁶ The HBCT BSB contained a headquarters and headquarters company, a distribution company, a field maintenance company (FMC), a brigade support medical company (BSMC), and one forward support company (FSC) each to support the armored reconnaissance squadron, the two combined arms battalions, and the fires battalion. The BSB and its subordinate units are vital components in the distribution of bulk fuel within the brigade.

Bulk Fuel Support in the Modular Army

One of this study's delimitations was to provide an in depth look at bulk fuel support at the brigade combat team level. Fuel is especially important considering the rising consumption rates needed to support current operations. The gallons of fuel required per soldier per day has quadrupled since Desert Storm and the BSB is the lynchpin for bulk fuel support in the BCT of the Modular Army.⁸⁷ The distribution company and the FSC are the two units primarily responsible for bulk fuel storage and distribution in the modular brigade structure. The BSB's distribution company is the

⁸⁵ Department of the Army, FM 4-90, *Brigade Support Battalion*, 2-1.

⁸⁶ *Ibid.*, 2-3.

⁸⁷ Peter Hoy, "The World's Biggest Fuel Consumer," *Forbes*, June 5, 2008, accessed May 20, 2015, http://www.forbes.com/2008/06/05/mileage-military-vehicles-tech-logistics08-cz_ph_0605fuel.html.

primary transportation and supply point for the BCT. It stores the third combat load for its supported units and provides supplies to the FSCs.⁸⁸ The fuel and water platoon of the distribution company was capable of storing 110,000 gallons of fuel in their organic fuel tankers (15 x 5K gallon tankers and 14 x 2.5K HEMTT tankers) with an additional storage capacity of up to 120,000 gallons in a fuel system supply point.⁸⁹ The tankers are capable of pushing fuel directly to the FSCs near their maneuver battalions or establishing logistics release points where the FSCs send their tankers to receive fuel.

The FSC is responsible for providing sustainment support to a maneuver battalion, and although organic to the BSB, they maintain a direct support relationship to their supported battalion.⁹⁰ The FSC commander is the senior logistician at the maneuver battalion and assists the battalion S-4 with battalion level logistics planning.⁹¹ These units provide field feeding, bulk fuel, general supplies, ammunition, and field maintenance support. The FSC holds an additional combat load for its supported battalion, including its required bulk fuel.⁹² The FSC distribution platoon receives, stores, and distributes up to 30,000 gallons a day in their 12 organic 2.5K heavy expanded mobility tactical truck (HEMTT) Tankers.⁹³

⁸⁸ Department of the Army, FM 4-90, *Brigade Support Battalion*, 3-4.

⁸⁹ *Ibid.*, 3-7.

⁹⁰ *Ibid.*, 6-1.

⁹¹ *Ibid.*, 6-2.

⁹² Department of the Army, Student Text (ST) 4-1, *Theater Sustainment Battle Book* (Fort Leavenworth, KS: U.S. Army Command and General Staff College, 2013), 6-10.

⁹³ *Ibid.*

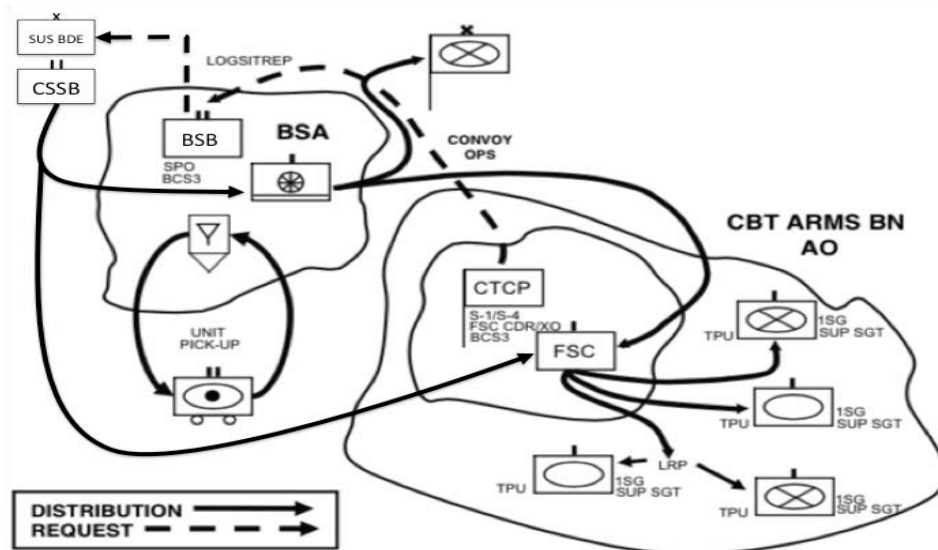


Figure 9. Bulk Fuel Support in the Modular Army

This figure depicts the fuel distribution and request procedures at the BCT level under modularity. The CSSBs replenish the BSB stocks or provide fuel directly to the FSCs. The BSB pushes fuel to the FSC by bringing fuel to the FSC utilizing the distribution company's fuel tankers or establishing logistics release points for the FSC to pick up fuel. The FSC delivers fuel to the maneuver units using their organic assets.

Source: Chart developed by the author summarizing data from Department of the Army, Field Manual (FM) 4-90, *Brigade Support Battalion* (Washington, DC: Government Printing Office, 2010), 1-5, 2-7, 2-12, 6-5.

The BSB structure was designed to provide a mix of sustainment capabilities enabling a BCT to be self-sustaining during any type of operation for up to 72 hours. This robust logistics capability, controlled by the BCT commander, was a key component of the expeditionary mission of the Army of Modularity. The Army is preparing to undergo another force modernization based on strategic policy changes and the realities imposed on it by an interwar budget; the result of this transformation is the Army 2020. Identifying the changes between the Modular Army and the Army 2020 is necessary to answer the secondary research questions.

The Army 2020 Design

One of the founding principles for the construction of Army 2020 is that the military will transition from an Army at war to an Army in a state of preparation for war.⁹⁴ U.S. forces are no longer charged with winning two conflicts simultaneously and instead are tasked to defeat one opponent while denying the objectives of a second aggressor and have been directed to reduce manning to levels that prohibit them from conducting large-scale, prolonged stability operations.⁹⁵ As part of that paradigm shift, the Army has identified five characteristics of the future operating environment (OE) that are likely to impact land based operations; increased velocity of human interaction, potential for overmatch, proliferation of weapons of mass destruction, spread of advanced cyberspace and counter-space capabilities, and operations among populations, in cities, and in complex terrain.⁹⁶ Designing a force to fight and win in that OE in a fiscally restrained environment is a driving force behind some of the force structure changes being implemented in Army 2020.

Using the Army Strategic Planning Guidance and the Army Campaign Plan, Army leadership began to develop the Army 2020 force structure in 2010. TRADOC immediately took the task and after extensive analysis, suggested 25 force design updates for implementation in order to provide the most capable forces within end strength

⁹⁴ Department of the Army, TRADOC Pamphlet 523-3-1, *The U.S. Army Operating Concept: Win in a Complex World* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 2014), 8.

⁹⁵ Leon Panetta, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: Department of Defense, 2012), 6.

⁹⁶ Department of the Army, TRADOC Pam 523-3-1, *The U.S. Army Operating Concept: Win in a Complex World*, 11.

limitations.⁹⁷ Within these 25 initiatives were designs including variations on the HBCTs and IBCTs, some with Strykers, some with mine-resistant ambush-protected (MRAP) vehicles, and other hybrid proposals.⁹⁸ Each of these proposals assumed the adoption of a third maneuver battalion in the ABCT and Infantry Brigade Combat Team (IBCT). The Army 2020 Task Force (TF) further refined the proposed force structures using a combination of BCT commander analysis, sufficiency analysis, and modeling and simulations analysis.

In order to gain tactical level input on the proposed changes, the Army 2020 TF held a BCT Commanders Workshop at Fort Leavenworth, Kansas in December of 2011. This group consisted of 23 current and former BCT commanders from the active and reserve components, as well as BCT Command Sergeants Major and experts from each of the warfighting functions.⁹⁹ The commanders agreed to discard the hybrid formations due to the additional costs required in maintaining them. This narrowed the force design update options to a HBCT with three maneuver battalions, the current three battalion Stryker formation, the IBCT with three maneuver battalions, or leaving the formations essentially the same (two maneuver battalions). The commanders ran each force structure through 34 separate vignettes representing demands from all combatant commands and

⁹⁷ Brad Pippin, Brenda Schmalstieg, Rustin Schemm, Trevor Dison, and Sharon Wagner, *Army of 2020 Analysis Supporting the Brigade Combat Team Design Decision* (Fort Leavenworth, KS: U.S. Army Training and Doctrine Command Analysis Center, 2012), ES-1.

⁹⁸ *Ibid.*, 5.

⁹⁹ *Ibid.*, 15.

including all forms of operations. The results of this analysis showed that the three-battalion design dominated the two-battalion designs in all vignettes.¹⁰⁰

The BCT Commanders Conference established a clear preference for the three battalion design, but Army 2020 TF had to determine whether or not the design was able to meet the Army's projected demands. To do this, Army 2020 TF conducted a strategic-level sufficiency analysis that compared the ability of an Army consisting of 58 three battalion BCTs against the capability of an Army consisting of 65 two battalion BCTs to support multiple demands consisting of operations ranging from major combat to humanitarian assistance. Even with fewer total BCTs, the additional capability of the three-battalion force provided greater capacity to meet the demands.¹⁰¹

The Army 2020 TF conducted modeling and simulations analysis to provide additional quantitative comparisons between the three versus two battalion constructs. The modeling and simulations occurred over a six-week period and consisted of three vignettes focused on offensive and stability operations in Northeast Asia. The study team ran over 6,500 hours of combat simulations ranging from seven hour to 72 hour long tactical level operations.¹⁰² The results of the modeling and simulations reinforced the findings of both the strategic level analysis and the BCT Commanders Conference. The three maneuver battalion BCT better prevented the enemy from gaining the initiative, provided increased firepower to the commander, improved the ability to constitute a

¹⁰⁰ Ibid., 15.

¹⁰¹ Ibid., 26.

¹⁰² Ibid., 30.

reserve, and provided the ability to operate across a larger area.¹⁰³ The results confirmed that the reintroduction of the third maneuver battalion into the ABCT and IBCT structures would provide a significant tactical advantage over the modular army's two battalion model.¹⁰⁴ In order to gain the additional tactical flexibility of the third maneuver battalion in the BCT, while addressing manpower constraints, the Army 2020 had to undergo significant force structure changes.

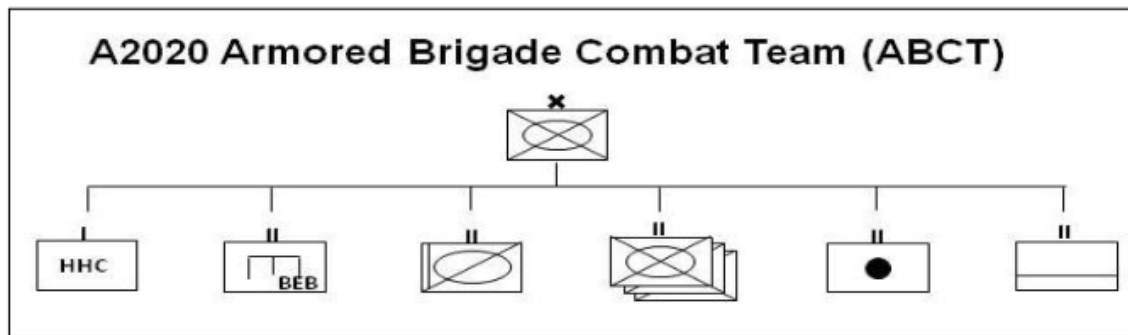


Figure 10. Army 2020 Armored Brigade Combat Team

The ABCT under Army 2020 has several differences to its modular counterpart in figure 6. The most obvious changes are the addition of the third combined arms battalion (CAB) and the transition of the BSTB to a BEB. The fires battalion reorganized to provide a fires battery to the third CAB. The MP platoon and vertical construction platoon once found in the BSTB have been moved to EAB.

Source: Department of the Army, *The United States Army 2020 Operational and Organizational Concept: Evolution 3* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 2014), 33.

¹⁰³ Ibid., 37.

¹⁰⁴ Ibid., 2.

The Army cites the results of the Army 2020 TF analysis in its latest Army 2020 Operational and Organizational Concept, and proposed further changes to the overall force.¹⁰⁵ These changes include the addition of a brigade engineer battalion (BEB) to every BCT to increase their mobility, counter-mobility, and survivability in combat. Army 2020 also creates the Reconnaissance and Surveillance BCT, the Expeditionary Military Intelligence Brigade and the Division Artillery (DIVARTY). These force structure changes required senior leaders to conduct a thorough review of sustainment procedures leading to several distinct differences in the concept of support for the Army 2020 and that of the Modular Army.

Sustainment in the Army 2020

As part of the Army 2020 redesign, Training and Doctrine Command tasked CASCOM to address sustainment for and, if required, revise the sustainment concept of support.¹⁰⁶ All proposed redesigns had to keep the BCT deployable, averaging no more than 4,500 soldiers, and were based on an Active Component end strength of 490,000 troops.¹⁰⁷ The Army's proposed force structure changes, including the addition of the third maneuver battalion and creation of the BEB, grew the overall size of the BCTs. The Army identified sustainment capabilities that could be removed from the BCT, including

¹⁰⁵ Department of the Army, *The United States Army 2020 Operational and Organizational Concept: Evolution 3* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 2014), B-11.

¹⁰⁶ *Ibid.*, 73.

¹⁰⁷ Department of the Army, *Sustainment Concept of Support: CASCOM Tactical-Level Sustainment for Army 2020* (Fort Lee, VA: Combined Arms Support Command, 2013), 6.

water purification, bulk fuel distribution over two days of supply, and bulk fuel storage to meet the force cap restrictions.¹⁰⁸ To provide a quantitative way to view the effects of changes in bulk fuel, the loss of one day of supply equates to 88,954 gallons.¹⁰⁹ The decision to remove this capability creates a greater reliance on echelons above brigade (EAB) to support the BCTs.

This increased reliance on EAB assets led to the creation of 13 active component corps and division aligned CSSBs.¹¹⁰ These CSSBs represent an evolutionary design over the Modular Army CSSB. While remaining modular, the Army 2020 CSSBs contain a base capability consisting of a headquarters company, a composite truck company (CTC), a composite supply company (CSC), a support maintenance company (SMC), and the capability to provide mission command for three additional modular companies. The composite supply company's petroleum and water platoon has the bulk fuel and water purification capabilities that once resided within the BSBs. The CSSBs are doctrinally responsible to provide bulk fuel storage, water purification, and additional bulk fuel distribution to the BSBs when required.¹¹¹

¹⁰⁸ Ibid., 6.

¹⁰⁹ Data generated by the author using CASCOT's 2015 Quick Logistics Estimate Tool for an ABCT in major combat operations in an arid environment.

¹¹⁰ Department of the Army, *Army 2020 Operational and Organizational Concept*, 73.

¹¹¹ Department of the Army, ATP 4-90, *Brigade Support Battalion*, 2-1.

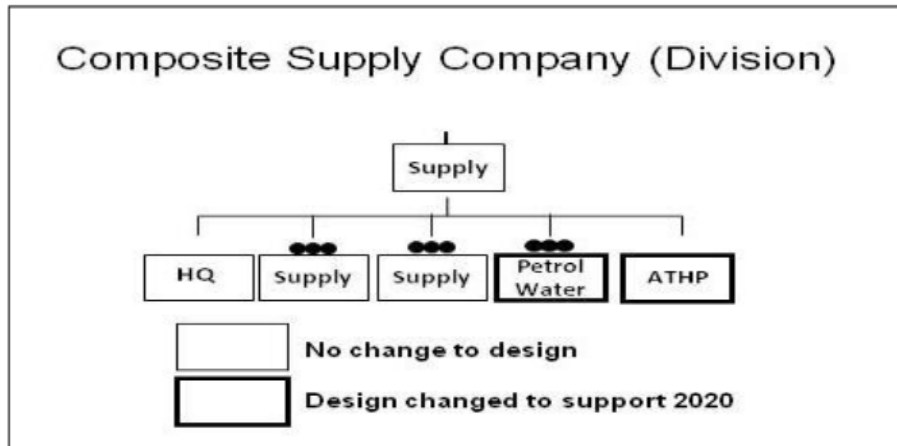


Figure 11. Army 2020 Composite Supply Company

The CSSB CSC received a petroleum and water platoon to fill the gap in sustainment created by removing the bulk fuel and water production capabilities from the BSB into EAB. The fuel section can receive and issue up to 100K gallons per day and store up to 300K gallons in its FSSP. The fuel section can provide local distribution of up to 60K gallons and provides quality surveillance and control measures for fuel that is stored or distributed by the platoon.

Source: Department of the Army, *The United States Army 2020 Operational and Organizational Concept: Evolution 3* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, 2014), 75.

Regionally aligning CSSBs and sustainment brigades provides the opportunity for sustainment units to nest their training, tactics, and procedures with their aligned maneuver units.¹¹² This alignment of the CSSBs creates a support structure that is similar to the MSB within the AoE, however, it is important to note that the CSSB is still assigned to the sustainment brigade and has no command relationship with the division.

¹¹² Todd A Huessner, Geoffrey C. De Tingo, and Craig M. Short, “Synchronizing Field and Sustainment Support: Roles and Responsibilities after 10 Years of War,” *Army Sustainment* 44, no. 4 (July-August 2012), accessed February 10, 2015, http://www.alu.army.mil/alog/issues/JulAug12/Synchronizing_Field_Sustainment.html.

The CSSB provides general support to the division BCTs as well as any division or corps level units within its assigned sustainment area of operations.¹¹³

In the Army 2020 design, the BSB retains the headquarters and headquarters company, a distribution company, a field maintenance company (FMC), a brigade support medical company (BSMC), and one FSC each to support the armored reconnaissance squadron, the three combined arms battalions, and the fires battalion. The main additions to the BSB are the extra FSCs to support the third maneuver battalion and the BEB. The ABCT commander provides mission command for the BSB since it remains organic to the brigade. The Army 2020 changes impact the BSB primarily by removing the capability to purify water and conduct bulk fuel storage. Additionally, the BSB has increased requirements to support the BEB and third maneuver battalion. The change in bulk fuel capabilities serves as a data point to compare and contrast the Modular Army and the Army 2020.

Bulk Fuel Support in the Army 2020

Bulk fuel remains a critical commodity, as Army 2020 forces are likely to deploy to austere environments to combat a full range of contingencies. Current trends in major acquisition programs are likely to generate greater fuel demands than those required in the Modular Army.¹¹⁴ The BSB distribution company and the FSC remain the two most integral components of fuel distribution within the ABCT. In Army 2020, the distribution

¹¹³ Department of the Army, *CASCOM Tactical-Level Sustainment for Army 2020*, 13.

¹¹⁴ Department of Defense, *Fiscal Year 2012 Operational Energy Annual Report*, September 1, 2013, accessed May 20, 2015, http://energy.defense.gov/Portals/25/Documents/Reports/20131015_FY12_OE_Annual_Report.pdf.

company loses the FSSP that provided the capability to store 120,000 gallons of fuel for sustained operations. Additionally, its ability to distribute fuel is reduced by 20,000 gallons due to the loss of its 15 x 5K tankers. The number of 2.5K HEMTTs in the company is increased from 14 to 18. Each HEMTT is equipped with a trailer and modular fuel system capable of holding an additional 2.5K gallons of fuel.¹¹⁵ This essentially turns the 2.5K HEMTT into a 5K tanker and mitigates the impact of the loss of the 5K tankers. In the Army 2020 design, the number of HEMTTs in the CAB FSC is reduced to only six tankers, but each HEMTT comes with a trailer and modular fuel system, thereby eliminating any loss of distribution capability in the FSC.¹¹⁶ The overall effect of these changes is the loss of bulk fuel storage capacity in the BCT and the reliance on the CSSB to account for this loss.

¹¹⁵ CASCOM Sustainment Center of Excellence, “Sustainment Concept of Support: CASCOM Tactical-Level Sustainment for Army 2020” (Briefing provided to author by COL Robert Hatcher, Director of CASCOM Force Development Directorate, January 21, 2015).

¹¹⁶ Ibid., 7.

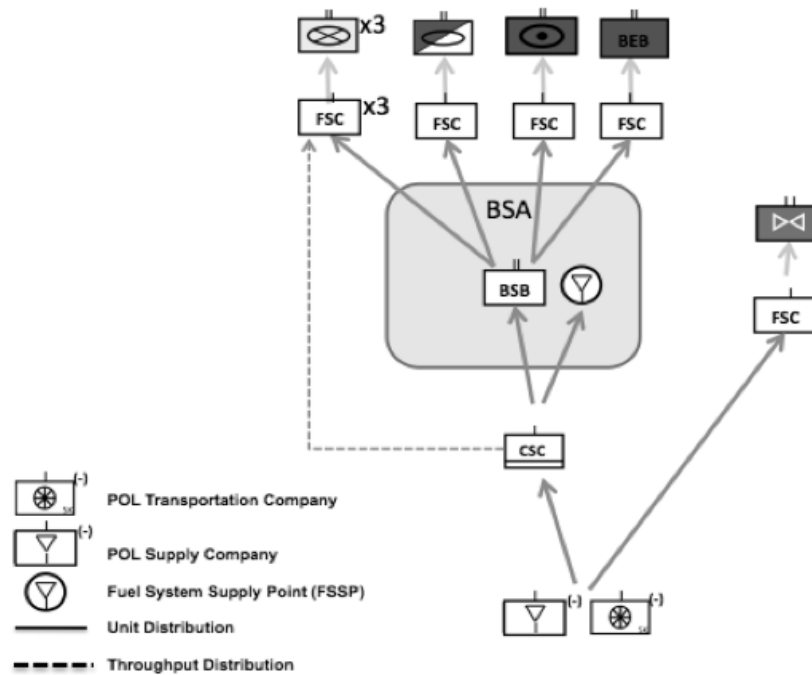


Figure 12. Bulk Fuel Support in the Army 2020

This figure depicts the flow of bulk fuel into the BCT in the Army 2020. The CSC receives from a petroleum oil and lubricant (POL) transportation company. The CSC provides distribution to the BSB distribution company using their HEMTT and 5K tankers. When requested, the CSC also establishes the FSSP in the brigade support area (BSA) providing bulk fuel storage for the BCT. The CSC is also capable of throughput delivery of fuel directly to the FSC. The BSB distributes fuel to the FSCs using its organic fuel tankers and the FSC delivers fuel to their supported maneuver units. The BSB is incapable of establishing a FSSP for conducting supply point distribution without augmentation from the CSSB.

Source: This figure is depicted in Department of the Army, *Sustainment Concept of Support: CASCOM Tactical-Level Sustainment for Army 2020* (Fort Lee, VA: Combined Arms Support Command, 2013), Slide 23, the author amended it to include the legend and to show the CSC establishing the FSSP in the BSA.

The reliance on EAB support creates a risk for sustainers within the BCT. The risk comes from a dependency on units outside of their divisions command and control. The literature review, thus far, has identified the sustainment organizations within the AoE, the Modular Army, and the Army 2020 and touched on the relationships each have

with their BCT, the units above brigade, and the division. To comprehend the impacts these changes have requires a further look at both command and support relationships for the Army.

Army Command and Support Relationships

Until this point, the study has mentioned changes in the command and support relationships in sustainment units but has only touched on the impacts these changes have on logisticians. Force structure changes and the corresponding changes in command and support relationships directly affect how sustainment operations within a division are managed. Analyzing the impacts of the command and support relationship changes helps identify some of the sustainment risks associated with the Army 2020.

Command relationships define superior and subordinate relationships between unit commanders and enable commanders to use subordinate forces with maximum flexibility.¹¹⁷ The three relationships most prevalent within the sustainment community are organic, assigned, and attached relationships. Organic command relationships are formed through organizational documents and reflect permanent placement. In an assigned unit, it is placed in a relatively permanent relationship where the gaining unit controls the functions of the unit and is responsible to administratively support their personnel. An attached relationship is formed when units or personnel are placed in an organization on a temporary basis.¹¹⁸ In the modular BCT, the entire brigade is organic.

¹¹⁷ Department of the Army, Army Field Manual (FM) 6-0, *Commander and Staff Organization and Operations* (Washington, DC: Government Printing Office, 2014), B-1.

¹¹⁸ Ibid., B-2.

At echelons above the brigade, the CSSB has a base of organic companies (CTC, CSC and the SMC) and a mixture of assigned and attached elements.

If relationship is:	Then inherent responsibilities:							
	Have command relationship with:	May be task-organized by: ¹	Unless modified, ADCON have responsibility through:	Are assigned position or AO by:	Provide liaison to:	Establish/maintain communications with:	Have priorities established by:	Can impose on gaining unit further command or support relationship of:
Organic	All organic forces organized with the HQ	Organic HQ	Army HQ specified in organizing document	Organic HQ	N/A	N/A	Organic HQ	Attached; OPCON; TACON; GS; GSR; R; DS
Assigned	Gaining unit	Gaining HQ	Gaining Army HQ	OPCON chain of command	As required by OPCON	As required by OPCON	ASCC or Service-assigned HQ	As required by OPCON HQ
Attached	Gaining unit	Gaining unit	Gaining Army HQ	Gaining unit	As required by gaining unit	Unit to which attached	Gaining unit	Attached; OPCON; TACON; GS; GSR; R; DS
OPCON	Gaining unit	Parent unit and gaining unit; gaining unit may pass OPCON to lower HQ ¹	Parent unit	Gaining unit	As required by gaining unit	As required by gaining unit and parent unit	Gaining unit	OPCON; TACON; GS; GSR; R; DS
TACON	Gaining unit	Parent unit	Parent unit	Gaining unit	As required by gaining unit	As required by gaining unit and parent unit	Gaining unit	TACON; GS; GSR; R; DS

Note: ¹ In NATO, the gaining unit may not task-organize a multinational force. (See TACON.)

ADCON	administrative control	HQ	headquarters
AO	area of operations	N/A	not applicable
ASCC	Army Service component command	NATO	North Atlantic Treaty Organization
DS	direct support	OPCON	operational control
GS	general support	R	reinforcing
GSR	general support–reinforcing	TACON	tactical control

Figure 13. Army Command Relationships

The figure displays the Army's five command relationships as well as the responsibilities inherent with each. Of interest for this study are the differences between organic, assigned, and attached relationships.

Source: Department of the Army, Army Field Manual (FM) 6-0, *Commander and Staff Organization and Operations* (Washington, DC: Government Printing Office, 2014), B-3.

The Army also establishes support relationships; these relationships do not constitute an establishment of command authority. Commanders assign support

relationships when the echelon of the supporting unit is the same or higher than the supported unit or if the supporting unit is providing support to several units simultaneously.¹¹⁹ The two most typical support relationships established for sustainment are direct support and general support.

Direct support is a relationship requiring a force to support another specific force and authorizing it to answer directly to the supported force's request for assistance. A unit assigned a direct support relationship retains its command relationship with its parent unit, but is positioned by and has priorities of support established by the supported unit.¹²⁰ General support is a relationship where the supporting unit provides support to multiple units or provides support on an area basis without being aligned with a particular subdivision of the force. Units assigned a GS relationship are positioned and have priorities established by their parent unit.¹²¹

¹¹⁹ Ibid., B-4.

¹²⁰ Department of the Army, Army Doctrinal Reference Publication (ADRP) 5-0, *The Operations Process* (Washington, DC: Government Printing Office, 2012), 2-18.

¹²¹ Ibid.

If relationship is:	Then inherent responsibilities:							
	Have command relationship with:	May be task-organized by:	Receive sustainment from:	Are assigned position or an area of operations by:	Provide liaison to:	Establish/maintain communications with:	Have priorities established by:	Can impose on gaining unit further command or support relationship by:
Direct support¹	Parent unit	Parent unit	Parent unit	Supported unit	Supported unit	Parent unit; supported unit	Supported unit	See note ¹
General support	Parent unit	Parent unit	Parent unit	Parent unit	As required by parent unit	As required by parent unit	Parent unit	Not applicable
Note: ¹ Commanders of units in direct support may further assign support relationships between their subordinate units and elements of the supported unit after coordination with the supported commander.								

Figure 14. Army Support Relationships

The figure displays two of the Army's four support relationships as well as the responsibilities inherent with each. Of particular interest are the differences between which headquarters is capable of establishing priorities for the supporting unit.

Source: Department of the Army, Army Field Manual (FM) 6-0, *Commander and Staff Organization and Operations* (Washington, DC: Government Printing Office, 2014), B-3.

In the AoE, the main and forward support battalions were organic to the DISCOM, which in turn, was organic to the division. This established a clear and concise chain of command enabling the division commander to ensure sustainment priorities properly aligned support assets to the planned operation. In modularity, many of the sustainment organizations were removed from the division and consolidated under sustainment brigades that are assigned to theater sustainment commands. The BSB became an organic unit within the modular ABCT, and the BSB contained sustainment

assets designed to allow the BCT to self-sustain for up to 72 hours.¹²² The Army 2020s concept of support increases the dependence on the CSSB, which is not included in the command relationship in the BCT and division.

Culturally, military leaders have a desire to have direct control of all their assets. Maneuver commanders are hesitant to work under a support relationship for concerns regarding shortfalls in support.¹²³ Concerns regarding the ability of sustainment brigade and CSSB to provide support simultaneously for numerous units arose during the Sustainment Operational Assessment conducted as part of the Army 2020 TF's analysis.¹²⁴

Having discussed sustainment, at a theoretical level, it is necessary to provide a concrete experience from which to build a basis for requirements of an Army at war. Operation Iraqi Freedom (OIF) provides the operational parameters needed to identify requirements in combat against a near peer threat since the maneuvers conducted used many of the same combat systems available today. The ground campaign, particularly the actions of 3rd Infantry Division (ID) from the 19th to the 30th of March 2003, is the most recent historical example of combined arms maneuver against an armored force.

From Theory to Reality-Operation Iraqi Freedom

The success of OIF challenged engrained concepts of force ratios required to defeat an opponent in the defense, as coalition ground forces were outnumbered in both

¹²² Department of the Army, FM 4-90, *Brigade Support Battalion*, 1-12.

¹²³ Abraham, 15.

¹²⁴ TRADOC Analysis Center, "Sustainment Operational Assessment" (Outbrief provided to MG Hodge, 10 June 2012). Slides 5, 8, 13, 15, 17.

personnel and tanks at a minimum of two to one.¹²⁵ Army planners maximized surprise and their operational tempo to overcome these disadvantages. The armored assault into Baghdad was the culmination of the extremely aggressive campaign plan during OIF.

When the initial assault into Iraq began, the coalition's principal ground units were the Army's V Corps, the 1st Marine Expeditionary Force (MEF), and the 1st British Armored Division.¹²⁶ The 3rd ID spearheaded V Corps' drive into Iraq and was responsible for securing An Nasiriyah with its access to Tallil Air Base and a major bridge across the Euphrates River.¹²⁷ They then had to secure An Najaf to establish a logistics node there for follow on operations to seize Baghdad. This required the division to secure supply routes covering over 240 miles of terrain. 3rd ID successfully accomplished these goals within three days of the initial assault into Iraq.

¹²⁵ Anthony H. Cordesman, *The Iraq War: Strategy, Tactics, and Military Lessons* (Westport, CT: Praeger, 2003), 37.

¹²⁶ United States Military Academy Department of History, "Operation Iraqi Freedom," accessed March 21, 2015, <http://www.usma.edu/history/SiteAssets/SitePages/Iraq/IraqiFreedomText.pdf>.

¹²⁷ Gregory Fontenot, E. J. Degen, and David Tohn, *On Point—The United States Army in Operation Iraqi Freedom* (Fort Leavenworth, KS: Combat Studies Institute Press, 2004), 116.

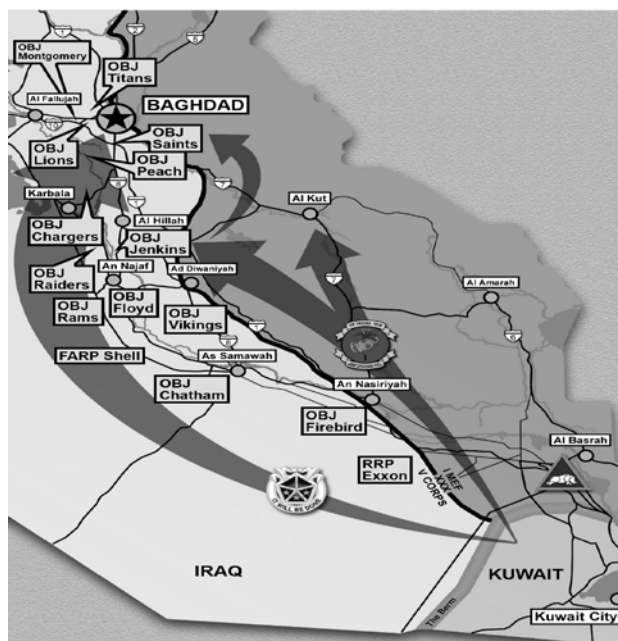


Figure 15. Maneuver of Ground Forces in OIF I

The figure summarizes the movement of ground forces in OIF I and shows the axis of advance for both the 1st MEF and V Corps.

Source: Gregory Fontenot, E. J. Degen, and David Tohn, *On Point—The United States Army in Operation Iraqi Freedom* (Fort Leavenworth, KS: Combat Studies Institute Press, 2004), 144.

The V Corp advance slowed from the 24th to the 30th of March for several reasons including a severe sandstorm, attacks by paramilitary forces, the need to maintain security along key supply routes, and moving units to relieve 3rd ID units from rear area security roles.¹²⁸ Additionally, a delay prior to assaulting Baghdad had been incorporated into war plans to build sustainment capability at Logistics Support Area (LSA)

¹²⁸ Eric Peltz, John M. Halliday, Marc L. Robbins, and Kenneth J. Girardini, *Sustainment of Army Forces in Operation Iraqi Freedom* (Santa Monica, CA: RAND, 2005), 7.

Bushmaster near An Najaf.¹²⁹ The pause provided V Corps the time needed to reallocate the 101st Airborne Division and a BCT from the 82nd Airborne Division to take responsibility for security along the southern supply routes and clear paramilitary forces from the southern cities. This series of actions enabled the 3rd ID to consolidate its forces and prepare to restart the offensive towards Baghdad on 31 March.¹³⁰

Rate and Distance of Advance: World War II Through Operation Iraqi Freedom

Commander, Organization	War	Start	Finish	Miles	Days	Miles/Day
Guderian, XIX Corps	WWII	Germany	Brest-Litovsk	325	14	23
Guderian, XIX Corps	WWII	Germany	Sedan	80	3	27
Guderian, XIX Corps	WWII	Germany	Dunkirk	144	11	13
Guderian, 2nd Panzer Group	WWII	Poland	Smolensk	413	25	17
Rommel, Africa Corps	WWII	El Agheila	Tobruk	1400	90	16
Montgomery, Eighth Army	WWII	El Alamein	Tunisia	248	16	16
Gavish, Southern Command	6 Day War	Israel	Suez	120	4	30
Yeosock, Third Army	ODS	Saudi Arabia	An Nasiriyah	210	4	53
Wallace, V Corps	OIF	Kuwait	An Najaf	220	3	73
Wallace, V Corps	OIF	Kuwait	Baghdad	350	14	25

Figure 16. Historic Armored Rates of Advance

The figure provides a comparison of the rates of advance during previous operations. This allows the reader to fully appreciate the pace and scale, in distance, of the maneuvers conducted by 3rd Infantry Division during the assault on Baghdad as well as the distance covered by sustainers pushing supplies from Kuwait.

Source: Eric Peltz, John M. Halliday, Marc L. Robbins, and Kenneth J. Girardini, *Sustainment of Army Forces in Operation Iraqi Freedom* (Santa Monica, CA: RAND, 2005), 6.

¹²⁹ James Kitfield, "Attack Always," *Government Executive*, May 6, 2003, accessed March 20, 2015, <http://www.govexec.com/defense/defense-beat/2003/05/attack-always/14015/>.

¹³⁰ Peltz et al., 57.

Within a week of the resumption of combat actions, the U.S. had elements of the 3rd ID and 1st MEF around Baghdad. Three days of hard fighting in the capital effectively toppled Saddam's regime and soldiers and marines were able to maneuver through the city at will.¹³¹ While the exact date of the collapse of the Iraqi Regime is debatable, by the 10th of April a majority of Iraq's combat forces were defeated.¹³² The fall of Baghdad marked the end of major combat operations in Iraq and completed one of the fastest ground assaults in recent history.

Sustainment During Operation Iraqi Freedom

While combat operations for OIF are generally viewed as successful, the sustainment of these operations was close to failure due to a myriad of issues.¹³³ OIF represents a time where the sustainment community was at a crossroads regarding revisions to the methods used to support combat forces. The sustainment units used in OIF were an Army of Excellence force transitioning from a supply system based on large stockpiles spread throughout the area of operations to one focused on reduced inventory and more timely distribution. Issues in sustainment for OIF highlight the difficulties in supporting continuous combat operations over extended distances.

The desire for the campaign to be executed quickly and with a smaller footprint than that involved in Operation Desert Storm led sustainers to shift towards distribution-based logistics (DBL) eliminating the large logistics stockpiles commonly referred to as

¹³¹ Fontenot et al., 374.

¹³² Ibid., 378.

¹³³ Peltz et al., 3.

iron mountains that tended to symbolize sustainment before OIF.¹³⁴ DBL does not mean that inventory is not kept in forward units or LSAs; however, it reduces the ability to cover disruptions in distribution flow and maintains minimal buffer stocks forward. DBL, more commonly referred to as just in time logistics, is a concept based on the commonly accepted business principles highlighted earlier in this chapter and emphasizes speed in acquiring supplies from the strategic base, accurately tracking them through the supply chain, and rapidly distributing them to the using unit.

Unfortunately, during OIF, the distribution capability available in theater was not able to meet the requirements generated by a force in combat. When 3rd ID crossed into Iraq the 377th Theater Support Command and 3rd COSCOM only had 25 percent of their required medium trucks available to conduct distribution operations.¹³⁵ The lack of trucks was exacerbated as truck companies were either removed from the deployment plan or had their arrival in theater shifted to a later date.¹³⁶ To account for these losses in capability, sustainment planners had hoped to rely on contracted logistics support. Regrettably, the contract awarded to Kellogg Brown and Root (KBR) only called for a specific number of vehicles and did not specify an operational readiness requirement.¹³⁷ This meant that a number of the vehicles supplied by KBR suffered from severe mechanical issues and further limited the distribution capacity in the theater.

¹³⁴ Ibid., 2.

¹³⁵ Ibid., 17.

¹³⁶ Ibid., 21.

¹³⁷ Ibid., 25.

These issues resulted in a reactive distribution system where the priorities were limited to food, water, and ammunition (bulk fuel was the one commodity that was readily available in theater).¹³⁸ The lack of transportation assets also contributed to resupply by inundation (RBI). RBI was created when a shortage in a class of supply required a surge of trucks to push resupply forward. Often this overwhelmed the supported unit's capability in that supply item but created a shortage in another class of supply starting the cycle all over again.¹³⁹ DBL did not account for RBI as the reduction in forward stocks and distribution assets, coupled with long distances between supply points, and enemy threats along the routes connecting the supply points meant there was a risk to forces of running out of supplies if there were any unexpected disruptions of the supply lines.

When 3rd ID slowed their advance (24 to 30 March), they had reached the limits of their logistics tether and needed resupply. The weather and road conditions slowed logistics convoys and the Army knew it would be impossible to advance without improving the logistics situation. V Corps plans called for the establishment of LSA Bushmaster near An Najaf to refit and rearm the 3rd ID prior to assaulting in to Baghdad. LSA Bushmaster reduced the length between supply lines for division assets and kept round-trip times from getting even longer. During the delay, more trucks began to arrive in theater and the number available in 3rd COSCOM's available increased by 63 percent.

¹³⁸ Ibid., 27.

¹³⁹ Bernard L. Moxley Jr., "Class III (Bulk) Distribution Successes: What Can Be Learned?" (Monograph, School of Advanced Military Studies, Fort Leavenworth, KS, 2005), 22.

This increased the ability of the logistics pipeline from Kuwait to approach the desired levels of supply and maintain a reliable distribution flow from this time forward.¹⁴⁰

Sustainment during OIF shows how crucial logistics is to operations. This was the first usage of DBL in military operations and due to a reduction in sustainment forces deployed prior to beginning the assault, the unexpected threats to the supply routes, and weather delays the reduction in stocks forward almost led to the 3rd ID's culmination. The reduced stocks and difficulties obtaining in transit visibility created discomfort amongst the maneuver forces and provide a recent demonstration of the negative effects from not properly integrating sustainment efforts with operations.

Summary

The Army's sustainment principles are based off of commonly accepted principles that are integral to successful business operations. The only identified tension between the Army's principles and the universal principles come in the realm of effectiveness versus efficiency. The tension comes from the fact that the Army's customer, the soldier, operates in an environment that is often far from the industrial base, with limited distribution networks, and a constant threat both to the supply chain and the soldier. These factors lead to the need for some redundancies in the system to account for loss. The Army's sustainment principles are present no matter which force structure they support just the units and methods change.

In the past 30 years, the Army has undergone several force structure changes due to a changing operational environment including the collapse of the Soviet Union, the rise

¹⁴⁰ Peltz et al., 58.

of asymmetric threats posed by non-state actors, and restrictions imposed on the force in an era of fiscal uncertainty. These changes resulted in the Army's shift from the AoE to modularity and the brigade-centric force. Recently, the reduction in forces involved in the Global War on Terror, revised strategic goals, and similar fiscal uncertainty are driving the development of the Army 2020 concept. In response to these changes, the Army has revised its sustainment doctrine, force structure, and relationships.

The Army 2020 design has reduced sustainment capabilities within the BSB and created division and corps aligned CSSBs. These changes created a force structure eerily reminiscent of AoE support structures. However, these new CSSBs retain the command and support relationships established in modularity and do not fall under the division for mission command.

The rapid assault into Iraq during OIF I, demonstrated America's belief in decisive action when waging warfare to bring about a swift and violent end to the conflict at hand.¹⁴¹ The desire for a swift end to the conflict brought the sustainment system near its breaking point. The review of OIF made it clear that sustainment operations during war directly tie in to the operational reach of the maneuver units. The study of combat and sustainment operations during OIF I established the operational parameters necessary for use in this study in chapter 4. The 3rd Infantry Division's execution of major combat operations in an arid environment provided the control variables to conduct a comparison between the sustainment capabilities available at the BCT level in the Modular Army and the Army 2020 design.

¹⁴¹ Victor Hanson, "The Western Way of War," *Australian Army Journal* 2, no. 1 (2004): 160-161.

Conclusion

The documents reviewed in this chapter identified a set of commonly accepted logistics principles and revealed how the Army built their sustainment principles accordingly. The research identified how operations and sustainment were conducted in the AoE, the Modular Army, and how they will be conducted in the Army 2020. The documents identified assumptions in the creation of the Army 2020 and the risks associated with the reduction in capabilities at the BSB. The review summarized current knowledge regarding the research topic. In order to answer the research questions, a method must be designed to analyze the data collected here to infer any meaning. The methodology in chapter 3 describes the method used to conduct this analysis.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

A sound logistics plan is the foundation upon which a war operation should be based. If the necessary minimum of logistics support cannot be given to the combatant forces involved, the operation may fail, or at best be only partially successful.¹⁴²

— Admiral Raymond A. Spruance

This chapter describes the research methodology used in this study to determine risks associated with recent Army organizational change and to suggest mitigation strategies. The research was conducted using a mixed methods approach. The chapter begins with a step-by-step explanation of the method used in this study, and then summarizes the processes used to select data for inclusion in the study. The chapter also includes a description of how the data was analyzed qualitatively and then quantitatively. The role of the researcher is explained in order to present any possible biases that existed in the research and then a discussion of how the researcher negated these biases to increase the validity of his findings is included in the standards of quality and verification.

Primary Research Question

How should the Army mitigate risk that may be created through increased reliance on EAB sustainment during ABCT operations in the Army 2020 force structure?

¹⁴² Naval Supply Systems Command (NAVSUP), “Logistics Quotations.”

Secondary Research Questions

1. What are the fundamental principles of sustainment upon which the Army bases its sustainment doctrine?
2. How has the Army conducted brigade level sustainment historically?
3. What effects have the changes in sustainment force structure had across the principles of sustainment?
4. What sustainment risks has the Army 2020 force structure change created for ABCT operations?

Methodology

This study consists of a mixed methods approach using an exploratory sequential design that involves the analysis of both quantitative and qualitative data in which the data is collected sequentially, and involves the integration of the data at one or more stages in the process of research.¹⁴³ The process this study uses, began with a qualitative analysis to explore the sustainment capabilities involved in both the Modular Army and the Army 2020 constructs. A quantitative analysis on fuel available within the ABCT is conducted to validate the findings of the qualitative analysis. Lastly, the fuel capabilities from both force structures are applied in a historical model to validate any effect on endurance in the offense. The researcher chose the exploratory sequential design for his

¹⁴³ John W. Creswell, Vicki L. Clark, Michelle L. Gutmann, and William Hanson, “Advanced Mixed Methods Research Designs,” in *Handbook of Mixed Methods in Social and Behavioral Research*, ed. Abbas Tashakkori and Charles Teddlie (Thousand Oaks, CA: SAGE Publications, 2003), 212.

analysis as it involves the use of both qualitative and quantitative approaches collected sequentially to increase the overall strength of the study.¹⁴⁴

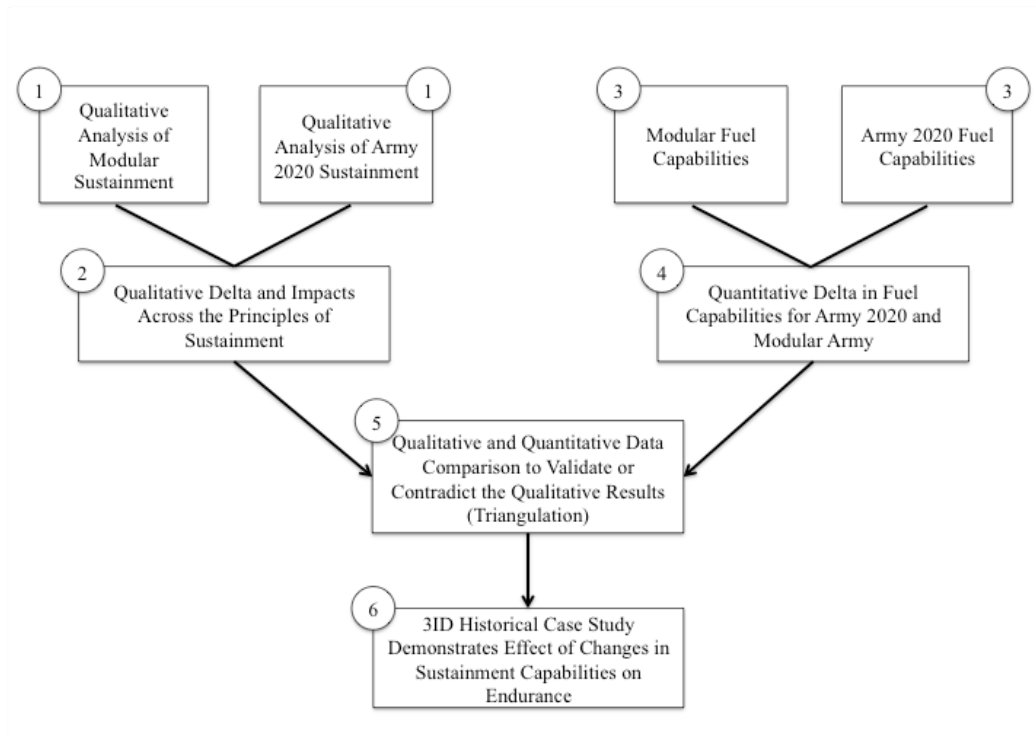


Figure 17. Methodology

Graphic representation of the study's methodology, the chart depicts the flow of information from the qualitative to the quantitative and how these either supported or contradicted the original hypothesis. Finally, an experiment using control data from OIF is conducted to determine the impacts of force structure changes on operational endurance.

Source: Created by author.

The following is a step-by-step description of the methodology used for this research project:

¹⁴⁴ John W. Creswell, Vicki L. Clark, *Designing and Conducting Mixed Methods Research* (Thousand Oaks, CA: SAGE Publications, 2007), 5.

1. Initially it is important to establish a baseline of the current sustainment capabilities within the Modular Army and the expected capabilities of the Army 2020 concept to determine the effects of any changes in their capabilities. The capabilities are derived from an examination of ADP 4-0 Sustainment 2012, ADRP 4-0 Sustainment 2012, ATP 4-93 Sustainment Brigade 2013, FM 4-90 Brigade Support Battalion 2010, ATP 4-90 Brigade Support Battalion 2014, CASCOM's Sustainment Concept of Support 2013, TRADOC's Army of 2020 Analysis Supporting the Brigade Combat Team Design Decision 2012, and SURVIAC's Report of Assessment of New DOTMLPF Capabilities: Army 2020 Sustainment Workshop 2013.

2. The data for each force structure identified in Step 1 is now analyzed using the Army's sustainment principles as evaluation criteria. According to the Army's 2012 Army Doctrinal Reference Publication (ADRP) 4-0, the doctrinal definitions for each of the principles of sustainment are:

- a. Integration is combining all of the sustainment elements within operations assuring unity of command and effort.
- b. Anticipation is the ability to foresee operational requirements and initiate necessary actions that most appropriately satisfy a response without waiting for orders.
- c. Responsiveness is the ability to react to changing requirements and respond to meet the needs to maintain support.
- d. Simplicity relates to processes and procedures to minimize the complexity of sustainment.

- e. Economy is providing sustainment resources in an efficient manner that enables the commander to employ all assets to the greatest effect possible.
- f. Survivability is all aspects of protecting personnel, weapons, and supplies while simultaneously deceiving the enemy.
- g. Continuity is the uninterrupted provision of sustainment across all levels of war.
- h. Improvisation is the ability to adapt sustainment operations to unexpected situations or circumstances affecting a mission.

This portion of the analysis addresses the suitability of the changes made by using the eight principles of sustainment as measures of performance in an attempt to determine if the Army 2020 force structure improves sustainment operations.¹⁴⁵ The author uses his personal experience as an Army logistician and basic understanding of sustainment doctrine to interpret whether or not the change was positive (+), negative (-), or had no effect on operations (0). This method is applied across all eight principles and tallied to determine the overall impact of the changes.

¹⁴⁵ Department of the Army, ADRP 5-0, *The Operations Process*, 5-2.

Table 1. Evaluation Criteria

Integration	Anticipation	Responsiveness	Simplicity	Economy	Survivability	Continuity	Improvisation	Magnitude of Difference

This table demonstrates how the study uses the Army's sustainment principles, identified in chapter 2, as evaluation criteria for the changes in sustainment operations from Modularity to the Army 2020.

Source: Created by author.

3. The results of the qualitative capabilities comparison conducted in Step 2 are largely theoretical and pose a challenge in drawing definitive conclusions regarding the effects of the force structure change. Therefore, it is important to conduct a quantitative analysis. To do this, this study focuses on the quantitative fuel capabilities within the ABCT. Fuel is one of the most critical assets required in maintaining initiative in the offense and ties directly back to the primary research question.¹⁴⁶ The lack of fuel assets in an attack can greatly reduce the endurance of an assault. In order to determine the capabilities in each structure the study identifies fuel storage and distribution assets in the BSB of an ABCT. The data comes from the CGSOC Student Text 4-1 June 2013, CASCOM's Sustainment Concept of Support, July 2013, and CASCOM's Concept of Support for Army 2020 Tactical Level Sustainment Support BCT/CSSB briefing obtained from CASCOM's Force Development Directorate in January 2015, and FMSWeb. FMSWeb is a website providing force structure information for all Army units.

¹⁴⁶ Department of the Army, ADRP 4-0, *Sustainment*, 3-14.

4. The quantitative capabilities identified in step three are depicted in a chart comparing and contrasting the differences between the force structures. The chart summarizes the CL III (B) assets in the ABCT. These assets include the number of 5,000-gallon fuel tankers, 2,500-gallon heavy expanded mobile tactical trucks (HEMTT), and fuel system supply points (FSSP) as well as a summary of the overall number of gallons of fuel that can be stored within a BSB in each force structure. This data provides the quantitative statistics used to determine the feasibility of the revised force structure in sustaining ABCT operations.

Table 2. Bulk Fuel Capacity

CLIII (B) System	Army 2020	Modular Army	Difference (Gallons)
5,000 Gallon Tanker			
2,500 Gallon HEMMT			
2,500 Gallon Modular Fuel Racks			
1,000 Gallon Tank and Pump Unit (TPU)			
FSSPs (gallons storage)			
Total Fuel Capacity			

This table demonstrates how the study compares and contrasts fuel capabilities available in the Modular Army and the Army 2020 construct. Determines the total loss or gain of capability generated by the changes to each force structure.

Source: Created by author.

5. The results of the quantitative analysis either validates or invalidates the results of the quantitative analysis. The hypothesis is that the results will demonstrate a significant change in capability. The argument to address these changes is confirmed by multiple data sources and methods (qualitative and quantitative). This confirmation means triangulation is achieved within the analysis of the data.

6. To further validate the outcome of the author's model, this study pursues an experiment using the operational requirements generated during 3rd Infantry Division's march to Baghdad during Operation Iraqi Freedom. This final step of the study provides a definitive example of the impacts of the force structure changes made in the Army 2020 design.

The study uses several variables, or measureable characteristics, throughout the experiment including independent, dependent, and control variables. An independent variable is one that probably causes or influences the outcome.¹⁴⁷ The dependent variable depends on the independent variable; they are the results of the changes created by the independent variable.¹⁴⁸ Finally, the control variable is used as a constant and unchanging standard of comparison in scientific experimentation.¹⁴⁹

The quantitative fuel capabilities identified in Step 4 serve as the independent variable. The output, or dependent variable, is the effect these changes have on a maneuver commander's endurance during offensive operations as defined by distance traversed before the ABCT's internal sustainment capabilities are exceeded. The control variables in the study are the operational parameters established by the historical case study of 3rd Infantry Division's actions in Operation Iraqi Freedom in 2003. The specific control variables are using major combat operations in an arid environment in the Army's Quick Logistics Estimate Tool (QLET) to determine the requirements for both force

¹⁴⁷ John W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Method Approaches*, 3rd ed. (Thousand Oaks, CA: SAGE Publications, 2009), 50.

¹⁴⁸ Ibid.

¹⁴⁹ Dictionary.com, s.v. "control variable," accessed February 15, 2015, <http://dictionary.reference.com/browse/control+variable>.

structures. This case study provides a consistent set of logistics requirements used throughout the experiment to ensure no intervening or mediating variables affected the outcome. The quantitative fuel capability for the BSB with an operational readiness (OR) rate of 100 percent for its equipment is listed. This study assumes that the OR rate for a unit in combat will not exceed 90 percent and reduces the gallons on hand within the ABCT accordingly. The study uses fuel consumption rates listed in the 2013 version of the ST 4-1 to identify the daily requirements, by battalion, in an ABCT.

To support offensive operations, the researcher assumes a desired supply status rate of no less than 70 percent for the combined arms battalions, cavalry battalion and BEB. BSB resupply operations are conducted to meet this objective until their bulk fuel supplies run out. Finally, the study assumes a rate of march of no more than six miles per hour during the offense. This enables the study to analyze the impacts of the force structure changes on an operation's endurance and addresses the acceptability of the loss of sustainment capability during an offensive operation.

Table 3. Bulk Fuel Distribution during Major Combat Operations

	Gallons OH @ 100% OR Rate	Gallons OH @ 90% OR Rate	Supply Status	Day 1 Requirements (Req)	Gallons OH	Supply Status	BSB Refuel Ops
Distribution Company							
CAV / RSTA FSC							
BEB FSC							
FA FSC							
CAB FSC							
CAB FSC							
CAB FSC							
TOTAL							

Bulk Fuel Distribution during Major Combat Operations. The table depicts the distribution of bulk petroleum from the BSB to the FSCs during major combat operations. The Army's Quick Logistics Estimate Tool (QLET) generates the daily requirements. This enables the reader to see the effects of the Army 2020 force structure changes of distribution operations within the ABCT.

Source: Created by author.

Data Collection Methods

There are four primary methods to collect data in qualitative analysis including observations, interviews, documents, and audio-visual materials.¹⁵⁰ The primary method for data collection for this mixed methods study on sustainment was via documents. Documents come in the form of primary and secondary sources. Primary resources are generated during the period under research and secondary sources are interpretations or analyzes of primary sources.¹⁵¹ To ensure validity, research was limited to public documents including previous Masters in Military Arts and Sciences theses, School for

¹⁵⁰ Creswell, *Research Design*, 180.

¹⁵¹ Princeton University, "Primary vs Secondary Sources," accessed February 15, 2015, <http://www.princeton.edu/~refdesk/primary2.html>.

Advanced Military Studies monographs, studies by research organizations, and published books for the literature review and is cited for reference.

The secondary data collection method for this mixed method analysis focused on quantitative data. The two most accepted methods for obtaining quantitative data are surveys and experiments.¹⁵² The method used in this study was an experiment designed to test the impact of the changes in sustainment capabilities at the BCT level on endurance in an operation. Data obtained was then compared with themes identified during the qualitative research to confirm or invalidate the hypothesis.

Data Analysis Methods

According to Webster's dictionary, the word analysis means a careful study of something to learn about its parts, what they do, and how they are related to each other.¹⁵³ This study involved organizing the data, organizing themes, representing the data, and forming an interpretation of what was discovered.¹⁵⁴ This study's method involved the sequential analysis of qualitative and quantitative data to validate the author's hypothesis.

Qualitative data analysis began immediately upon the selection of the research problem. To focus the analysis process the researcher followed these steps; get to know the data, focus the analysis, categorize information, identify patterns, and

¹⁵² Creswell, *Research Design*, 145.

¹⁵³ *Merriam-Webster Dictionary*, s.v. "analysis," accessed February 15, 2015, <http://www.merriam-webster.com/dictionary/analysis>.

¹⁵⁴ John W. Creswell, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, 3rd ed. (Thousand Oaks, CA: SAGE Publications, 2013), 179.

interpretation.¹⁵⁵ To focus the analysis, the researcher viewed all documents in relation to the problem statement and secondary research questions. Patterns were identified related to the primary and secondary research questions. Finally, these patterns were integrated to draw qualitative conclusions regarding changes in sustainment capabilities.

Quantitative data analysis was conducted following the collection of qualitative data. The quantitative sustainment capabilities are expressed in the number fuel assets (trucks and storage systems) and gallons of fuel available within the BSB in the ABCT in both the Modular Army and the Army 2020. This data was obtained using student texts from the Command and General Staff Officer's College (CGSOC), documents provided by CASCOM regarding the Army 2020, and government websites such as FMSWeb that provided the overall equipment available in each force structure.

Once capabilities were identified in each system, the data was input into an experiment using OIF I to establish the operational parameters for the design. This established a common set of requirements and conditions to test the varying sustainment capabilities, or independent variable, against. The outcome, or dependent variable, were effects that the changes in sustainment capability had on freedom of maneuver which for this study is defined as distance traveled prior to exhausting internal sustainment resources. This data was used to assess the suitability of the changes in sustainment within the ABCT.

¹⁵⁵ Ellen Taylor-Powell and Marcus Renner, *Analyzing Qualitative Data* (Madison, WI: Cooperative Extension Publishing Operations, 2003), 2.

Role of the Researcher

The role of the researcher varied depending on the type of data being analyzed. In qualitative research, data is mediated through the human instrument and the readers of the research need to know about that instrument.¹⁵⁶ In this study, the author is the human instrument in question and must describe relevant aspects of self, including any biases and assumptions, any expectations, and experiences to qualify his ability to conduct the research.¹⁵⁷

This research used an emic approach, meaning that the researcher is an insider to the process or program being studied.¹⁵⁸ As a Logistics Officer in the U.S. Army for over thirteen years, the researcher is a part of the process regarding the restructuring of the Army's sustainment force structure. The impacts on sustainment created by the addition of the third maneuver battalion to each ABCT directly affect the author and drove the desire for further research. If the support structure is not adequate for the warfighter in the ABCT then sustainment, at its most basic level, is failing to meet the Chief of Staff of the Army's intent to maintain the ABCT as an expeditionary self-sufficient force. With experiences at both the tactical and operational levels in the Army, the researcher has the background necessary to understand concepts discussed in this thesis.

The familiarity with the Army's sustainment concept created a bias prior to beginning analysis. Personal experience already demonstrated a need for greater

¹⁵⁶ Marilyn Simon, "The Role of the Researcher," accessed February, 16, 2015, <http://dissertationrecipes.com/wp-content/uploads/2011/04/Role-of-the-Researcher.pdf>.

¹⁵⁷ Ibid.

¹⁵⁸ Ibid.

sustainment assets during operations creating a wariness of any plan involving removing capabilities from the ABCT. This bias led to the choice of the exploratory sequential design since the qualitative and quantitative data would serve as a check and balance system to counter this bias. Quantitative data should be repeatable by others and, under the same conditions, should yield similar results removing biases and subjectivity.¹⁵⁹

Members of this study's committee, two of which also have sustainment backgrounds, further balanced any pre-existing biases. Peer reviews occurred throughout the process. The peer reviews expanded the initial views and questioned assumptions ensuring a more valid use of source data. Using the exploratory sequential design, peer reviews, and the committee review, any biases are sufficiently countered enabling valid inferences upon the completion of analysis.

Standards of Quality and Verification

The primary control measure to ensure quality research was conducted was the use of multiple methods and sources to provide corroborating evidence.¹⁶⁰ Triangulation occurred during qualitative data collection when information from different sources confirmed one another. This process was crucial in identifying the sustainment principles and capabilities of sustainment organizations. When more than one resource confirmed a sustainment principle or capability, triangulation was achieved.

To further ensure the validity of the data, quantitative results from the experiment corroborate or contradict the qualitative results. The assumption is that if findings

¹⁵⁹ Ibid.

¹⁶⁰ Creswell, *Qualitative Inquiry and Research Design*, 251.

obtained via the quantitative analysis confirmed those of the qualitative analysis, then the validity of those findings have been established.¹⁶¹ This second set of corroborating data further strengthens the validity of inferences drawn by the researcher.

The third control measure used to assist in quality assurance and verification was the use of a peer review. This review provided an external check on the research process. Peers served in the role of devil's advocate and asked hard questions about the methods used, meanings, and interpretations; and provided a chance to discuss frustrations or accomplishments along the way.¹⁶² The use of multiple methods of data analysis to ensure triangulation as well as a peer review confirms the credibility of the research conducted.

Summary

The exploratory sequential design increases the reliability of the research. Reliability is defined as the extent to which a test or procedure produces similar results under constant conditions.¹⁶³ By conducting a qualitative analysis in examining multiple documents regarding sustainment force structure, this study is able to identify the capabilities available in each construct. The quantitative analysis of bulk fuel validates or invalidates the findings of the qualitative analysis and establishes the base capabilities to be applied against requirements generated in an historical case study, further validating

¹⁶¹ David Silverman, *Interpreting Qualitative Data: A Guide to the Principles of Qualitative Research*, 4th ed. (London: SAGE Publications, 2011), 369.

¹⁶² Creswell, *Qualitative Inquiry and Research Design*, 251.

¹⁶³ Judith Bell, *Doing Your Research Project: A Guide for First-Time Researchers in Education, Health, and Social Science*, 5th ed. (Maidenhead, United Kingdom: McGraw-Hill Open University Press, 2010), 119.

the negative effects of the changes in sustainment by demonstrating their impact on operations.

Conclusion

The method described in this chapter provided the tools necessary to conduct and validate the research. By providing a detailed explanation of the steps taken, the researcher enables the confirmation of the results in subsequent studies. The method established in chapter 3 was necessary to answer the research questions. Chapter 4 provides the findings of the analysis conducted using this method.

CHAPTER 4

FINDINGS AND ANALYSIS

Introduction

Logistic considerations belong not only in the highest echelons of military planning during the process of preparation for war and for specific wartime operations, but may well become the controlling element with relation to timing and successful operation.¹⁶⁴

— Vice Admiral Oscar C. Badger

The methodology used in this research was based on sustainment theory presented in chapter 2 and used both qualitative and quantitative data to address the research questions. The primary focus of this chapter is revealing those results beginning with a qualitative analysis of the impact the changes in force structure have on each of the principles of sustainment. This data is validated by the results of the quantitative analysis showing the decrease in capabilities, at the ABCT level, to provide bulk fuel to its forces. Finally, further validation of the results is achieved by inputting quantitative data into an experiment to determine the effects of the changes in sustainment force structure in the Army 2020 on the ABCT's endurance during combat operations.

Qualitative Analysis Results

The literature review revealed several substantial differences between sustainment in the Modular Army and the Army 2020. The concept of modularity came to fruition in the early 2000s as a response to increased demand for forces in the Global War on Terror. The Modular Army created a self-sustaining brigade centric force that was capable of

¹⁶⁴ Naval Supply Systems Command (NAVSUP), "Logistics Quotations."

rapidly deploying anywhere in the world. The HBCT consisted of two combined arms battalions, a reconnaissance squadron, a fires battalion, a brigade troops battalion and a support battalion. This reduced the number of maneuver battalions formerly found within a brigade in the AoE, but provided the BCT commander control over the enablers from the fires, recon, and troops battalion that had been lacking in the AoE.

To support the modular BCTs, the Army amended its AoE sustainment concepts to create efficiencies, flatten the command structure, and still provide in depth support within the BCT. These changes included the replacement of the DISCOM and MSB with Sustainment brigades and CSSBs that were removed from the division chain of command and instead assigned to the Theater Sustainment Commands. The BCT's only remaining organic sustainment unit, the BSB, provided the unit's logistical needs for up to 72 hours of continuous operations.

As the Army campaigns in Afghanistan and Iraq end, Congress has emplaced fiscal constraints in the Budget Control Act of 2011. The Army is reducing its end strength from a wartime high of 570,000 soldiers in the active army to no more than 490,000, with possible reductions to 420,000 if current discretionary cap reductions take effect in 2016. These constraints as well as previously existing gaps in capabilities led to the creation of the Army 2020 TF, tasked with reorganizing the force to maintain its lethality while reducing its end strength.

The Army 2020 TF recommended several changes, including reorganizing troops from inactivating units to grant the remaining BCTs a third maneuver battalion. This provided commanders with a similar maneuver capability to that of the AoE force structure. The additional maneuver battalion enables commanders to employ two

battalions while maintaining on in reserve, an option that was not available under modularity. The impact of adding the third maneuver battalion, while reducing the overall end strength in the Army, meant a reduction in the overall brigades in the force. In regard to the ABCT, there is a reduction from 26 HBCTs in Modularity to just 16 ABCTs in the Army 2020 force structure. Therefore, there is also a reduction of 10 BSBs.¹⁶⁵

Table 4. Effects of Reduction in BCTs

Design WIF	26 HBCTs with the Two- Maneuver Battalion Design	16 ABCTs with the Three- Maneuver Battalion Design	Changes to ABCT	Changes to the Army
Sustainment	• 130 Forward Support Companies (Five Forward Support Companies per ABCT)	• 96 Forward Support Companies (Six Forward Support Companies per ABCT)	• Gains one Forward Support Company	<ul style="list-style-type: none"> • Loss of 34 Forward Support Companies • Loss of ten Medical Companies • Loss of ten Maintenance Companies • Loss of ten Transportation Companies

This table summarizes the impacts of the Army's change to using the three-maneuver battalion design in Army 2020. It provides a snapshot of gains and losses in regards to company strength sustainment elements.

Source: Jonathan B. Godwin, "Armored Brigade Combat Teams: Back to the Future" (Master's thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 2014), 46.

The significant reduction in the overall number of sustainment battalions and companies across the Army did not alleviate issues regarding the Army 2020 force cap of 4,500 soldiers at the brigade level. The additional maneuver battalion and the BEB each

¹⁶⁵ Jonathan B. Godwin, "Armored Brigade Combat Teams: Back to the Future" (Master's thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 2014), 46.

required their own FSC. The additional FSCs are assigned to the BSB and raised the total personnel in the BSB of an ABCT from 996 in Modularity to over 1,300 in the Army 2020.¹⁶⁶ The addition of over 300 soldiers to the BSB was not coupled with any increase in the size of the battalion's staff. In fact, the officer in charge of the battalion S3 section is reduced in grade from a Major (O-4) to a Captain (O-3). This change leads to a loss of up to six years experience in the section responsible for ensuring warfighting function integration and synchronization across the planning horizons in current operations, future operations, and plans.¹⁶⁷ The support operations section of the BSB, which is primarily responsible for synchronizing the distribution operations for all units assigned or attached to the brigade, receives no additional personnel to assist with the integration of the new units into the brigade concept of support.¹⁶⁸

¹⁶⁶ MG Duane A. Gamble, "CSSB Passback," e-mail message to the author, April 22, 2015.

¹⁶⁷ Department of the Army, ATP 4-90, *Brigade Support Battalion*, 2-4.

¹⁶⁸ *Ibid.*, 2-5.

Table 5. BSB Staff Comparison

	HBCT BSB (Current)	ABCT BSB (Army 2020)
BN Staff	83	83
Distribution Company	156	143
Maintenance Company	96	94
Medical Company	82	82
Recon FSC	120	114
BEB FSC	N/A	138
FA FSC	115	149
Combined Arms BN FSC	344	525
	(172 x 2)	(175 x 3)
Total	996	1328

The total number of personnel in a BSB within the ABCT increases in Army 2020. The additional manpower and equipment associated with the addition of the FSCs for the BEB and third combined arms battalion provide created the need to shift capabilities to EAB organizations to keep the overall end strength of the BCT near 4,500 soldiers.

Source: MG Duane A. Gamble, “CSSB Passback,” e-mail message to the author, April 22, 2015.

In addition to the changes in personnel, the ABCT brigade support battalions lose significant capabilities. The 5K petroleum tankers and the FSSP are removed from the BDE entirely along with the capability to produce purified water. These changes were required to meet General Raymond T. Odierno’s force cap of 4,500 soldiers per brigade combat team after the addition of the extra maneuver battalion. Losing these assets resulted in an increased reliance on echelon above brigade sustainment assets in order to mitigate the loss in supply capability.¹⁶⁹

In regard to water purification, the BSB lost eight water treatment specialists from the distribution company’s water section. The Tactical Water Purification System and the Lightweight Water Purification System provided the combined capability to produce up

¹⁶⁹ Department of the Army, *Sustainment Concept of Support*, 6.

to 1,325 gallons of potable water per hour from a salt-water source.¹⁷⁰ This ability is entirely removed from the BSB in the Army 2020 design. Additionally the researcher identified the minimum daily requirements of water to support a brigade using 7.23 gallons of water per person per day as the required rate to sustain soldiers in an arid environment.¹⁷¹ Taking that rate and multiplying it by the number of soldiers assigned to the ABCT in both the Modular Army and the Army 2020 provided the daily requirement for the brigade in each force structure. The Modular HBCT requires 24,813 gallons a day, while the Army 2020 ABCT requires 33,413 gallons per day. The researcher identified that in the Army 2020 there is a reduction in water storage capacity from 39,000 gallons to 29,600 gallons. This means that the BCT is no longer capable of storing or generating its daily potable water requirements creating a need for a daily resupply from EAB assets. The elimination of purification assets combined with a reduction in storage capability creates a resupply by inundation (RBI) design.

The overall effect of the loss in equipment and personnel is the increased dependence on EAB sustainment for water purification and bulk petroleum. This dependency led to further revisions in sustainment doctrine and force structure. The Army is creating three corps and 10 division aligned CSSBs and sustainment brigades in the active component to create pre-deployment support relationships between the EAB

¹⁷⁰ Department of the Army, ST 4-1. *Theater Sustainment Battle Book*, 4-3.

¹⁷¹ U.S. Army Combined Arms Support Command, *Water Planning Guide: Potable Water Consumption Planning Factors By Environmental Region and Command Level* (Ft Lee, VA: Force Development Directorate, November 25, 2008), accessed May 21, 2015, [http://www.quartermaster.army.mil/pwd/publications/water/Water_Planning_Guide_rev_103008_dtd_Nov_08_\(5-09\).pdf](http://www.quartermaster.army.mil/pwd/publications/water/Water_Planning_Guide_rev_103008_dtd_Nov_08_(5-09).pdf).

units and the BCTs they help sustain.¹⁷² The Army maintains that these changes are not indicative of a return to a division centric-force; however, the sustainment command and support relationships are certainly reminiscent of those that existed in the AoE.¹⁷³

Merely identifying the changes between sustainment in Modularity and the Army 2020 is not enough to advance this field of study. This study's methodology provided a means to conduct a more thorough analysis of the effects these changes at the BCT using the Army's sustainment principles as evaluation criteria of to determine the suitability of the changes in structures. The qualitative analysis identifies the associated risks of the organizational changes and enabled the researcher to develop potential mitigation strategies.

Qualitative Delta and Impacts Across the Principles of Sustainment

The researcher used his thirteen years as an active duty Army Logistician and a basic understanding of the Army's current sustainment doctrine, to analyze the effects of both the reduction in capability within the ABCT and the reliance on support from the CSSB across the principles of sustainment. The researcher identified four critical changes in force structure between the Modular Army and the Army 2020 they are: changes in bulk fuel capabilities, increase of the BSB without a corresponding increase in the BSB staff, changes in water purification and distribution capabilities, and the increased dependency on EAB units in the Army 2020 Concept of Support. This chapter provides

¹⁷² Department of the Army, *Sustainment Concept of Support*, 11.

¹⁷³ LTC Mark A. Walker, Sustainment Headquarters (SRC 63) Organization Integrator HQDA G-3/5/7, e-mail message to author, April 17, 2015.

an explanation of the change or delta and then uses the Army's sustainment principles as measures of performance. This process allows the comparison between the two structures and develops an understanding of the difference between them. The change is then characterized as a negative impact, no change, or positive impact across each of the sustainment principles. The results of the qualitative analysis are described in the next four subchapters.

Modular Army and Army 2020 Force Structure Comparison: Changes in Bulk Fuel Capabilities

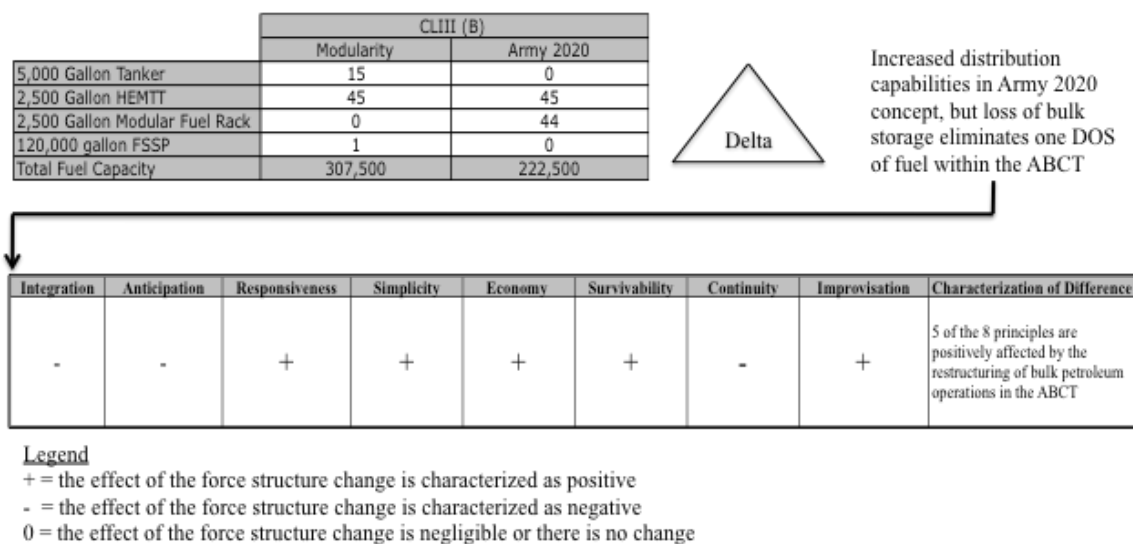


Figure 18. Changes in Bulk Fuel Capabilities

This figure identifies the differences in bulk fuel storage and distribution capabilities in the BSB of the Modular Army and Army 2020. The figure also summarizes the author's analysis of the impact of these changes across each of the principles of sustainment.

Source: Created by the author.

The characterizations of change identified in Figure 18 were developed based upon the following analysis:

1. Integration—In the Army 2020, the ABCT's sustainment planners must integrate their logistics plans with EAB concepts of support earlier in the fight due to the reduction in days of supply on hand. When compared with the capabilities of the Modular Army, this reduction in capability created an increased reliance on EAB efforts. The Army 2020 has yet to properly identify command and support relationships reducing unity of command. Therefore, the overall effect of the Army 2020 force structure change on integration is characterized as negative.

2. Anticipation—The ability for sustainment planners to accurately anticipate requirements in the Army 2020 force structure is reduced, temporarily, since requirements estimates for the newly established BEB coupled with the increase in requirements to support the third combined arms battalion must be verified during operations. Therefore, the effect of the Army 2020 force structure change on anticipation is characterized as negative.

3. Responsiveness—The BSB of Army 2020 has increased distribution capability over the Modular Army in terms of the maneuverability of the HEMTT refuelers, thereby increasing the BSB's ability to rapidly respond to demands for resupply. However, the increased reliance on EAB support for the third day of supply in the Army 2020 force structure, can negate the BSB's internal ability to provide responsive support to the maneuver elements. The researcher determines the overall gain in maneuverability and distribution capability in the Army 2020 over the Modular Army outweighs the negative impact of increased reliance on the CSSB for resupply. Therefore, the effect of the Army 2020 force structure change on responsiveness is characterized as positive.

4. Simplicity–Refuel operations within the BSB have become simpler in the Army 2020 due to the reduction in the number and types of refuel systems within the ABCT. In the Modular Army, there were four separate fuel systems within the BSB; the FSSP, the 5K Tanker, the HEMTT, and the Tank and Pump Unit (TPU). In the Army 2020, the only fuel distribution asset is the HEMTT. This change not only simplifies distribution operations but eases maintenance demands by reducing the types of equipment that must be maintained in the BSB. Therefore, the overall effect of the Army 2020 force structure change on simplicity is positive.

5. Economy–In the Army 2020 structure, consolidating fuel storage and distribution assets at EAB is economical and reduces the number of FSSPs required in the Army’s inventory when compared to the Modular Army. The effect of the Army 2020 force structure change on economy is characterized as positive.

6. Survivability–The consolidation of fuel assets at EAB, in the Army 2020, provides additional distance from the forward line of troops to the first bulk fuel storage points increasing survivability of these assets when compared to the Modular Army that had these large static fuel farms included in the BSB. The overall effect of the Army 2020 force structure change on survivability is therefore characterized as positive.

7. Continuity–The increased reliance on the CSSB, when compared to the Modular Army, poses a risk to continuity as the Army has yet to identify clear support relationships for the divisionally aligned CSSBs increasing the possibility for an interruption in sustainment. The effect of the Army 2020 force structure change is therefore characterized as negative for continuity.

8. Improvisation—In the Army 2020, the increased maneuverability of the all HEMTT force compared to the 5,000 gallon tankers included in the Modular Army force structure, enables sustainment planners to use routes for resupply that were previously untenable due to the inability of the 5,000 gallon tanker to operate in rough terrain. In the Modular Army, the FSSP limited the ability of a brigade to rapidly exploit gains in an offensive as the collapsible fuel tanks were difficult to drain and move. In Army 2020, the consolidation of these assets at the CSSB, coupled with the increase in modular fuel racks across the BSB, allows the BSB to rapidly reposition itself to adapt to any unforeseen circumstances affecting the mission. Therefore, the effect of the Army 2020 force structure changes on improvisation is characterized as positive.

The Army 2020 force structure represents a positive change in five of the eight sustainment principles over the Modular Army force structure. The consolidation of assets at the CSSB is both more economical and survivable than having these systems available at each BSB. Additionally, the replacement of the 5,000 gallon tanker and the TPU with a pure HEMTT fleet simplifies bulk fuel distribution in the ABCT. Planners now only have one platform to consider for resupply and the HEMTT is more mobile than either the tanker or the TPU, this increases the ability to improvise methods to deliver fuel to forward units. Anticipation is negatively effected, but this is temporary as units adapt their support planning based on after action reports from exercises conducted with the new force structure. Continuity is reduced as the BSB loses its bulk storage capability and relies more heavily on the divisionally aligned CSSB. However, in the Modular Army, the FSSP was traditionally used during stability operations and this fact reduced the overall impact of the loss since the capability was not planned for use during

an offensive operation. The overall effect of removing the bulk fuel assets from the ABCT in the Army 2020 force structure is positive as it enables the BSB to provide simple, responsive and economical support to the warfighter.

Modular Army and Army 2020 Force Structure Comparison:
Increase of BSB End Strength without
Increasing the BSB size of the Staff

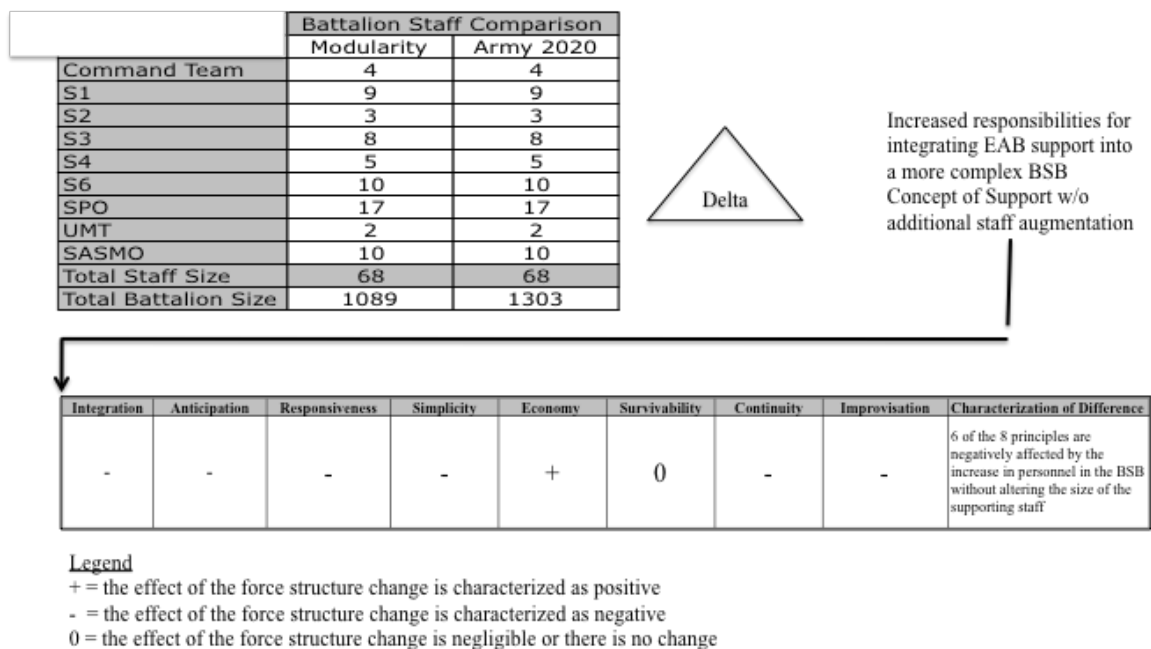


Figure 19. Battalion Staff Comparison

This figure identifies the differences in the overall size of the BSB in Army 2020 versus that of the Modular BSB and highlights that, despite this increase, the staff tasked to manage operations of the unit remains the same. Provides a graphic to depict the effects of this change across each of the principles of sustainment.

Source: Created by the author.

The characterizations of change identified in figure 19 were developed based upon the following analysis:

1. Integration—The reduction in rank of the BN S3 from Major to Captain, in the Army 2020 force structure, makes integration more difficult than it was in the Modular Army as the BN S3 is essentially a peer with the subordinate commanders of the BSB, increasing the likelihood of friction regarding synchronization of operations. In the Army 2020, the BSB S3 is the only company grade Operations Officer in the ABCT, all other BNs are authorized a field grade officer for this position. This inherently places the BSB S3 in a subordinate position when discussing training with other battalions. The Army 2020 force structure changes are therefore characterized as negative for integration.

2. Anticipation—The effects of the Army 2020's addition of the third maneuver battalion and the support requirements of the BEB have yet to be fully determined and will initially make anticipating sustainment requirements difficult whereas the Modular Army has refined its requirements estimates over 10 years of use in the Global War on Terror. This effect is temporary and will correct itself as units begin building historical data to better determine their support requirements. The effects of the Army 2020 force structure on anticipation are therefore characterized as negative.

3. Responsiveness—Anticipation and responsiveness are inexorably linked, and changes in the ability to anticipate requirements in the Army 2020 coupled with the additional tasks of managing a larger battalion inhibit the ability of the staff to respond quickly to a need. The BSB staff in the Modular Army was responsible for managing a smaller force and had more accurate requirements estimates based on operational experience enabling them to plan precisely and respond to needs rapidly. The changes in the Army 2020 force structure are characterized as having a negative effect on responsiveness.

4. Simplicity–To apply the principle of simplicity to the Army 2020 force structure Changes, the researcher expanded on the basic doctrinal definition of simplicity to include the need for clarity of tasks, standardized and interoperable procedures, and clearly defined command relationships.¹⁷⁴ The span of control of the Army 2020 BSB is thirty three percent larger than that of the BSB in the Modular Army but there is no corresponding growth in the size of the BSB staff. This has detrimental impacts across the battalion, especially in the support operations section that is responsible for integrating these additional units into the brigade’s concept of support. Any time an organization is tasked to do more with less, it reduces the simplicity of operations as personnel take on additional duties reducing the clarity in their responsibilities. The effects of the Army 2020 force structure on simplicity are therefore characterized as negative.

5. Economy–The Army 2020 force structure does not increase the size of the BSB staff in place in the Modular Army in spite of the increase of between 200 to 300 soldiers. This is economical for the Army 2020 as any increase would have to be implemented across every BSB in the Army and the number of billets available in a 490,000 or 420,000 soldier army is limited. The effect of the Army 2020 force structure change is therefore characterized as positive for economy.

6. Survivability–The placement of the staff on the battlefield remains the same in both the Army 2020 and Modular Army concepts of support and therefore their likelihood of survival does not change between force structures.

¹⁷⁴ Department of the Army, ADRP 4-0, *Sustainment*, 1-3.

7. Continuity–Not increasing the staff and reducing the experience of the BN S3 in Army 2020, negatively affects continuity because the increased coordination, planning, and battle tracking associated with integrating two new companies into the battalion’s operations requires seasoned planners. The Modular Army had a field grade officer in the BSB S3 and historically proven support requirements when compared to the BSB in the Army 2020. Additionally, increasing the span of control for the BSB in the Army 2020, without a corresponding increase in the support operations section, negatively impacts continuity as the same number of people are now required to integrate requirements for two additional units into the brigade’s concept of support and distribution plan. This increased workload, when compared to the Modular Army, may lead to problems in successfully coordinating for uninterrupted sustainment of the brigade from EAB support units. The effect of the Army 2020 force structure change is therefore characterized as negative for continuity.

8. Improvisation–In the Army 2020 force structure, the reduction in grade of the battalion S3 limits the familiarity of sustainment planning in this key position when compared to the Modular Army. The resulting inexperience inhibits the ability to improvise solutions in training and operations. Therefore, the effect of the Army 2020 force structure changes on improvisation is characterized as negative.

The Army 2020 force structure represents a positive change in only one of the eight sustainment principles over the Modular Army. It is economically sound for the Army to leave the BSB staff at its Modular Army manning levels. There is no change in survivability of the staff as they are located in the same position on the battlefield in Modularity and the Army 2020. Anticipation is negatively effected, but this is temporary

as units adapt their support planning based on after action reports from exercises conducted with the new force structure so the overall affect is negligible.

The remaining six sustainment principles are negatively affected by the Army 2020 force structure changes that created the increased responsibilities of coordinating sustainment operations for two additional battalions without any increase in the size of the support operations section. Therefore, the overall effect of this change is negative and imposed limitations on BSB sustainers to improvise, integrate new units into sustainment planning, and reduced responsiveness by increasing tasks on the staff.

Modular Army and Army 2020 Force Structure Comparison:
Water Purification, Storage, and Distribution Assets
moved to EAB Units

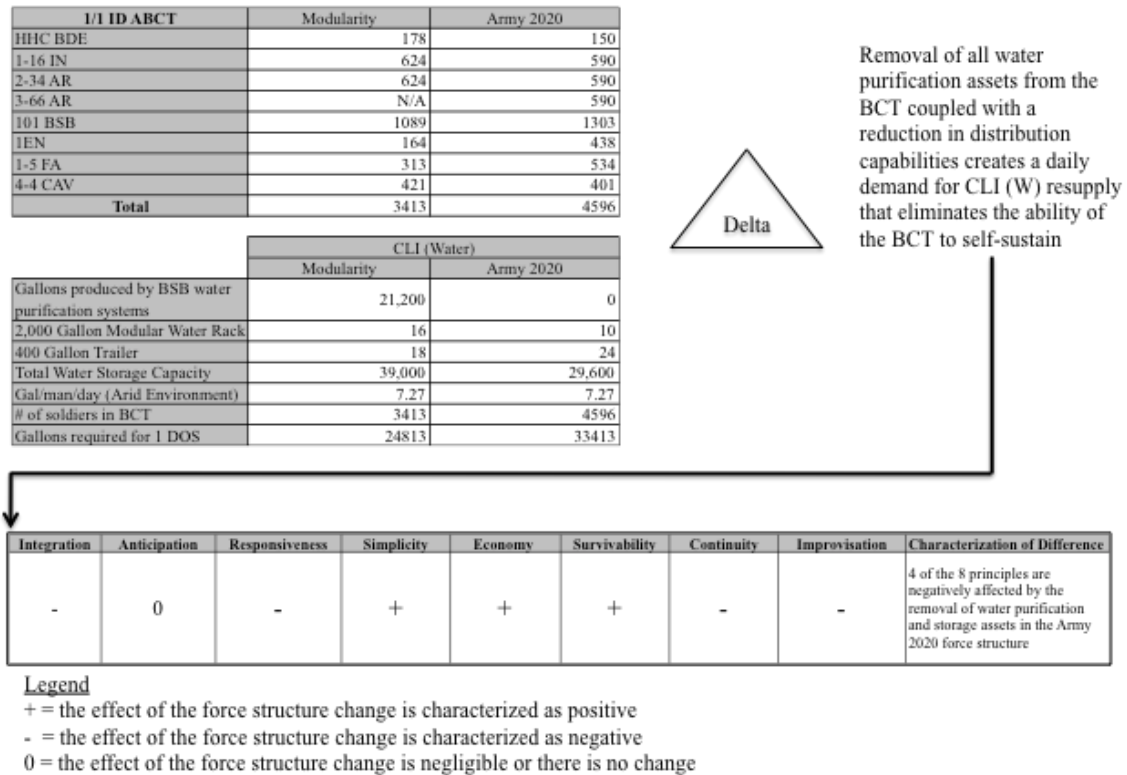


Figure 20. Water Purification, Storage, and Distribution Comparison
This figure identifies the differences in bulk water purification, storage, and distribution capabilities in the BSB and provides an analysis of the impact of these changes across each of the principles of sustainment.

Source: Created by the author.

The characterizations of change identified in figure 20 were developed based upon the following analysis:

1. Integration–In the Army 2020, the ABCT’s sustainment planners must integrate their logistics plans with EAB concepts of support earlier in the fight due to the reduction

in days of supply on hand. When compared with the capabilities of the Modular Army, this reduction in capability created an increased reliance on EAB efforts. The Army 2020 has yet to properly identify command and support relationships reducing unity of command. Therefore, the overall effect of the Army 2020 force structure change on integration is characterized as negative.

2. Anticipation—There is no change to the basic formulas used to predict consumption of water, therefore, the ability of the staff to anticipate demand is not affected by the Army 2020 force structure changes. The increase in requirements for water directly correlates to the increase in personnel over the Modular Army, and the staff can coordinate with the CSSB based on the aforementioned formulas. The Army 2020 force structure changes have no effect on anticipation.

3. Responsiveness—In the Army 2020 force structure, the removal of the water purification assets coupled with the reduction in storage capacity at the BSB creates a daily resupply requirement for bulk water. The Modular Army, given a water source, could purify its own bulk water and was able to store more than one day of supply within its organic water tanks. The Army 2020 BSB does not have the organic storage capacity to provide responsive and flexible support to the maneuver elements. The changes in the Army 2020 force structure are characterized as having a negative effect on responsiveness.

4. Simplicity—The reliance on EAB assets in the Army 2020 concept of support increases the simplicity of sustainment operations at the BCT level. By eliminating water purification assets within the BSB, unlike in the Modular Army, there is no need for brigade level planners to find a potable water source near their area of operations. The

BSB is able to focus on water distribution through increased coordination with EAB planners. Therefore, the overall effect of the Army 2020 force structure change on simplicity is positive.

5. Economy–In the Army 2020 structure, consolidating water purification and distribution assets at EAB is economical and reduces the overall quantity of water purification systems required in the Army’s inventory when compared to the Modular Army force structure. The effect of the Army 2020 force structure change on economy is characterized as positive.

6. Survivability–In the Army 2020, the consolidation of water purification assets at EAB provides additional distance from the forward line of troops to the water production and storage equipment increasing survivability of these assets when compared to the Modular Army. The overall effect of the Army 2020 force structure change on survivability is therefore characterized as positive.

7. Continuity–The Army 2020 created a system where the ABCT must receive a daily resupply of bulk water from EAB assets. This change is in contrast to the Modular Army’s BSB that had the ability to continuously provide purified water to the ABCT. The effect of the Army 2020 force structure change is therefore characterized as negative for continuity.

8. Improvisation–With a nearby water source, the Modular Army was able to purify its own drinking water and had the organic storage capacity to hold more than one day of supply. The reliance on EAB assets, in the Army 2020 force structure, for purified water reduces not only the BSB’s ability to improvise sustainment operations it negates

the concept of a self-sustaining force. The characterization of these changes in the Army 2020 is negative for improvisation.

The Army 2020 force structure represents a positive change in three of the eight sustainment principles regarding water storage and distribution in the ABCT when compared to the Modular Army. The consolidation of assets at the CSSB is more economical and having these systems at EAB, further away from the front lines increases the survivability of these assets. Continuity is reduced as the BSB lost its capability to purify water. However, the TWPS and LWPS were traditionally used during stability operations, not offensive operations, and this fact reduced the overall impact of the loss. The reduction in storage capability from 39,000 to 29,600 gallons eliminated the ability to self-sustain for more than 48 hours and reduced the continuity of support available within the ABCT in the Army 2020. The overall effect of removing the water purification from the BSB is negative and imposed limitations on the BSB regarding integration, improvisation, and continuity throughout operations.

Modular Army and Army 2020 Force Structure Comparison: Increased Dependency on EAB Units in the Army 2020 Concept of Support

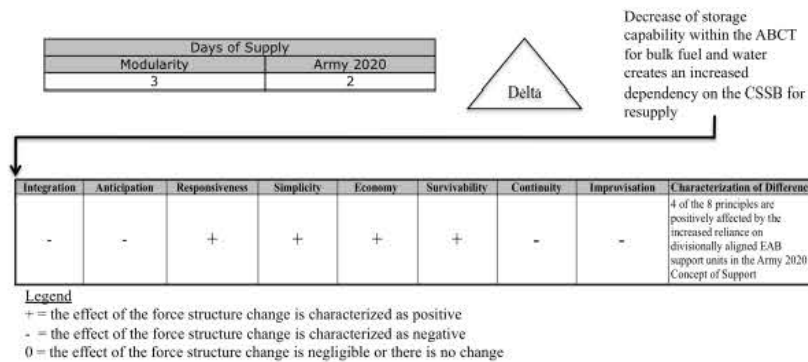


Figure 21. Increased Dependency on EAB Support

This figure provides an analysis of the impact of the loss of one day of supply within the ABCT and the ensuing increased reliance on CSSB assets across each of the principles of sustainment.

Source: Created by the author.

The characterizations of change identified in figure 21 were developed based upon the following analysis:

1. Integration–The increased reliance on EAB assets in the Army 2020 force structure without clearly defined command and support relationships limits the effective building of the unity of command within the division. The Modular Army used standard support relationships, not terms like divisionally aligned, to define interactions between brigade and EAB units. The changes in the Army 2020 Concept of Support are characterized as negative for integration.

2. Anticipation–Compared to the ability to anticipate requirements in the Modular Army, there is a temporary decrease in the sustainers’ ability in the Army 2020 to

anticipate requirements as the BCTs build historical data to revise their sustainment requirements due to the increased demands from their new battalions. The changes in the Army 2020 Concept of Support are characterized as negative for anticipation.

3. Responsiveness—The removal of water purification and storage capabilities in the BSB in the Army 2020 reduces the ability of the BSB to provide responsive support to the warfighter. In the Army 2020 force structure, the reduction of supplies kept forward reduces the capacity of the BSB to surge support forward in response to unexpected actions on the battlefield. This hinderance is primarily applicable to units in stability operations or in the defense as water supply during the offense is traditionally done using bottled water.¹⁷⁵ The ability of the BSB to provide responsive support regarding bulk fuel is vastly increased in the Army 2020. By using the HEMTT as the sole distribution vehicle the distribution company can now push fuel to FSCs in rougher terrain and over less developed road networks greatly expanding the area of operations for fuel resupply when compared to the Modular Army. The large benefit in increased responsiveness in fuel distribution outweighs the negatives associated with the loss of water purification assets, and therefore the overall characterization of the changes for responsiveness are positive.

4. Simplicity—The Army 2020 force structure's streamlining of the types of equipment maintained at the BSB reduces the overall repair parts required for maintenance, simplifies refueling procedures, eliminates the need for BSB soldiers to establish and operate fuel farms or water purification sites when compared to the

¹⁷⁵ U.S. Army Combined Arms Support Command, *Water Planning Guide*, VII-5.

Modular Army force structure. The overall effect of the Army 2020 force structure change on simplicity is positive.

5. Economy–Consolidating bulk fuel and water purification assets at the CSSB, in the Army 2020, creates an economy of scale by reducing the demand for these items by roughly two thirds across the Army inventory compared to the Modular Army force structure. The effect of the Army 2020 force structure change on economy is characterized as positive.

6. Survivability–The survivability of more static systems like the FSSP and water purification is increased by their location in EAB units in the Army 2020 Concept of Support. Unlike in the Modular Army, where these limited assets were maintained in the BSBs, the CSSB and its companies are further from the forward line of troops and therefore less likely to be threatened by direct or indirect fire. Additionally, by going to a HEMTT pure distribution fleet it is harder for the enemy to identify the brigade support area (BSA), whereas in the Modular Army, the BSA was easily identifiable due to the 5,000-gallon tankers. The effect of the Army 2020 force structure change on survivability is characterized as positive.

7. Continuity–Compared to the Modular Army, the BSB without the FSSP and water purification assets is more mobile but the tradeoff for this maneuverability is decreased capability to self-sustain for more than 48 hours. The decreased continuity within the In the Army 2020 force structure BDE is one factor that led to the creation of divisionally aligned sustainment brigades and CSSBs. Until command and support relationships are clearly identified for the divisionally aligned units there is an increased risk of an interruption in sustainment due to misaligned priorities of support. The effect

of the Army 2020 force structure change is therefore characterized as negative for continuity.

8. Improvisation—The reduction in sustainment capability in the BSB of the Army 2020 may lead commanders to be more risk adverse and less able to improvise solutions to turn unexpected situations into opportunities to exploit. Therefore, the effect of the Army 2020 force structure changes when compared to the Modular Army force structure is characterized as negative for improvisation.

The Army 2020 Concept of Support created divisionally aligned CSSBs to account for the loss of bulk fuel distribution over two days of supply within the BSB and represented a positive change in three of the eight sustainment principles over the Modular Army. The removal of the water purification and bulk fuel storage assets from the BSB, in the Army 2020, made them more mobile and better suited to sustain maneuver forces during the offense than the Modular Army force structure. However, that mobility comes at the increased reliance on EAB assets to ensure the continuity of operations. The Army 2020 changes lacked clearly defined command and support relationships that limit the integration of assets within the division and risk the uninterrupted provision of sustainment to the BCT. The changes to sustainment in Army 2020 increased the ability of the BSB to conduct simple and responsive support while increasing the survivability of static equipment by moving it to the CSSB over the Modular Army. However the Army 2020 force structure imposed limitations on the BSB regarding integration, anticipation, improvisation, and continuity throughout operations. The overall effect of the Army 2020 force structure change is neutral due to an increased

capability to conduct internal resupply with this being offset by the increased reliance on EAB assets reducing simplicity and continuity.

Overall Impact of Army 2020 Design on Sustainment

Table 6. Summary of Qualitative Analysis

	Integration	Anticipation	Responsiveness	Simplicity	Economy	Survivability	Continuity	Improvisation
Bulk Fuel	-	-	+	+	+	+	-	+
BSB Staff	-	-	-	-	+	0	-	-
Water Purification	-	0	-	+	+	+	-	-
CSSB Dependency	-	-	+	+	+	+	-	+
Overall Impact	-4	-3	0	+2	+4	+3	-4	0

Legend

+ = the effect of the force structure change is characterized as positive

- = the effect of the force structure change is characterized as negative

0 = the effect of the force structure change is negligible or there is no change

The table provides a summary of the overall effect of the Army 2020 force structure changes in the BSB across the principles of sustainment. Economy shows a large improvement as equipment is removed from the BSB and consolidated at echelons above brigade. This same action increases survivability by moving those assets further from the forward line of troops. The analysis reveals that the overall effect of the changes is negative, especially on integration and continuity.

Source: Created by the author.

Based on this analysis, the overall effects of the changes in sustainment at the BSB in the Army 2020 are negative. It is evident that CASCOM planners were successful in adhering to General Odierno's requirement to gain economies of scale.¹⁷⁶ The consolidation of assets at the CSSB provided a cost effective alternative to keeping those capabilities within every BSB. Also, the reduction in the types of equipment maintained

¹⁷⁶ Department of the Army, *Sustainment Concept of Support*, 4.

at the BSB increased simplicity in both the fuel and water distribution operations and by maintaining only one fuel distribution platform the Army 2020 reduced maintenance costs associated with having multiple systems performing the same task.

The Army 2020 created sustainment risks by reducing the BSB's ability to provide continuous and integrated support during all elements of decisive action and made it more difficult to improvise in a complex operating environment. The root of the issue, specifically for continuity and integration is the lack of a doctrinally defined relationship between the divisionally aligned CSSB and its supported BSB. The removal of typically static systems such as the FSSP and water purification assets from the BSB seem to indicate a focus on offensive operations. The ability to store large amounts of fuel and produce potable water, at the BCT level, enabled EAB assets to reduce their distribution actions during stability operations. The removal of the FSSP and water purification assets created a long-term dependency on the CSSB to provide this capability even during stability operations. This discovery is an unexpected result of the qualitative analysis.

With the qualitative analysis between Army 2020 and Modularity completed, the next step in the methodology is to conduct a quantitative analysis on bulk fuel capabilities in the two structures. This second method of analysis provides a means to validate the results of the qualitative analysis. In doing so, the researcher provides triangulation of his results strengthening the study's findings.

Quantitative Analysis Results

Bulk fuel was chosen for the quantitative analysis due to its importance in military operations. The capabilities in this study are represented by the total gallons of

fuel available for storage and distribution; this measurement is applicable to military and civilian functions making the analysis more accessible to non-military readers. Bulk fuel vehicles and systems within the ABCT provide known quantities of support that readily translate into quantitative data.

This study uses data from 101st Brigade Support Battalion from 1st Brigade, 1st Infantry Division. Data was culled from several sources to include the CASCOM Concept of Support for Army 2020, the CSSB Passback briefing given to the Army's Deputy G4, and FMSWeb.¹⁷⁷ FMSWeb is an Army website that provides information on past, current, and future force structures for all units in the Army. The site was used to verify data provided in the slide decks was accurate.

The analysis compared two separate equipment and personnel listings, known as Modified Table of Organization and Equipment (MTOE) listings for the 101st BSB from FMSWeb. The first had an effective date of August 18th, 2012 and provided the equipment under the modular army. The second has an effective date of October 16th, 2015 and reflects changes to the BSB under the Army 2020 construct. The equipment listed on the MTOE for the 101st, following its conversion to an Army 2020 unit, matched the data from the CASCOM and HQDA briefings, validating their accuracy. A summary of the quantitative changes is provided below.

¹⁷⁷ MG Duane A. Gamble, e-mail message to the author, April 22, 2015. FMSWeb provides documentation on all Army force structure including manpower and equipment requirements and authorizations. FMSWeb maintains current and historical information to support analysis. FMSWeb is supported by the US Army Force Management Support Agency.

Table 7. Bulk Fuel Capacity Analysis

CLIII (B) System	Army 2020	Modular Army	Difference (Gallons)
5,000 Gallon Tanker	0	15	-75,000
2,500 Gallon HEMMT	45	45	0
2,500 Gallon Modular Fuel Racks	44	0	110,000
1,200 Gallon Tank and Pump Unit	0	2	-2,400
FSSPs (gallons storage)	0	1	-120,000
Total Fuel Capacity	222,500	309,900	-87,400

The table provides a quantifiable depiction of the loss of one day of supply of CLIII (B) within the BSB and what assets were removed from the BSB creating that loss. Data includes equipment from the distribution company and all the forward support companies.

Source: Created by the author.

One of the Army 2020's redesign goals was to maintain lighter and more agile formations, and eliminating bulk fuel storage systems was deemed necessary to provide an affordable, agile, adaptive, and responsive force capable of addressing complex operations associated with the future operating environment.¹⁷⁸ The removal of the fuel system supply point (FSSP) is directly aligned with the goals of providing an agile and responsive force. The FSSP is a collapsible fabric tank fuel farm, consisting of six 20,000-gallon collapsible fuel bags, and is the Army's primary means for the receipt and storage of bulk petroleum and for its issue to combat forces under tactical conditions.¹⁷⁹ However, the BSB is no longer agile once it establishes a fuel farm. The collapsible fabric tanks require time and effort to emplace and just as much time to drain and move. That reduction in agility limits the BSB's ability to maneuver with the ABCT on the

¹⁷⁸ Department of the Army, *Sustainment Concept of Support*, 2.

¹⁷⁹ Department of the Army, Field Manual (FM) 10-67-1, *Concepts and Equipment of Petroleum Operations* (Washington, DC: Government Printing Office, 1998), 12-4.

offense and reduces the overall responsiveness of sustainment. The removal of this system reduces the amount of equipment the BSB must carry forward increasing the mobility of the unit.

In stability operations, the ability to establish a FSSP reduced the frequency of resupply from EAB assets. The reduction of over 87,000 gallons of bulk fuel storage equates to slightly less than the 88,954 gallons that represent a day of supply for an ABCT in combat operations in an arid environment. The loss in capability directly stems from the removal of the FSSP from the BSB, but as mentioned earlier the FSSP is primarily used in stability and defensive operations so the reduced bulk storage capacity does not negatively affect the ability of the BSB to support the ABCT during offensive operations. In another step taken to increase the agility and responsiveness of the BSB, the Army 2020 completely redesigned its distribution capabilities from what had been available in the Modular Army.

The Modular BSB had three separate vehicles capable of bulk fuel distribution; a 5,000-gallon tanker, a 2,500-gallon tanker, and a 1,200-gallon tank and pump unit. The Army 2020 only has the 2,500-gallon HEMTT, but does add the modular fuel system-tank rack module. This tank rack is a 2,500-gallon trailer that the HEMTT can tow and together create a system capable of distributing up to 5,000 gallons of fuel. The removal of the TPU and 5,000-gallon tanker streamlines fuel distribution and maintenance operations in the BSB. The 5,000-gallon tanker was primarily designed for highway use thus limiting its ability to push fuel to the FSCs in an austere environment.¹⁸⁰ In contrast,

¹⁸⁰ Department of the Army, FM 10-67-1, *Concepts and Equipment of Petroleum Operations*, 24-14.

the HEMTT is an all-weather and all-terrain vehicle enabling it to provide sustainment in terrain that the 5,000-gallon tanker could never reach.¹⁸¹ The focus on assets designed to provide fuel using unimproved road networks supports the ability to sustain operations in complex and austere environments.

Table 8. Bulk Fuel Distribution Capabilities

5,000 Gallon Tanker	Army 2020	Modularity	2,500 Gallon Tanker / Trailer	Army 2020	Modularity	1,200 Gallon Tank and Pump Unit	Army 2020	Modularity
Distribution Company	0	15	Distribution Company	18	14	Distribution Company	0	0
CAV / RSTA FSC	0	0	CAV / RSTA FSC *	3	3	CAV / RSTA FSC	0	1
BEB FSC	0	N/A	BEB FSC	3	N/A	BEB FSC	0	N/A
FA FSC	0	0	FA FSC *	3	4	FA FSC	0	1
CAB FSC	0	0	CAB FSC	6	12	CAB FSC	0	0
CAB FSC	0	0	CAB FSC	6	12	CAB FSC	0	0
CAB FSC	0	N/A	CAB FSC	6	N/A	CAB FSC	0	N/A
TOTAL	0	75,000		222,500	112,500		0	2,400

This table identifies the differences in distribution capabilities between the Army 2020 and Modularity. Army 2020 reduces the types of distribution systems from 3 to 1 but adds the 2,500-gallon modular fuel trailer. The 2,500-gallon HEMTT fueler pulls this trailer creating a 5,000-gallon system. The * indicate a mismatch of trailers and 2,500 gallon tankers in the Army 2020 construct. The CAV/RSTA FSC has three 2,500-gallon HEMTTs but only one 2,500-gallon trailer while the FA FSC has three HEMTTs and four 2,500-gallon trailers.

Source: Created by the author.

In addition to the changes in types of equipment in the BSB, the Army 2020 also changed the allocation of some of its assets in its companies. The distribution company is the only unit in the BSB that suffered a loss of distribution capability in the conversion. The FSCs for the field artillery and cavalry battalions increased their distribution capability. The addition of an FSC to support the BEB and the third maneuver battalion resulted in a gain of 45,000 gallons in overall capacity. These gains are matched by

¹⁸¹ Ibid., 24-9.

demands generated by the new forces and do not reflect an expansion in the capability to provide prolonged sustainment.

Table 9. Bulk Fuel Capacity by Unit

	Army 2020	Modularity
Distribution Company	90,000	110,000
CAV / RSTA FSC	10,000	8,700
BEB FSC	15,000	N/A
FA FSC	17,500	11,200
CAB FSC	30,000	30,000
CAB FSC	30,000	30,000
CAB FSC	30,000	N/A
TOTAL	222,500	189,900

This table is a summary of the number of gallons of fuel that each company of the BSB is able to distribute using their internal assets in both Modularity and Army 2020. The transition from the BSTB to the BEB is shown, as is the additional combined arms battalion. The loss of the 5,000-gallon tankers reduced the Distribution Company's capability.

Source: Created by the author.

Qualitative and Quantitative Analysis Comparison

It is undeniable that the BSB loses its bulk fuel storage capability in the Army 2020 concept. However, it does gain an additional 32,600 gallons in its distribution assets when counting the combination of HEMTT and modular flat rack systems. While the quantitative data confirms the loss of capability regarding fuel storage, it also identified that the apparent gain in distribution capacity is neutralized by the additional requirements of supporting the BEB and the third maneuver battalion. The simplification of distribution and the all-terrain capabilities of the HEMTT increase the responsiveness of the BSB. The loss of the FSSP and its storage capacity has negative effects on the

Army 2020 as it conducts defensive and stability operations, however, the distribution capacity remains equal to that of the Modular Army BSB and the increased mobility of the HEMTT fueler actually increases the responsiveness of the BSB regarding bulk fuel distribution. This data validates the findings of the qualitative analysis regarding bulk fuel operations in the Army 2020 design. The final step in the researcher's method is to determine the effect of these changes on the endurance of an offensive operation.

Effect of changes in Sustainment Capabilities on Endurance

The author designed an experiment to determine the impact of the loss of the BSB's bulk fuel storage capability coupled with the increase in distribution capability and requirements for supported units. This experiment compares progress of the 3rd Infantry Division in OIF I to the progress capable in the Army 2020 and Modular Army force structures. The 3rd Infantry Division's actions provide an excellent case study, as their initial attack to An Najaf was one of the swiftest in the history of armored warfare. The 3rd Infantry Division took three days to reach An Najaf, a distance of 220 miles from their border-crossing site in Southern Iraq. This experiment is designed to show effects on maneuver of the sustainment capabilities that reside solely in the BSB of the Army 2020 and the Modular Army, to do this the researcher did not include resupply from EAB assets in the equation.

The experiment uses the Army's Quick Logistics Estimation Tool (QLET) 2015, a Microsoft Excel program developed by CASCOM, to identify the daily requirements for bulk fuel within the Army 2020 ABCT and the Modular Army HBCT. The author verified that the unit data in QLET matched FMSWeb to ensure the data accurately

reflected each force structure. Using the ABCT force file, during major combat operations in an arid environment, the average daily requirement for fuel is 88,954 gallons. Under the same conditions, the fuel requirement for the Modular HBCT is 72,684 gallons.

Table 10. Army 2020 ABCT Bulk Fuel Requirements

Force Strength	4,706					NOTE: We acknowledge that the Platform can hold 10 pallets,	select more than one fuel platform, scroll down to line	
				Pallet Type	Warehouse		Fuel Platform Type	HEMMT w/Trailer
Joint Phase:	Joint Combat Operations (PH)	Joint Stacking (Warehouse Only)			Single		Fuel Platform Capacity (gal)	5000
Climate:	Arid		Cargo Platform Type	PLS/LHS w/Trailer			Water Platform	HIPPO
			Pallets Per Platform	16			Water Platform Capacity (gal)	2000
Requirements by Class of Supply								
Class:		Rate	Gallons	LBS	STONS	Pallets	Platforms	% Total Dry Cargo:
Class I		8.64		40,660	20.33	46	2.9	12.7%
Class II		1.54		7,247	3.62	18	1.2	2.3%
Class III	Bulk	AVG	88,954					
	Package	AVG		11,656	5.83	15	1.0	3.6%
Class IV	Barrier/Fortification	2.34		11,012	5.51	12	0.8	3.4%
	Construction	3.32		15,624	7.81	16	1.0	4.9%
Class V				47,652	23.83	32	2.0	14.8%
Class VI	Basic	0.336		1,581	0.79	4	0.3	0.5%
	Additional	0		0	0.00	0	0.0	0.0%
Class VII				18,216	9.11	46	2.9	5.7%
Class VIII	(Soldier Based Only)	0.19		894	0.45	2	0.2	0.3%
Class IX				11,517	5.76	19	1.2	3.6%
Water	Bulk Drinking - Potable	7.72	18,165					
	PKG Drinking - Potable	50.0%		151,497	75.75	61	3.9	47.2%
	Other - Potable	2.49	11,718					
	Non_Potable	0.00	0					
Ice		6.00		28,236	14.12	12	0.8	
Mail	Prograde	0.75		3,520	1.76	6	0.4	1.1%

Screenshot from the Army's Quick Logistics Estimation Tool (QLET) depicting daily supply requirements for an ABCT during major combat operations in an arid environment. This program provides the researcher the baseline requirements needed to sustain an Army 2020 ABCT.

Source: QLET 2015, data input by author.

Table 11. Modular HBCT Bulk Fuel Requirements

Force Strength	4,153								
				Pallet Type	Warehouse	NOTE: We acknowledge that the Platform can hold 10 pallets, but the factor used for this tool is 8	To select more than one fuel platform, scroll down to line 59		
Joint Phase:	Major Combat Operations (PH I-III)		Pallet Stacking (Warehouse Only)	Single			Fuel Platform Type	HEMMT w/Trailer	
Climate:	Arid		Cargo Platform Type	PLS/LHS w/Trailer			Fuel Platform Capacity (gal)	5000	
			Pallets Per Platform	16			Water Platform	HIPPO	
							Water Platform Capacity (gal)	2000	
Requirements by Class of Supply									
Class:		Rate	Gallons	LBS	STONS	Pallets	Platforms	% Total Dry Cargo:	
Class I		8.64		35,882	17.94	41	2.6	12.5%	
Class II		1.54		6,396	3.20	16	1.0	2.2%	
Class III	Bulk	AVG	72,684						
	Package	AVG		9,487	4.74	12	0.8	3.3%	
Class IV	Barrier/Fortification	2.34		9,718	4.86	10	0.7	3.4%	
	Construction	3.32		13,788	6.89	15	1.0	4.8%	
Class V				47,684	23.84	32	2.0	16.6%	
Class VI	Basic	0.336		1,395	0.70	3	0.2	0.5%	
	Additional	0		0	0.00	0	0.0	0.0%	
Class VII				15,930	7.96	41	2.6	5.5%	
Class VIII	(Soldier Based Only)	0.19		789	0.39	2	0.2	0.3%	
Class IX				9,505	4.75	16	1.0	3.3%	
Water	Bulk Drinking - Potable	7.72	16,031						
	PKG Drinking - Potable	50.0%		133,695	66.85	54	3.4	46.5%	
	Other - Potable	2.49	10,341						
	Non_Potable	0.00	0						
Ice		6.00		24,918	12.46	11	0.7		
Mail	Prograde	0.75		3,106	1.55	5	0.4	1.1%	

Screenshot from QLET depicting daily supply requirements for a Modular HBCT during major combat operations in an arid environment. This program provides the researcher the baseline requirements needed to sustain the HBCT.

Source: QLET 2015, data input by author.

The researcher then built a table depicting the gallons of fuel available with the BSB's refueling assets at 100 percent and 90 percent operational readiness rate. The reduction from 100 percent to 90 percent is based on an assumption that 10 percent of the equipment will be non-mission capable due to maintenance faults across the force. The data illustrates the requirements generated by two days of major combat operations.

There is one variation between the researcher's chart for the Army 2020 ABCT and the daily requirements generated by QLET, the researcher lowered the requirements for the third combined arms battalion (CAB) to reflect the two up one back tactical

formation.¹⁸² Meaning that two of the CABs' requirements are generated using the maximum fuel requirements to reflect their actions while in contact with the enemy, while the third CAB is in reserve and using the average fuel requirement.

The researcher established the following priorities of resupply for the ABCT; CAB 1, CAB 2, CAV, BEB, CAB 3, FA FSC, and BSB. For the HBCT the priorities are CAB 1, CAB 2, CAV, FA FSC, BSTB and the BSB. This establishes that the maneuver elements in contact have priority over those in reserve or support roles. The researcher also established a goal that the units in contact maintain a fuel on hand percentage of no less than 70 percent for as long as is possible.

The table displays the supply status at each unit location using green, amber, red, and black colors to depict levels of supply. Green indicates that the unit is at 85 percent or greater on bulk fuel. Amber indicates that the unit is at 70 to 84 percent strength. Red indicates that the unit is at 50 to 69 percent strength and is essentially combat ineffective. Black indicates that the unit is at less than 50 percent strength.

¹⁸² Jerold E. Brown, *Historical Dictionary of the U.S. Army* (Westport, CT: Greenwood Press, 2001), 480.

Table 12. Army 2020 Bulk Fuel Distribution during Major Combat Operations

	Gallons OH @ 100% OR Rate	Gallons OH @ 90% OR Rate	Supply Status	Day 1 Requirements (Req)	Gallons OH	Supply Status	BSB Refuel Ops	Day 2 OH	Supply Status	Day 2 Req	Gallons OH	Supply Status	BSB Refuel Ops	Day 3 OH	Supply Status
Distro Company	90,000	81,000	90	20,496	60,504	67	0	20,504	23	20,496	8	0	0	8	0
CAV / RSTA FSC	10,000	9,000	90	4,070	4,930	49	2,500	7,430	74	4,070	3,360	34	0	3,360	34
BEB FSC	15,000	13,500	90	5,194	8,306	55	2,500	10,806	72	5,194	5,612	37	0	5,612	37
FA FSC	17,500	15,750	90	8,580	7,170	41	0	7,170	41	4,293	2,877	16	0	2,877	16
CAB FSC	30,000	27,000	90	18,652	8,348	28	15,000	23,348	78	18,652	4,696	16	0	4,696	16
CAB FSC	30,000	27,000	90	18,652	8,348	28	15,000	23,348	78	18,652	4,696	16	0	4,696	16
CAB FSC	30,000	27,000	90	12,873	14,127	47	5,000	19,127	64	12,873	6,254	21	0	6,254	21
TOTAL	222,500	200,250	90	88,517	111,733	50	40,000	111,733	50	84,230	27,503	12	0	27,503	12

This table illustrates the bulk fuel requirements to support an ABCT during major combat operations without resupply from the CSSB. FSCs conduct unit distribution to their supported battalions and the BSB distribution company provides general support to units in brigade support area and direct support to the FSCs. Refuel operations are conducted by HEMTTs and the minimum resupply is assumed to be 2,500 gallons.

Source: Created by the author.

Table 13. Modular HBCT Bulk Fuel Distribution during Major Combat Operations

	Gallons OH @ 100% OR Rate	Gallons OH @ 90% OR Rate	Supply Status	Day 1 Requirements (Req)	Gallons OH	Supply Status	BSB Refuel Ops	Day 2 OH	Supply Status	Day 2 Req	Gallons OH	Supply Status	BSB Refuel Ops	Day 3 OH	Supply Status
Distro Company	110,000	99,000	90	19,561	69,930	64	0	37,430	34	19,561	8,360	8	0	860	1
BSTB *	9,509		90	9,509	0	0		0	0	9,509		0		0	0
CAV / RSTA FSC	8,700	7,830	90	3,736	4,094	47	2,500	6,594	76	3,736	2,858	33	0	2,858	33
FA FSC	11,200	10,080	90	4,293	5,787	52	0	5,787	52	4,293	1,494	13	0	1,494	13
CAB FSC	30,000	27,000	90	18,652	8,348	28	15,000	23,348	78	18,652	4,696	16	5,000	9,696	32
CAB FSC	30,000	27,000	90	18,652	8,348	28	15,000	23,348	78	18,652	4,696	16	2,500	7,196	24
TOTAL	199,409	179,468	90	74,403	105,065	53	32,500	96,507	48	74,403	22,104	11	7,500	22,104	11

This table illustrates the bulk fuel requirements to support a modular HBCT during major combat operations without resupply from the CSSB. FSCs conduct unit distribution to their supported battalions and the BSB distribution company provides general support to units in brigade support area and direct support to the FSCs. Refuel operations are conducted by HEMTTs for the CAV and CABs. * The BSTB had no supporting FSC and relied on the BSB for fuel support.

Source: Created by the author.

The researcher's tables clearly show the distribution of fuel on the battlefield from the BSB to the FSCs. The supply status on hand columns depict the gallons of fuel remaining within the FSC or distribution company that are available for issue to the maneuver unit. Table 12 illustrates how the increased distribution capabilities in the distribution company and FSCs of the Army 2020 enables the BSB to provide continuous fuel support throughout three days of combat operations with the maneuver units topped off with fuel and prepared for operations on day four. At this point, the BSB is unable provide further support and at the completion of the fourth day the offense has culminated. This remains above the established definition for self-sustaining as the BSB's internal assets are capable of supporting the brigade in the offense for more than 72 hours.

Table 13 shows the same operations for the BSB in the Modular Army. The additional 20,000 gallons of fuel available from the combination of 5,000-gallon tankers and HEMTTs in the distribution company is accounted for in the Army 2020 design by the increased distribution capabilities within the FSCs of the BEB and CAV. The requirements for the BSB to provide the BSTB with fuel, in the HBCT model, further reduces the ability of the distribution company to use the 20,000 gallons in additional fuel distribution capacity to support the maneuver units during combat operations on day three. This means that, like the Army 2020 design, the Modular Army HBCT is able to conduct offensive operations without reaching culmination until day four of an assault. So the Army 2020s BSB, despite the loss of the bulk storage provided by the FSSP, is still capable of providing distribution similar to what was available in the Modular Army.

This coupled with the increased maneuverability of the distribution company due to the HEMTT pure fleet has a positive effect on sustainment of the ABCT during an offensive.

To provide a measureable comparison to OIF I, the author assumed the following; combat operations lasted no more than 12 hours per day, two of those hours were spent in a tactical idle (not progressing forward), and the units conducted refuel operations for two hours daily. This left a total of eight hours of forward movement per day for the 3rd Infantry Division. Figure 16 in chapter 2, indicated that the 3rd ID advanced 220 miles to An Najaf in the first three days of OIF I. That means that they were traveling 73 miles per day. To determine an average rate of march, the researcher divided the distance per day by the eight hours of actual movement conducted. The result was that their rate of march was 9.2 miles per hour. Using that rate of march, the Army 2020 force and the Modular HBCT are both capable of reaching the Karbala area with fuel remaining for limited operations on a fourth day.

Table 14. Distance Traveled on the Final Day of Operations

Modular Army	% of daily Requirements at FSC on D+3	% equated to operating time avail on D+3	Distance traveled using 9.2 MPH planning factor
CAB 1	52	6 hrs 20 min	48.4 miles
CAB 2	39	4 hrs 40 min	43 miles
FA	35	4 hrs 12 min	38.6 miles
CAV	76	9 hrs 07 min	83.9 miles
Army 2020	% of daily Requirements at FSC on D+3	% equated to operating time avail on D+3	Distance traveled using 9.2 MPH planning factor
CAB1	25	3 hrs	27.6 miles
CAB2	25	3 hrs	27.6 miles
CAB3*	49 avg / 34 max	4 hrs 05 min	37.3 miles
FA	35	4 hrs 12 min	38.6 miles
CAV	76	9 hrs 07 min	83.9 miles

To determine distances covered in a partial day of operation the percentage of the unit's daily fuel requirements was used to determine how many hours of operating time were available per unit. Using the 9.2 MPH planning factor, the author determined the range of operations in the partial day. The author ended the brigade's forward movement when one of the combined arms battalions was no longer able to advance. In the Army 2020, the third CAB transitions from the reserve to the offense, resulting in the use of the maximum fuel requirement for planning instead of the average consumption planning factor. The total difference in ground seized between the forces is just over 15 miles.

Source: Created by the author.

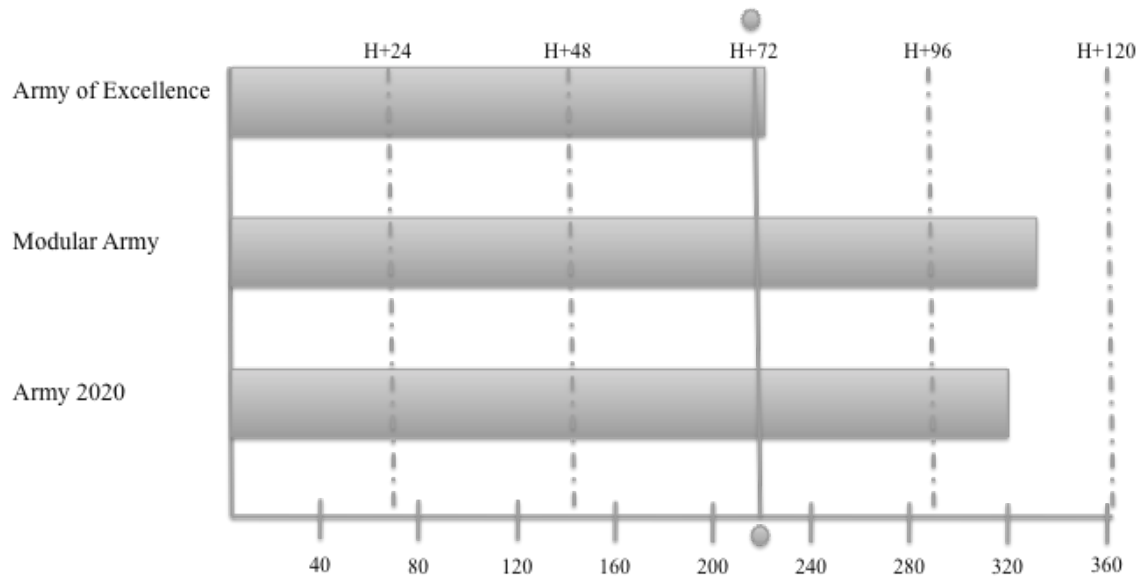


Figure 22. Sustainment Impacts on Maneuver

This figure illustrates the increased capability of both the Modular HBCT and the Army 2020 design over the AoE 3rd Infantry Division. All three force structures have the support required to meet the design requirement of conducting self-sustained operations for 72 hours, indicated in the figure by the *. The Modular Army and Army 2020 forces are capable of exceeding the design requirement and conducting continued operations for a fourth day of combat. Based on the data from tables 12, 13, and 14 each force is capable of conducting limited operations for a fifth day with the Modular Army capable of conducting sustained operations covering 335 miles of terrain while the Army 2020 design culminates at 319.6 miles. The total difference in ground seized between the forces is just over 15 miles.

Source: Created by the author.

This final step in the research model provides further validation that, despite the loss of the bulk fuel storage capacity in the Army 2020 design, the overall effect on offensive operations is minimal. The author's model clearly demonstrates the capabilities of both the Modular Army and the Army 2020 to self-sustain for more than 72 hours of combat operations. This final step in the research method provides a graphic depiction of the limited impacts of the force structure changes between the Modular Army and the Army 2020 on offensive operations.

Summary

Based on the data analysis, it is clear that, the Army 2020 model allows for greater simplicity, survivability and economy. The results of the analysis demonstrate that sustainment force structure changes in the Army of 2020 increase the ability of the BSB to conduct sustainment operations within the ABCT due to enhanced distribution capabilities for fuel and more mobile forces due to the reduction in static systems. It does, however, create risk in integration, anticipation, and continuity. The Army 2020 limits the ability to provide continuous and responsive support by eliminating capabilities within the BSB and increasing the dependence on the CSSB for purified water earlier during operations. This multiple echelon system increases the amount of coordination needed to conduct logistical operations but does not provide additional manpower to ensure this occurs. The BSB staff is less able to integrate forces and operate simply and effectively due to the increased coordination required to support two additional battalions and liaise with EAB units for resupply. The Army 2020 design creates difficulties in integration and continuity in regards to EAB support units due to vaguely defined support relationships that increase the risk of culmination.

Conclusion

The data analysis conducted in chapter 4 identified the effects that the Army 2020 changes in sustainment force structure have using the principles of sustainment as evaluation criteria. The results of this analysis demonstrate areas of increased risk within the Army 2020's concept of sustainment. The study's conclusions and recommendations to mitigate these risks are discussed in chapter 5.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Introduction

My men can eat their belts, but my tanks gotta have gas.¹⁸³

— George S. Patton

This goal of this research was to determine what, if any, changes the Army should make to mitigate the risks created by the dependency on EAB sustainment for ABCT operations. The literature review and the researcher's model provided the necessary data to answer the primary and secondary research questions. This chapter provides conclusions and recommendations based on the results of the literature review and the research conducted. The researcher explains the overall conclusions revealed by the data analysis, then provides recommendations to mitigate the identified risks, and lists recommended topics for further research to advance the field of study.

Conclusions

Reduced operational tempo and fiscal constraints emplaced by the Budget Control Act of 2011 have led the Army to change from the Modular Army to the Army 2020 force structure. This change increases the lethality of the ABCT by reintroducing the third maneuver battalion into the brigade. However, to accomplish this and remain under the Chief of Staff United States Army's (CSA) force caps several capabilities had to be consolidated at echelons above the brigade. Senior leaders identified bulk fuel, water

¹⁸³ Basil Henry Liddell Hart, *History of the Second World War* (New York, NY: Putnam, 1971), 562.

purification, and troop transport as three logistics capabilities for consolidation. The study's findings demonstrate that there are numerous advantages created by the Army 2020 design but also identified areas of increased risks to sustainment operations.

The ABCT's BSB, in the Army 2020, was clearly designed to create an economy of scale across the force and accomplished this by removing bulk fuel and water purification capabilities from the battalion and consolidating them at the CSSB. The removal of static systems like the FSSP from the BSB increased the survivability of these assets by moving them further from the edge of battle. The Army 2020 force structure's streamlining of the types of equipment maintained at the BSB reduces the overall repair parts required for maintenance, and simplifies refueling procedures. Additionally, with the HEMTT pure distribution fleet for the Army 2020 design, it is harder for the enemy to identify the BSA, unlike in the Modular Army, where the BSA was easily identifiable due to the 5,000-gallon tankers. This redesign of the BSB's distribution systems decreases the vulnerability of the entire BSA.

The dependence on an organization outside of the command and control of the division for sustainment creates a risk that, if not addressed, can lead to the culmination of forces during operations. Currently, the corps and division aligned CSSBs provide general support to units in or passing through its designated area.¹⁸⁴ General support relationships do not allow the supported commander to directly set priorities for the supporting units and provides a friction point early in operations between sustainment elements and the combat units they are supporting. If priorities of support are not properly aligned, then the potential exists, in the redesigned distribution plan for bulk fuel

¹⁸⁴ Department of the Army, ATP 4-93, *Sustainment Brigade*, 1-1.

and purified water to conduct resupply by inundation similar to resupply operations in OIF I, where a shortage in a class of supply required a surge of trucks to push resupply forward. This has the potential to overwhelm the supported unit's capability in that supply item but create a shortage in another class of supply.

An unexpected finding of the research was the decreased ability within the ABCT to support stability operations. The removal of bulk fuel storage and water purification assets from the BSB prevents the BSB from being self-sustaining in long-term stability operations. The BSB, in the Army 2020 force structure, requires augmentation from the CSSB's composite supply company or a quartermaster petroleum support company to establish bulk fuel storage. This establishment of a fuel farm reduces the requirements for resupply and the number of vehicles on the supply routes. The same is true for water purification. As long as a unit is located near a water source, the ability to generate potable water reduces the demand for resupply from the CSSB. As of 2012, Army doctrine still expects commanders to execute continuous and simultaneous combinations of offensive, defensive, and stability operations outside of the United States, however, the sustainment changes in the Army 2020 all seem to indicate a focus on the offense over defense or stability operations.

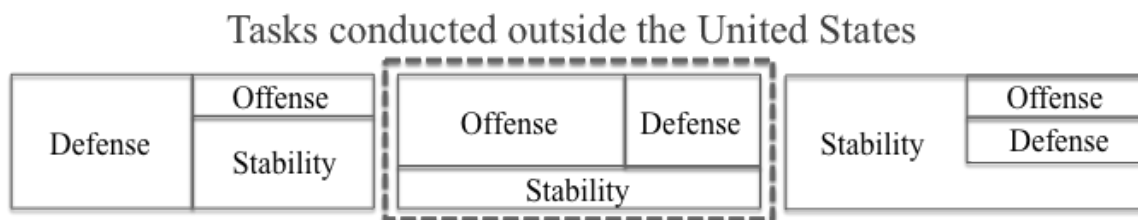


Figure 23. Changes to Decisive Action

The figure depicts the expectation, listed in the 2012 ADRP 3-0 *Unified Land Operations*, that commanders simultaneously execute a mixture of defense, offense, and stability operations. Each box represents an example of how brigades prioritize their efforts based on the mission. However, the Army 2020 design changes, limit the BSB's ability to support defensive and stability operations. This seems to indicate a focus on offensive operations at the expense of being able to simultaneously conduct defensive and stability operations leaving only the center box within the realm of the supportable.

Source: Modified from data in Department of the Army, Army Doctrinal Reference Publication (ADRP) 3-0, *Unified Land Operations* (Washington, DC: Government Printing Office, 2012), 2-3. Emphasis added by the author to highlight increased focus on offensive operations in Army 2020.

The researcher assumes that, in a budget-constrained environment, any recommendations calling for the reinstitution of bulk fuel storage and water purification at the BSB are unacceptable. Additionally, all recommendations must be aligned with the CSA's guidance restricting the number of soldiers in an ABCT to approximately 4,500. With that in mind, the researcher offers the following recommendations to increase the effectiveness of sustainment operations in the Army 2020.

Recommendations

The researcher has identified two recommendations to alleviate the risks associated with the changes to sustainment force structure in the Army 2020. First, the Army needs to properly define the command and support relationships for habitually aligned sustainment brigades and CSSBs. The Army validated this recommendation

when, in February 2015, the CSA directed that Sustainment Brigades be aligned (attached) to each division headquarters no later than July, 2015.¹⁸⁵ The change in command relationship increases unit cohesion and simplifies the chain of command for sustainment units. This solution is preferable to the vaguely discussed habitual orientation originally proposed. However, the researcher recommends assigning the sustainment brigades to their divisions.

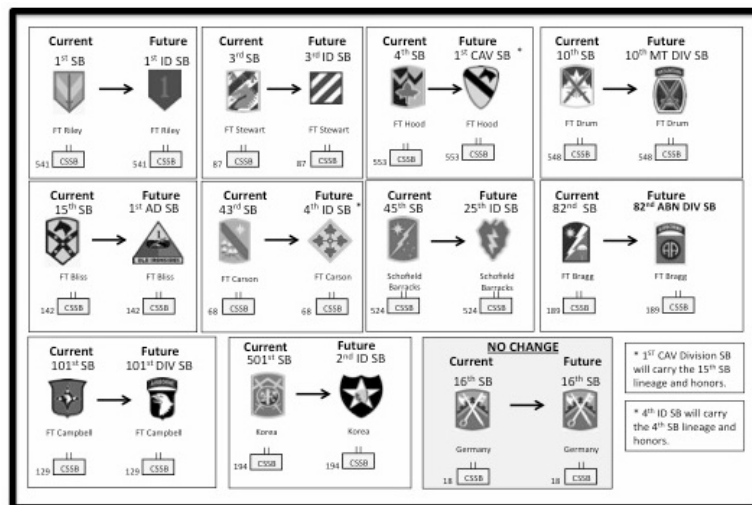


Figure 24. Sustainment Brigade Realignment

The figure displays the Army's planned sustainment brigade alignment for the Army 2020. The identified sustainment brigades are attached to the corresponding divisions and the sustainment brigade soldiers will wear the parent division's shoulder sleeve insignia.

Source: MG Duane A. Gamble, "CSSB Passback," e-mail message to the author, April 22, 2015.

¹⁸⁵ Department of the Army, EXORD 145-15, *Attachment, Redesignation and/or Reflagging of Sustainment Brigades* (Washington, DC: Department of the Army, 2015), 2.

An attached relationship is formed when units or personnel are placed in an organization on a temporary basis.¹⁸⁶ The sustainment brigade, as an attached organization, remains available for deployments that are not synchronized with their division. The resulting lack in sustainment at home station and during possible deployments for the remaining division assets negates any gains in training and unit readiness across the division. Conversely, the assignment of sustainment brigades and CSSBs to a division reflects a relatively permanent relationship where the division assumes control of the functions of the assigned unit. This relationship helps the Army 2020 achieve their goals of maximizing mission command, and creating positive impacts on organizational training, unit readiness, and leader development.¹⁸⁷ If the sustainment brigade and their CSSBs are assigned to the division, they will develop the long-term relationships necessary to build cohesive teams and create standard operating procedures increasing the effectiveness of their operations.

The assignment of sustainment brigades to the divisions in the Army 2020 has a positive impact across several of the principles of sustainment. Establishing a chain of command that is capable of aligning sustainment priorities within division operations increases the simplicity of sustainment. The assigning of the sustainment brigade also has a positive impact on integration and continuity, as the division G4 is now responsible for ensuring a synchronized sustainment effort. Finally, it increases the likelihood of

¹⁸⁶ Department of the Army, FM 6-0. *Commander and Staff Organization and Operations*, B-2.

¹⁸⁷ *Ibid.*, 2.

responsiveness since the sustainment brigade commander now receives direction from the division commander.

The second recommendation is regarding the organization of the BSB staff. Data analysis clearly showed a decrease in efficiency across the staff brought about by the increase of over 300 soldiers in the BSB while reducing the battalion operations officer from a major to a captain. Operating under the assumption that an increase in personnel is not feasible under current force caps, the researcher recommends combining the S3 shop and Support Operations Section (SPO). This change requires no additional personnel and simplifies the operations process within the BSB.

Within the ABCT, the BSB is the only battalion that maintains two sections to conduct operations planning. As of 2015, the duty of the SPO includes being the principal staff officer for coordinating support of the brigade, serving as the key interface with the sustainment brigade and providing mission command of the execution of BSB sustainment operations.¹⁸⁸ Whereas the battalion S-3 prepares and distributes written operation orders and plans. The S-3 works closely with the BSB support operations section to assist in the development of the concept of support for the brigade and coordinates with the SPO to develop the unit task organization, plan and execute operations security, and develop plans for the BSB's deployment.¹⁸⁹ This split in responsibilities results in separate sections tracking data that is inextricably linked to each other's duties.

¹⁸⁸ Department of the Army, ATP 4-90, *Brigade Support Battalion*, 2-5.

¹⁸⁹ *Ibid.*

By combining the SPO and S3 into a consolidated operations section, the Army 2020 maintains the economical gains identified in chapter 4 and improves in several other sustainment principles. Creating a single operations officer with the rank of major increases the ability of the BSB to properly integrate subordinate commanders into operations planning and ensures the operations officer of the BSB is the equivalent rank of the other battalion's operations officers increasing the unity of effort in the brigade. By streamlining the operations process under one section, the responsiveness of the BSB will increase. The merger of the SPO and S3 creates a section that mirrors the rest of the battalions in the ABCT increasing the simplicity in coordinating sustainment operations across the brigade. By merging the sections under the leadership of a major, the BSB staff is able to operate more innovatively by leveraging the major's previous experience to accomplish the mission.

Recommendations for Further Research

This research answered the primary and secondary research questions established in chapter 1 but in the process identified areas for further research regarding sustainment in the Army 2020. If the Army is seeking to maximize unit cohesion and simplify the chain of command for sustainment units, then there needs to be further study into the effects on home station sustainment and training if the divisionally aligned CSSB deploys separately from its division headquarters. If the suggestion to merge the SPO and S3 sections is adopted then further research can determine if automation assets like the command post of the future systems can be consolidated, creating further gains in economy. While this study focused on the ABCT and the changes to its BSB, there is also a need for further analysis on the effects of removing the troop transport capabilities from

the IBCT BSB. Finally, further research needs to be conducted regarding the effects of the Army 2020 on decisive action. If indeed, as this study indicates, there is a shift from the ability to simultaneously conduct offensive, defensive and stability operations then further research can determine if this was a desired effect or an unintended consequence of the force structure change and then identify second and third order effects of this outcome.

Conclusion

This study took a unique approach to analyzing the differences between the Modular Army and the Army 2020. By using the principles of sustainment as evaluation criteria, the author blended Army doctrine and personal experience to identify risks that did not present themselves in standard modeling and simulations. The researcher used the quantitative data from the BSB's bulk fuel capabilities to validate the findings of the qualitative analysis. The experiment created using the historical case study of OIF I demonstrated the effects of the changes on endurance during major combat operations. The model's experiment also provided a means for subsequent researchers to repeat this analysis to enhance the validity of the study's findings.

The findings indicate that in an era of fiscal uncertainty, the economical gains of consolidating the bulk fuel and water purification assets at the CSSB made the risks associated with those actions acceptable to the Army. By properly assigning the sustainment brigades and their subordinate CSSBs, the recommendations provided by the researcher offer a plausible solution to mitigate the sustainment risks created by the Army 2020 force structure changes. Additionally, consolidating the S3 and SPO sections within the BSB, with a major as the officer in charge, increases responsiveness and simplicity in

brigade operations by creating a force structure in the BSB that mirrors those of the other battalions.

The researcher's methodology is a lasting contribution to the field of study as it provides a unique means to conduct an analysis of organizational change. The use of the mixed methods approach using a principles based qualitative analysis validated by a quantitative analysis enables any principle-based organization considering an organizational change to adopt this methodology. Organizations can substitute their principles and applicable quantitative data into the model to help better determine the effects of proposed changes. The pairing of the qualitative and quantitative analyses serves as a method to reduce internal biases held by those conducting the research. Additionally the use of both qualitative and quantitative analysis provides different approaches to the same situation that may generate surprising findings missed by doing a purely qualitative or quantitative review. This methodology is applicable in situations unrelated to the topic of military force structure changes increasing its value to the field of study.

GLOSSARY

Anticipation. Anticipation is the ability to foresee operational requirements and initiate necessary actions that most appropriately satisfy a response without waiting for orders (Department of the Army 2012).

Brigade Combat Team. A combined arms organization consisting of a brigade headquarters, at least two maneuver battalions, and necessary supporting functional capabilities (Department of the Army 2012).

Brigade Support Battalion. The battalion within the Brigade Combat Team responsible for providing logistic support to ensure the supported commander's freedom of action and maneuver. Consists of a headquarters and headquarters company, a distribution company, a field maintenance company, a brigade support medical company, and a forward support company per supported maneuver battalion (Department of the Army 2014).

Continuity. Continuity is the uninterrupted provision of sustainment across all levels of war (Department of the Army 2012).

Decisive Action. Continuous, simultaneous combinations of offensive, defensive, and stability or defense support of civil authorities tasks (Department of the Army 2012).

DOTMLPF. Doctrine, Organization, Training, Material, Leadership and Education, Personnel, and Facilities.

Economy. Economy is providing sustainment resources in an efficient manner that enables the commander to employ all assets to the greatest effect possible (Department of the Army 2012).

Improvisation. Improvisation is the ability to adapt sustainment operations to unexpected situations or circumstances affecting a mission (Department of the Army 2012).

Integration. Integration is combining all of the sustainment elements within operations assuring unity of command and effort (Department of the Army 2012).

Responsiveness. Responsiveness is the ability to react to changing requirements and respond to meet the needs to maintain support (Department of the Army 2012).

Self-Sustaining. The ability to operate without additional organizational augmentation for 72 hours (Elkins, 2008).

Simplicity. Simplicity relates to processes and procedures to minimize the complexity of sustainment (Department of the Army 2012).

Survivability. Survivability is all aspects of protecting personnel, weapons, and supplies while simultaneously deceiving the enemy (Department of the Army 2012).

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