THE FUTURE OF MODULAR LOGISTICS IN FORCE PROJECTION OPERATIONS

A MONOGRAPH
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Second Term AY 98-99

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DTIC QUALITY INSPECTED 4

19991109 036

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	29 April 1999	MONOGRAPH

4. TITLE AND SUBTITLE

THE FUTURE OF MODULAR LOGISTICS IN FORCE PROJECTION OPERATIONS

5. FUNDING NUMBERS

6. AUTHOR(S)

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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

SEE ATTACHED

14. SUBJECT TERMS

MODULARITY
FORCE PROJECTION
MODULAR LOGISTICS

15. NUMBER OF PAGES
47

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED

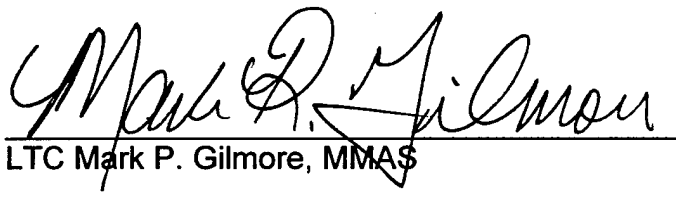
SCHOOL OF ADVANCED MILITARY STUDIES

MONOGRAPH APPROVAL

Major Charles W. Kibben

Title of Monograph: *The Future of Modular Logistics in Force Projection Operations*

Approved by:



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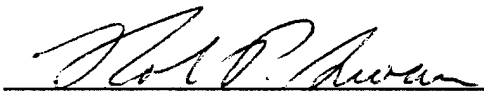

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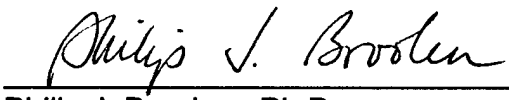

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Accepted this 27th Day of May 1999

ABSTRACT

The Future of Modular Logistics in Force Projection Operations by Major Charles W. Kibben, USA, 43 pages.

Rapid change in the world political environment since the end of the Cold War has resulted in significant reduction in military spending and a fundamental shift in the United States Military Strategy for the 21st Century. With the change of military strategy, Army doctrine has changed from one based on forward presence to a doctrine of force projection. As the army reorganizes in preparation for the challenges associated with force projection operations, logisticians seek the capabilities to sustain current and future logistical requirements. Meeting the logistical demands associated with force projection operations requires a significant revision of current logistical concepts and systems.

One of the many concepts currently being integrated into the Army logistical structure is modularity. This monograph examines the question of whether modular logistical concepts can adequately support future force projection operations. The monograph identifies the tenets of modularity and defines the critical resources required to make modular logistical systems capable of supporting future force projection operations. To assess the ability of modular systems to meet the sustainment demands associated with force projection operations, the capabilities and limitations of current and proposed modular organizations are analyzed and compared to determine the feasibility of modularity as a logistical force design methodology.

Finally, The monograph shows that while modular logistical structures and systems have tremendous capability to support future battlefield sustainment operations, weaknesses in automation, training, and the current structure of the system do exist and could impact on the flexibility and responsiveness required to support future force projection operations. The conclusions suggest that if modular logistical systems are to become a primary means of supporting future operations, they must continue to evolve, change, and adapt to the operational environments the Army will face in the 21st century.

CONTENTS

ABBREVIATIONS

ASCC	Army Service Component Commander
CONUS	Continental United States
CSS	Combat Service Support
DMC	Distribution Management Center
EEM	Early Entry Module
FEI	Functionally Emulative Increment
FLE	Forward Logistic Element
FSB	Forward Support Battalion
FSC	Forward Support Company
MDE	Modular Design Element
MOADS	Maneuver Oriented Ammunition Distribution System
OPTEC	Operational Test and Evaluation Center
PLS	Palletized Loading System
RML	Revolution in Military Logistics
TAACOM	Theater Area Army Command
TFOP	Theater Force Opening Package
TSC	Theater Support Command

CHAPTER I: INTRODUCTION

"Successful force projection requires tailorable, flexible logistics"[1]

FM 100-5
Operations
June, 1993

Section 1: Background

Rapid change in the world political environment since the end of the Cold War has resulted in significant reductions in military spending and a fundamental shift in United States Military Strategy for the 21st Century. With the change of military strategy, Army doctrine has changed from one based on forward presence to a doctrine of force projection. While the doctrine of forward presence depended on maintaining a robust theater sustainment capability and pre-positioned assets to reinforce forces deploying from the Continental United States (CONUS), the focus of power projection is on the demonstrated ability to alert rapidly and field a force capable of sustaining a variety of multifaceted operations.

Achieving the right mix of capabilities necessary to support multifaceted operations ranging from domestic support to large-scale conventional war with a doctrine of force projection, requires a logistical force structure that is mobile and task organized. To meet the logistical challenges associated with the potential deployment and sustainment of future force projection packages, logistics support structures and systems must be versatile, deployable, and expandable.[2] Logistical forces now and in the future must be capable of rapid force projection

from the CONUS or forward based stations, and prepared to sustain operations over extended lines of communications.

Maximizing potential capability while minimizing the expenditure of resources during force projection operations necessitates the requirement for split-based logistical operations. Designed to reduce unnecessary strategic lift requirements, enhance flexibility, and avoid duplication of effort with no loss of sustainment capability, the split-based concept is now the preferred method of sustaining military organizations during force projection operations. By design, split-based operations call for the deployment of only those logistical capabilities necessary to sustain operations in theater while retaining functional logistics capabilities at the CONUS base.

Supporting split-based operations requires logistical support packages that are tailored to current operational considerations. To meet the demand for tailored logistical support packages, the Army has integrated the concept of modularity. Modularity by no means is a new concept. Many private organizations use modularity to achieve efficiency and effectiveness in their daily business operations. In a military context, modularity permits the detachment of functions and capabilities from a parent unit for deployment within a force projection organization. The primary benefit of modularity from a military standpoint is that it enables the parent organization to retain the functions and capabilities necessary to perform all mission requirements at a reduced level of operation. While the Army has recognized the need for modular forces that have the capability to perform split-based operations, an initial review of doctrine and logistical force

structures suggest that further development and integration of modular logistical support structures and methods can enhance force projection logistical capability.

Section 2: Purpose

The purpose of this monograph was to determine how the concept of modular logistics facilitates force projection doctrine. The scope of the paper concentrates on the strategic, operational, and tactical considerations associated with sustaining force projection operations by using modular logistical approaches to split-based operations. The primary research question to be answered is: Does the concept of modular logistics adequately support future force projection operations? To answer the question, the following subordinate questions are answered:

1. What are the present and future force projection doctrinal and operational considerations that facilitate the requirement for the integration of modular logistics and split-based operations?;
2. What are the limitations and capabilities of modular logistics in support of force projection operations?;
3. What changes or modifications to the current force structure based on the modular concept design could better support the doctrine of force projection?;

The data presented throughout the monograph is structured to question the conceptual and organizational aspects of the modular logistics concept as it pertains to force projection operations. The conclusions help determine how modular logistical concepts can be used or modified to improve sustainment

capability during future force projection operations. To answer the primary and subordinate research questions effectively, Force XXI and current Army doctrine are assessed to establish how well current and future organizational structures and functions adapt to the objectives and tenets of modularity as defined in the 1995 version of TRADOC Pamphlet 525-68, Concept for Modularity.[3]

In Chapter II the monograph defines and details the doctrinal implications associated with the concept of modularity. Focusing on current and Force XXI doctrine, the analysis explores doctrine to determine how the concept of modularity has been integrated into force projection logistical operations. Modularity is explored from a tactical, operational, and strategic standpoint to determine how the concept has been integrated into the current military force structure to enhance efficiency and effectiveness while continuing to maintain a responsive combat capability during force projection operations.

Chapter III defines and assesses the capabilities and limitations of modular logistical organizations in support of force projection operations. The capabilities and limitations of modular logistical organizations as they relate to organizational structure, communications and command and control, are analyzed to establish what sustainment capability modular organizations offer future force projection operations. The logistical functions of modular organizations are assessed and measured in terms of the capability to generate and sustain combat power for a broad spectrum of military operations. This assessment helps establish how well modular organizations are prepared to meet the logistical requirements associated with future force projection operations.

Chapter IV is devoted to suggesting how change and innovation can enhance sustainment capability during force projection operations. This analysis recommends modification which may have a positive impact on future logistical operations dominated by increased velocity and less logistical mass. Changes or modification are proposed in order to suggest actions that could enhance ability of future force projection organizations to build and sustain combat power.

While the purpose of this paper was to determine the effectiveness of the modularity concept in relation to building and sustaining combat power during force projection operations, it serves two other purposes. First, by examining the aspects of modularity as they pertain to force projection operations, this monograph gives the reader a better understanding of how modular logistical structures operate to enhance sustainment capability during force projection operations. Second, by exploring the application of modular logistics to military operations, this monograph identifies the limitations of modularity that could negatively impact on future force projection operations.

CHAPTER II: THE CONCEPT OF MODULARITY

> The future Army must be prepared to face a full range of military operations that will allow it to be rapidly tailorable and expandable, strategically deployable, and effective as part of a joint and multinational team.[4]

Section 1: The Doctrine of Modularity

Modularity is a business concept that has been adopted by the Army to help prepare for a dynamic and uncertain future. Ron Sanchez, Graduate Professor of Management at the University of Western Australia best sums up the Army's dilemma in the following comment:

> As organizations try to prepare for futures with significant uncertainties, they are finding that many traditional management concepts that have helped to achieve organizational success in stable environments do not effectively prepare organizations for an increasingly dynamic and uncertain future.[5]

Faced with an uncertain strategic and operational environment, the Army is not unlike the business world in many respects. Both business and the Army seek new management theories and practices that focus on developing flexible organizations that can respond rapidly to changing technological opportunities. The concept of modularity as it relates to military operations has its basic foundation in business practices. Alvin and Heidi Toffler, authors of numerous books predicting future organizational developments in society, wrote in their book War and Anti-War that "changes in organizational structure in the armed service parallel developments in the business world."[6] There are also numerous examples in Fortune 500 Companies today where modularity has proven to provide the organizational strategic flexibility necessary for business

organizations to adapt to future business challenges. Like the Army, large business organizations are highly complex and desire maximum capability and effectiveness in conjunction with the most efficient use of resources.

Within the context of Army doctrine, modularity has been defined in TRADOC Pam 525-68 as "a means of providing force elements that are interchangeable, expandable, and tailorable to meet the changing needs of the Army."[7] In doctrine, the Army has identified three objectives for modularity as it applies to establishing force structures:

> 1) Modularity will provide tailored functions and capabilities needed by force projection forces across the range of military operations.
>
> 2) Modularity will provide the methodology for the Army to achieve a force structure that will optimize rapid assembly of mission-oriented contingency forces that are effective and efficient.
>
> 3) Modularity will provide a means of rapid identifying, mobilizing, and deploying doctrinally sound, sustainable, fully mission capable elements and organizations capable of operating in a joint and combined environment.[8]

The objectives provide the methodology linking force structure to the functions and capabilities associated with force projection operations. In addition, the modularity objectives are tailored to the anticipated military resource constraints associated with building and maintaining future force structures.

While modularity objectives serve as a blueprint for building the future force structure, the tenets of modularity present fundamental characteristics that directly complement future logistical concepts. The doctrinal tenets of modularity as they relate to responsiveness, economics, effectiveness, and flexibility,

compliment the Army's proposed effort to revolutionize how military logistics will be conducted in the future.

The revolutionary ideas associated with future Army logistical concepts and systems are embraced in the term Revolution in Military Logistics (RML). The RML proposes to leverage technology with capability to enhance both the effectiveness and efficiency of the force. As a result of change, the RML envisions a distribution based logistical systems driven by the enablers associated with anticipatory logistics.

Anticipatory logistics focuses on logistical efficiency with no reduction in capability. By enhancing the responsiveness of the logistical system from the strategic to the tactical level, anticipatory logistics and it's associated enablers seek to increase the efficiency and timeliness of logistical support through the intensive management and movement of resources. Key to the anticipatory logistics support concept is a flexible and tailorable force structure that can integrate support activities capable of enhancing supply throughput while increasing the velocity of logistics support.

The tenets of modularity outlined in doctrine complement anticipatory logistics practices and serve to guide in the development of future modular logistical organizations and practices. First, modular organizations and concepts must be responsive. Modularity must serve to reduce the time required to get logistical support from the source to the user. Second, modular organizations must be capable of performing their mission on short notice. Third, modularity must be deemed economical in terms of cost effectiveness and in the application of

resources. Modular units must deploy with the right mix of forces and capabilities to accomplish their assigned mission for the duration of the operation. Effectiveness stems from the proper tailoring or mix of forces based on both environmental and mission considerations. Modular organizations are deemed effective because they have the internal capability to meet the needs of the commander and accomplish each assigned mission. Fourth, modularity must promote flexibility through diversification. A modular organization retains flexibility by diversifying with a multi-functional capability. The multi-functional capability allows the modular organization to expand or contract in anticipation of unanticipated mission requirements. Finally, the tenets of modularity must be interrelated with the tenets of Army operations and sustainment doctrine to enhance future force projection operations.

The Army currently has two doctrinal approaches regarding the concept of modularity; Functionally Emulative Increments (FEIs) and Modular Designed Elements (MDEs). Each is unique from two aspects. First, from the standpoint of how forces organic to a parent unit are tailored and equipped to support split-based force projection operations. Second, from the standpoint of what each design provides in terms of sustainment capability.

FEI's are defined as "organizations constructed with increments so that each increment reflects the function of the organization."[9] FEI's are no more then mini-versions of the parent organization that perform multi-functional capabilities inherent to the parent organization at reduced capability. The most common application of FEI's are found in Combat Service Support (CSS) units. The prime

example widely used in the current force structure is the Forward Support Battalion (FSB). The FSB is designed with numerous multi-functional capabilities in terms of supply, medical, and maintenance support that allows for the parent unit to detach elements, called Forward Logistics Elements (FLEs), to support operations over an extended period of time at a reduced capability. The utility of the FLE concept is twofold. First, FLEs are tailorable. They have the ability to expand or contract rapidly to adapt to a variety of mission requirements. This capability has proven to be invaluable in a number of missions where task organizations change and supply requirements vary based on the size and composition of the supported force. Second, the FLE is multi-functional and capable of providing a range of support that spans from medical services to maintenance repair.

In circumstances where functional capabilities are desired over multi-functional capability, doctrine calls for an Modular Design Element (MDE). Doctrine describes the modular design element as an "organization constructed with discrete elements that create the functional capability of the organization."[10] MDE's are an adaptive form of force packaging that facilitate a functional mix of capabilities that do not mirror the overall capability of the parent organization. For example, a Direct Support Ammunition Company will deploy a ammunition platoon to support an operation. The platoon is considered a MDE because it is functionally oriented and not a reflection of the parent unit's whole capability. MDEs find their utility in support of forces where the capability of certain commodities of support have priority. A classic example is the water support

provided for humanitarian operations in Rwanda. Early on in the planning for the operation, it was determined that the supply of drinking water was key to the accomplishment of the assigned mission and a primary focus of the operation. To accomplish the mission, separate Field Service Companies deployed Water Distribution Platoons to support the operation.

While both approaches to modularity provide an ample framework for creating modular organizations through the process of task organization, combat service support units are more problematic from the standpoint that their roles and requirements are both diversified and specialized. Modularity also has the potential to render the parent unit non-mission capable should certain critical capabilities be deployed in significant quantities. To further complicate mission success, operations are often conducted over extended lines of communications in austere environments where the infrastructure is ill prepared to supplement ongoing support operations.

Building successful modular support structures for the future requires a doctrinal approach that fully integrates the current aspects of modularity with future operational sustainment concepts. By considering modular support structures as a conceptual design for sustaining future split-based contingency operations, capabilities afforded by automation and organizational design must be studied and evaluated. The sustainment aspects associated with building the right mix of capabilities necessary to support forces over extended distances, coupled with the increasing importance of information technologies, require an assessment of the current and future role of modularity in operational doctrine.

Section 2: Current Doctrine

Although the doctrinal concept of modularity complements current doctrine, no mention of it is made in FM 100-5. There is, however, a reference to modular units in the glossary where doctrine defines them as "units comprised of multiple capabilities; depending on the requirement, modules can be added or subtracted from the unit or force package."[11] This definition identifies the requirement for organizations that are tailorable to the demands associated with force projection operations. To assist in building modular organizations, the concept of modularity as it exists in the business world was promoted as an economical means of tailoring forces for potential split-based operations. Ideas related to the civilian application of modularity were modified and transferred to Army doctrine in TRADOC Pamphlet 525-68.

Since the publication of TRADOC Pamphlet 525-68, combat service support doctrine and organizational structures have recognized the benefits associated with the concept of modularity in preparing to support force projection operations using split-based operations. Prior to the integration of modularity, the Army successfully conducted split-based operations in support of both large and small scale contingency operations. As split-based operations became the norm, force projection planners were faced with the realization that while tailored organizations served well in supporting forward deployed organizations, the parent unit often suffered from a loss of critical functions that sometimes rendered the organization non-mission capable. To counter the loss in parent unit

capability and provide adequate support for forward deployments, modularity is slowly being integrated into the Army sustainment structure.

The most recent example of the integration of modularity into doctrine is found in the 1998 version of FM 9-6, Munitions Support in the Theater of Operations. In FM 9-6, the Army refined the doctrinal concept of the Maneuver Oriented Ammunition Distribution System (MOADS) that supported the forward presence Army since its inception. To accomplish this transformation, the Ordnance Corps integrated technology with force structure to achieve modularity. The new concept known as the Maneuver Oriented Ammunition Distribution System-Palletized Loading System (MOADS-PLS) doctrine, creates a flexible ammunition distribution system based on the doctrinal concept of modularity.[12] Using the modular design element as defined in TRADOC Pamphlet 525-68, the Ordnance Corps introduced an evolutionary support organizational concept identified as the modular ammunition company.

The modular ammunition company by design is a force structure capable of supporting any contingency by ensuring only the right mix of equipment and personnel are deployed into an operational theater. By design, modular ammunition companies are composed of platoon size elements known as modular ammunition platoons. The platoons, while smaller than traditional ammunition platoons, are uniquely structured in that they are autonomous and optimize the use of strategic lift assets for deployment. Each platoon organization has the inherent capability for limited self-sustainment and has the capability to expand or contract during deployment to support the staging for follow-on forces

until the situation requires standard units or additional increments and elements. Most importantly, the parent unit experiences no loss of critical capabilities with the deployment of individual platoon size elements.

While the new modular ammunition company design is untested, the concept establishes a framework for the integration of modularity into the development of new functional and multi-functional sustainment structures better suited for use during future split-based operations. The implications of the modular ammunition company design, coupled with advances in better business practices, have potential for other sustainment systems. Many applications associated with modularity and modular units can be expanded to other aspects of sustainment from the strategic to the tactical level.

Section 3: Emerging Doctrine

Emerging doctrine has fully embraced the concept of modularity in its approach to future force projection operations and future Army doctrine has as one of its five underlying characteristics "tailorability and modularity."[13] With so much effort being expended on defining what the Army wants to do, one must question how the Army plans to further implement modularity into the force structure in light of shrinking resources and an uncertain future strategic environment. Careful consideration must be given to recognize where bold change is required, and where little or no change is needed.

To understand fully how the concept of modularity can best benefit the development of future sustainment methods, the full exploration of modularity

from a business and military perspective is required. With the introduction of new concepts such as total asset visibility, anticipatory logistics, and battlefield distribution, the implications of supporting future operations become more apparent. As a result, future doctrine will continue to integrate and exploit the gains in new technology required to support and sustain future force projection operations

While the changes that reflect the integration of modularity in the Army will be driven by new technology, care must be taken to insure that overall logistical force cohesion and effectiveness is maintained. As new forms of automation, communication, and support equipment are introduced, each must be evaluated based on how well it facilitates support for both deploying and non-deploying conventional and modular forces. In addition, technology will drive the formation of new command and control relationships, equipment developments, and personnel considerations that when taken to the extreme, could result in dysfunctional systems. As the Army looks to the future, it must temper the right mix of technology to meet the challenges of the future and balance continuity with change.

Section 4: Conclusion

The doctrinal review of modularity as presented in this chapter demonstrates three key points. First, modularity compliments current doctrine. The concept of modularity has been applied to the current force structure in such forms as the modular ammunition company and platoon, and both concepts have potential

utility for other sustainment support activities in conjunction with future split-based operations. Second, emerging doctrine requires modularity as the force design methodology for the future. Given the emphasis on forces that can rapidly project and sustain combat power with maximum efficiency, modularity allows for the tailoring of forces to meet the demands associated with a variety of operational considerations. Third, modularity as it applies to split-based force projection operations has potential for integration into the future force structure.

The application of modularity to future logistical force structures should be explored and adapted to the sustainment requirements associated with future force projection operations. To assess fully the potential benefits modularity offers the Army logistical system, the primary capabilities and limitations of modularity as a force projection design methodology must be determined. Once determined, these capabilities and limitations must be judged against the capability to build and sustain combat power during force projection operations.

CHAPTER III: CAPABILITIES AND LIMITATIONS

The Army must recognize where bold change is necessary and where little or no change is needed.

TRADOC Pamphlet 525-5
Force XXI Operations
August, 1994

Section 1: Introduction

To assess the effectiveness of modularity as an organizational design concept for future operations, the command and control, automation, and organizational aspects of current and proposed doctrinal modular organizations and concepts are reviewed and compared to traditional logistical support systems. The comparison serves to highlight the advantages and disadvantages of both modular and traditional logistical organizations in respect to their ability to support adequately logistical split-based force projection operations.

Section 2: Command and Control

Getting the right command and control (C2) headquarters and capabilities into a theater of operations is key to providing responsive and focused logistics support at the decisive time and place during force projection operations. As the Army continues to downsize, there is debate over how to best structure command and control headquarters to support and manage theater logistical support activities during split-based force projection operations. Currently, there are two differing schools of thought within the Army pertaining to future logistical command and control organizations and functions for force projection forces in a

theater of operations. These schools of thought are divided between the traditional command and control structure as offered by the Theater Area Army Command (TAACOM), and the new modular concept of the Theater Support Command (TSC).[14]

The traditional command and control approach for Army logistical support operations at the operational level is the Theater Area Army Command (TAACOM). Under the TAACOM concept, logistical activities are grouped according to specialized functions such as transportation, medical, personnel and finance under the control of an Army Service Component Commander (ASCC).[15] Utilized to support the doctrine of forward presence, proponents of the TAACOM concept argue that the functional approach offered by the TAACOM structure under the direction of the ASCC is also adequate for future force projection operations. Advocates point out that under the direction of the ASCC, the TAACOM support organization as currently prescribed in doctrine can tailor the force structure to support the capability required to ensure effective and efficient logistical support for the full spectrum of future force projection operations.

It cannot be argued that the TAACOM doctrinal concept has not successfully supported large scale Army operations. Theater logistical operations during Operation Desert Storm were successful in supporting the requirements of the wartime commander. By deploying the 22nd Support Command with augmented functional capabilities, the Army theater sustainment system over an eighteen month period demonstrated the ability to mass supplies for more than 365,000 soldiers, re-deploy the forces and their materiel, and close-out the theater.[16]

Opponents of the TAACOM argue that the primary problem associated with traditional theater logistical support during Desert Storm was not that the logistical system provided enough supplies to accomplish the mission, but that an inadequate command and control system resulted in inefficient resource management. Studies since the conclusion of Operation Desert Storm point out that logistical practices used during the operation were deficient in two critical areas. First, the requisitioning of unneeded supplies due to the lack of total asset visibility caused a massive build-up of excess resources in the theater. Second, the inefficient allocation of transportation assets caused a lapse in the timely distribution of resources. Despite using some of the best technology available to manage the flow of materials into theater, approximately 22,000 containers had to be opened in theater to determine ownership, contents, or destination.[17] Once the destination was determined, the transportation priority system did not facilitate the timely movement of assets to the using unit.

To adequately meet the logistical support requirements associated with the doctrine of power projection and solve ultimately the logistical problems like those encountered during Operation Desert Storm, the Army is studying the Theater Support Command (TSC) as a replacement for the TAACOM. The TSC is an integral part of the effort to reshape logistical commands at the operational level. The modular design proposed by the TSC minimizes strategic lift requirements by deploying the minimum capabilities and organizational structure necessary to successfully ensure an adequate logistics presence during the critical buildup and follow-on phases of force projection operations.

The unique quality of the TSC that separates it from the TAACOM design, is its multi-functional and layered approach to theater sustainment operations. By designing modular elements that mirror strategic and operational sustainment activities, the TSC eliminates the need to tailor existing force packages and integrates existing command and control structures with the organic resources necessary for the efficient management of theater logistical operations.

The TSC design focuses on those functions necessary to rapidly deploy and build combat power during force projection operations. By design, the TSC concept seeks to build an organic command and control capability through the development of Theater Force Opening Packages (TFOP).[18] TFOP's are multi-functional logistics support groups configured with a mix of combat support and combat service support battalion level task forces. Within the TFOP, there are Theater Force Opening Modules often referred to as Early Entry Modules (EEM's).[19] EEM's are designed with the organic command and control capability necessary to establish rapidly the functional requirements necessary to meet the logistical requirements associated with a full range of force projection operations. A TSC battle-rostered EEM provides not only early-entry command and control logistical capability, but allows the Commander in Chief (CINC) to build incrementally his echelons-above corps support structure with no degradation in combat power.

The TSC concept envisions the buildup of logistics in theater as a three-phased process. During phase one, the TSC EEM's deploy to the theater of operations where they establish the capability necessary to sustain current forces

and prepare to receive follow-on elements. As required to support the operation, EEM's from functional commands are also deployed and are attached to the TSC. At phase two, the balance of the TSC deploys to establish full-scale logistics operations and functional EEM's become staff directorates within the support operations section of the TSC. At phase three, the remainder of the functional headquarters as required to support operations is deployed to theater based on the requirements of the warfighting CINC. The phased approach to building and sustaining combat power not only minimizes strategic lift requirements by deploying the minimum structure needed to accomplish the mission successfully, but ensures that a capability based logistical command and control structure is in place and functional throughout both the buildup and execution phases of operations.

To further enhance operational level synchronization and distribution operations while maintaining control over units and material flowing into and out of the theater, the TSC concept also calls for the establishment of Distribution Management Centers (DMC's).[20] DMC's under the TSC concept are established at each echelon of support to facilitate logistical management and the movement of resources from the strategic to the tactical level. The primary function of each DMC is to deconflict and balance the flow of resources at critical nodes in the supply pipeline. They also provide staff supervision to functional management centers and ensure that CINC priorities for support are enforced throughout the theater of operations.

The Operational Test and Evaluation Center (OPTEC) has assessed the TSC concept based on data collected at three test locations. OPTEC's conclusions were briefed to the Chief of Staff of the Army on 11 August 1997 by the CASCOM commander, Major General Robert K. Guest.[21] In the briefing, Major General Guest supported the integration of the TSC concept as the future structure for supporting future logistical split-based force projection operations. His conclusions, based on the TSC concept evaluation, pointed out to the Army Chief of Staff that the TSC conceptual design was superior to the current TAACOM structure in terms of its ability to command and control force projection and split-based operations. In his analysis, Major General Guest pointed out that the concept evaluation findings supported the integration of the TSC as a means to establish unity of command over sustainment functions within the theater of operations by linking operational and tactical logistics functions to the strategic-level sustainment base.

The conclusions from the TSC concept test support clearly the further integration of modularity into future logistical command and control structures designed to support split-based force projection operations. Concepts like the EEM and DMC are necessary to synchronize distribution operations and to maintain command and control over split-based force projection operations where there is a premium on reducing the logistical footprint in a theater of operations. The modular approach offered by the TSC takes a holistic approach to developing a seamless logistics system with the capability to provide efficient logistics support over a broad spectrum of potential force projection operations.

Even though the TSC organizational design has been determined to be superior to that of the TAACOM in terms of efficiency, the employment of EEM's present specific challenges that could limit operational effectiveness. First, there is the issue of collective training. Supporting force projection operations require forces capable of both rapid and efficient operations. Unlike the TAACOM organizational design that tailored functional resources based on specific mission requirements, EEM's are designed to focus on the multi-functional aspects of force projection operations. To achieve the responsive capability necessary to support functional mission requirements during force projection operations, battle-rostered EEM's must be augmented with additional personnel and resources. The time required to rapidly train and integrate additional personnel and resources into the deploying EEM structure could hamper efficiency and responsiveness. Second, EEM's could lack the resources and manpower to effectively react to unanticipated missions requirements. Multi-functional EEM's have the potential to become overwhelmed by unanticipated functional sustainment requirements resulting in reduced logistical efficiency and effectiveness.

By reducing the resources and manpower currently available in the TAACOM structure and increasing the number and variety of potential sustainment missions, gaps in sustainment support could appear. To counter potential logistical shortfalls, the TSC organizational design must anticipate the unexpected and address training issues. What must be avoided is any effort to gain efficiency through a reduction in resources solely to cut costs. Changing the

current TAACOM organizational structure must be based on gaining the logistical capability necessary to sustain future force projection operations.

Section 3: Automation

Building logistical support structures that facilitate future doctrinal approaches to operations require a fundamental shift in logistical practices from the strategic to the tactical level. In addition, future operational doctrine as prescribed by Force XXI doctrine and Joint Vision 2020 advocates substituting velocity for mass to reduce the logistics footprint and create the conditions for greater battlefield mobility and flexibility.[22] To accomplish this radical shift in the way the Army will be projected and sustained during future operations, the Army must have a logistical system that is both anticipatory and distribution based.

The seamless logistical system required for future split-based force projection operations requires real-time situational awareness that can only be achieved through digitization and the modular integration of automation and technology.[23] To make modularity work, anticipatory logistics enablers such as Total Asset Visibility and Just in Time Logistics depend heavily on integrated automation processes and technological advances.

One significant challenge associated with the integration of modular structures and automation into split-based force projection operations is connectivity. Currently, the Army has seventy two different logistics systems and databases.[24] Of the seventy two, a majority lack connectivity and integration. To enhance connectivity and data integration within the Army logistics structure, the Army is

currently developing an automation system that is integrated, modular and interactive.

The system proposed to eliminate connectivity problems and provide the modular automation necessary to support future Army split-based force projection operations is the Global Combat Support System-Army (GCSS-Army).[25] While GCSS-Army supports situational awareness for command and control structures, its primary purpose is to integrate combat service support (CSS) information. The GCSS-Army system supports the CSS functions of manning, arming, fixing, moving, and sustaining soldiers and systems from the strategic to the tactical level.[26] The modular design of the system allows for it to be tailored to accommodate CSS missions and organizations during split-based force projection operations. The GCSS-Army system as proposed, will provide CSS elements a responsive and efficient capability to rapidly anticipate and synchronize the flow of resources, services, and information from the sustainment base to the supported unit during split-based force projections operations.

Successful implementation of automation in support of modular organizations is not without limitation. Automation systems like GCSS-Army are contingent upon a vast array of support information systems and accompanying communications networks. In addition, the level of infrastructure development and extended lines of communication may require communication resources not available locally during potential force projection operations in austere environments. As operations become more joint and multinational, the issue of interoperability of current and future automated systems with other services and

allies becomes essential.[27] These concerns, coupled with the enemy's potential ability to interdict automated lines of communications, must be assessed continually to ensure that automation does not become the achilles heel during future Army force projection operations.

Section 4: Organizational Design

There is a fundamental shift in the way logistics units are being organized and structured for future force projection operations. At the strategic and operational levels, organizations like the Theater Support Command (TSC) are being tested in a effort to improve future logistical efficiency and responsiveness. Within the Force XXI division, forward support companies now provide the model for multi-functional support on the battlefield. At the corps level, modular ammunition platoons are now being integrated into the current logistical support structure and corps material management systems are being resourced for split-base force projection operations. While each organization performs a unique logistical function on the battlefield, they are similar in one respect. All are designed to support split-based operations and conform with some aspect of modularity.

Future force designs like the Force XXI CSS concept are founded on the principles of anticipatory and distribution-based logistics. Both concepts focus on reducing stockage levels within the division and centralizing logistics functions at the tactical level. As a result of centralized logistics, 1,442 combat service support personnel spaces have been eliminated from the Army of Excellence division structure. The new divisional design referred to as the Conservative

Heavy Design (CHD), puts the number of CSS spaces in the division at 4,321.[28] To achieve the same level of support with a significant reduction in personnel requires the Army to build a CSS structure founded on the tenets of modularity.

The answer to improved efficiency with no loss in capability has been captured in the Force XXI modular Forward Support Company (FSC) organizational concept. The FSC which was formed by consolidating elements from a maneuver battalion's organic support with direct support level functions is now being implemented as part of the Force XXI division redesign. Recent evaluations of the FSC concept during the Division Advanced Warfighting Experiment (DAWE) conducted in November 1997 by the Army Training and Doctrine Command (TRADOC) at Fort Hood, Texas, have proven that the modular FSC supports both the principles of distribution-based and anticipatory logistics.[29] Of the units and systems evaluated, it was discovered that the FSC organizational structure allowed logistics leaders the flexibility to move idle or uncommitted CSS assets to the right place on the battlefield in time to provide maximum logistics support.

Further modular design refinements in organization structure have also take place in the Corps Material Management Center (CMMC). The CMMC by doctrinal design effectively provides centralized material and maintenance management for the corps but is not well suited for split-based operations. The current employment doctrine does not allow the CMMC to configure to task force organization and echeloned deployment.[30] The reason for this is quite simple.

The current CMMC organization, equipment, and automation capability are not easily divisible for deployment.

To provide on-site material management support of force projection operations, the CMMC structure and capability are being redesigned based on the tenets of modularity. Personnel and automation capability are being configured into "fly away" packages with the capability to displace in increments and deploy modular elements forward to multiple locations while leaving a portion of the organization in a secure base or installation location.[31]

To accomplish it's split-based material management function, the CMMC has been augmented with department of the Army civilians and contractors who operate the non-tactical home based installation activities while modular elements deploy into theater to support forward deployed forces. Force projection modular elements from the 18th Airborne Corps have successfully supported division operations in both Somalia and Haiti.

The FSC and proposed CMMC structures are well suited to modularity. Both concepts allow for the phased expansion of functions linked to mission requirements in support of split-based force projection operations. The FSC by design is particularly suited to shifting assets based on METT-T considerations while the CMMC concept uses the building-block principle to tailor the management capabilities required for force projection across the full spectrum of military operations.

Although the modularity aspects associated with FSC's and CMMC's offer significant capabilities in supporting tactical land combat operations, the FSC and

CMMC organizational structures are not without limitations. First, both structures are heavily dependent on assured communications to control automated logistical functions. Without the connectivity afforded through the integration of automation processes and communications links, logistical management and control can become dysfunctional and impact on the ability to rapidly build and sustain combat power before, during, and after operations. Second, both the FSC and CMMC must be resourced with the right personnel and equipment to conduct modular operations. Significant reductions in CSS personnel associated with the FSC design and the requirement for civilian augmentation within the CMMC could impact on the efficient and responsive support required for large scale split-based force projection operations.

Section 5: Conclusion

This chapter has presented some of the current and future organizational designs and concepts that focus on modularity as a means to build and sustain combat power during future split-based force projection operations. By assessing the capabilities and limitations associated with the logistical application of modularity, the research has identified the strengths and weaknesses of modularity as it continues to be associated with anticipatory and distribution based logistical systems. Given the Army can no longer afford to maintain and resource a logistical system based on the concept of mass logistics and that resources and personnel strengths continue to decline in the future, the Army must seek innovative ways to support force projection operations. By continuing

to integrate the concept of modularity and other logistical enablers into the force structure from the strategic to the tactical level, force projection logistical capability can be continuously enhanced.

CHAPTER IV: CHANGE AND INNOVATION

Section 1: Introduction

The perceived limitations associated with supporting future force projection operations detailed in Chapter III suggest that change and innovation are necessary to enhance logistical support on the future battlefield. Focusing on efficiency, future logistical operations will be characterized by increased velocity and less logistical mass. As mass logistical procedures are replaced by ones based on velocity, a fundamental understanding of requirements and assets coupled with a reduction in the supply chain from source to user is necessary. Sustaining force projection operations by velocity requires logistical systems capable of rapidly locating and moving resources from source to consumer. How to modify, improve, and adapt current and future systems to satisfy estimated operational requirements for future forces projection operations must be both evolutionary and revolutionary

In retrospect, modularity offers many unique capabilities to the timely support of force projection operations and logistics based on velocity. Modular concepts and structures provide the requisite operating characteristics essential to enhancing responsive and effective logistical support for a variety of future force projection operations. Modular concepts in support of split-based operations can be more effective and efficient than previous logistical systems based on traditional approaches to supporting operational logistical requirements.[32] In short, modular concepts have considerable merit as a methodology for supporting future force projection operations

Even so, one cannot rule out the possibility that alternative solutions relating to employment of current capabilities could be implemented to enhance the effectiveness and efficiency that modularity offers the logistical system. This chapter explores some of the challenges facing future logistical systems and offers solutions that when integrated with modular concepts, could serve to better adapt the logistical systems' ability to support future force projection logistical requirements.

Section 2: Restructuring

One of the major changes in future logistical support for force projection operations will be in the area of organizational systems and structures. The current logistics system is simply not responsive enough to support the logistical requirements associated with force projection. Supporting future force projection operations will require a logistical command and control organization focused on all aspects of sustainment integration at the strategic level. The logistical command and control structure for future force projection operations must be capable of linking directly CONUS logistical activities with operational requirements to achieve the necessary responsiveness required for future operations. To responsively link strategic resources with operational requirements, a single logistical command must be established with the capability of integrating the three domains of technology and acquisition, force projection, and force sustainment to support mission requirements.[33] Linking the three domains under one command at the strategic level will centralize the effort for

projecting effective logistics into the theater of operations. To oversee theater logistical operations will require a modular operational and deployable element that can be readily attached to the force commander if necessary.

The shift to a centralized logistical command has both advantages and disadvantages in terms of supporting force projection operations. The primary advantages are twofold. First, since future logistics operations are envisioned to be driven by both focused and anticipatory logistics, one sustainment command and control structure can ensure the responsive flow of critical resources. Centralizing the three domains of support facilitate the rapid and timely transmission of requirements and the delivery of critical resources. By instituting centralized control over such functions as supply and transportation, logistical capability can be adjusted to better match operational resource requirements. Second, by using modular organizational structures the right mix of personnel and equipment can be provided to the operational commander based on the particular support requirements associated with the theater of operations.

The primary disadvantage of the concept relate to the size and scope of a centralized logistical command and control structure. Building a centralized logistical command and control organization will require the integration and consolidation of functional processes performed previously by a number of Army logistical organizations and headquarters. The alignment of functions with capabilities will require a transformation in the existing logistical organizational support structure and new doctrinal approaches to logistical sustainment support for force projection operations. In addition, political considerations as they apply

to personnel and stationing considerations could prove to be both costly and time consuming.

Although the transformation to a centralized command and control structure may prove difficult in the short term, future force projection operations will require a logistical system and structure tailored for efficiency and responsiveness.[34] By slowly integrating existing logistical command and control organizations and functions now to better support future force projection logistical requirements, the Army has the opportunity to develop the necessary doctrine and structure suited for future force projection operations. Using modular force designs with associated technological advances promote centralized logistical systems that are both responsive and efficient.

Section 3: Automation

The U.S. Army is now and will continue to be in the future heavily dependent on automation and technology to support future operations.[35] Force projection logistical operations are no different in respect to their heavy dependence on automation to sustain split-based operations over extended lines of communication. As technology speeds up the pace of future operations, force projection automation systems must continue to keep pace. Even so, force projection cannot rely completely on technology to meet all logistical demands. Personnel operating the system must have the ability to make the sustainment system work manually.

Achieving the automation capability necessary to sustain future force projection operations will require an ongoing process of modernization and experimentation.[36] To enhance capability, the Army must focus on three primary issues. First, the Army must replace dated logistical systems in favor of versions capable of meeting the demands associated with future force projection considerations. Second, the Army must upgrade continually the connectivity necessary to meet the vast information requirements associated with force projection. Third, automation systems must be protected from attack.

The Army can no longer depend on logistical automation systems incapable of rapid information integration and transmission. The Army has done much to enhance logistical capability with the introduction of the Global Combat Service Support System-Army (GCSS-Army). The GCSS-Army system has successfully integrated various logistical functions and improved the responsive situational awareness necessary for future force projection operations.[37] Even so, GCSS-Army continues to go through a number of growing pains in the attempt to integrate the capability to support all sustainment activities. To date, the system still does not have the full capability to interface rapidly with other automated combat service support systems essential to split-based force projection operations.[38] In addition, the system has yet to achieve the capability necessary to replicate all sustainment functions.

One problem associated with GCSS-Army is the inability to integrate ammunition management functions. Ammunition management has traditionally been a function of the Standard Army Ammunition System (SAAS).[39] SAAS has

been modified continually to shift it's focus from peace to wartime operations. To date, the system still does not have the full capability to interface rapidly with other automated combat service support systems essential to ammunition sustainment operations, and is prone to crash under extreme environmental conditions. The inability of SAAS or any system to adapt to the rapid information requirements demanded by the potential pace of future force projection operations could put the force at unnecessary risk.

The tremendous amount of information required to support force projection will require a proliferation in automated networks. The ability to rapidly pass information using even dedicated communications circuits will be a formidable task. Evidence of connectivity problems are not new during military operations. Early in Operation Desert Storm, there was a 70,000-electronic message backlog that caused flash precedence messages to take five days to reach their destination.[40] As additional automated systems compete for existing communications links, logistical requirements driven by anticipatory logistics could be disrupted causing critical logistical shortages in the field.

Last, but not least, automated systems are by no means secure to disruption by the enemy. Logistical automation systems are both elaborate and critical to successful force projection operations. Despite their criticality, these systems are generally subject to less stringent security measures than other military systems.[41] A potential enemy could significantly disrupt our operations merely by denying us information by interfering with logistics transmissions links.

The solution to these and other problems are by no means easy to solve. Countering automation weaknesses will require a logistical system that is inherently redundant. To ensure logistical systems have the ability to support future force projection operations, existing commercial automation programs which can be adapted to the Army's current computer inventory must be prepared to replicate logistical functions if the primary system is interdicted or overloaded. The advantages are twofold. First, by merging automated sustainment functions with current systems, the current logistical system can be refined and streamlined. This could not only speed up the transmission of data, but add a new dimension of flexibility to the system. Second, by integrating logistical functions into a variety of existing systems and training personnel in alternate sustainment management activities, redundancy is maintained within the system, a critical factor should the current system be rendered ineffective.

Section 4: Training

The final proposal offered to improve the responsiveness and capability of logistical systems during force projection operations does not concern itself with equipment or doctrinal revisions, but focuses on the human dimension of logistical sustainment operations as they relate to training. Realistic training in the basic warfighting sustainment skills necessary to implement force projection logistical doctrine is essential to generating and sustaining combat power.[42] As many logistical systems have not been stressed during force projection operations, many questions remain unanswered in relation to how current

logistical systems will meet the demands associated with future logistical operational considerations. How well the logistical system functions, or fails to function, will be heavily dependent on the interaction and preparation of personnel associated with force projection sustainment activities.

Modularity and the current focus on technology will require soldiers and civilians that are both highly trained and mentally agile. To effectively support future force projection operations, personnel must first have a firm understanding of the basic principles of warfare and logistics. Secondly, they must have a fundamental understanding of the technology associated with current logistical systems and operations. Force projection operations in a wide range of environmental conditions will require personnel grounded in the fundamentals associated with logistical support. An understanding of the unique aspect associated with each operation and the mental agility to think through the problems associated with force projection logistics will be critical to mission success. There is no technical substitute for well-trained logisticians.

Section 5: Conclusion

Increasingly, logistics will play an important roll in future force projection activities. Although modularity offers many unique logistical capabilities that can facilitate future operations, supporting future force projection operations will require continuing change in the way logistical organizations are organized and equipped. To achieve the efficiency and effectiveness necessary to sustain operations focused on velocity rather than mass, the logistical system must seek

to improve, adapt, and modify existing doctrine and resources to future operational requirements. Automation issues must be resolved and personnel with the skills necessary to meet the logistical challenges associated with force projection operations need to be developed. The U.S Army has the capability to support a wide range of operations in a variety of environments. Keeping the right mix of personnel and equipment necessary to sustain mission requirements will require ideas that are both evolutionary and revolutionary.

CHAPTER V: CONCLUSION

This monograph sought to answer the primary research question; Does the concept of modular logistics adequately support future force projection operations? The answer to the primary research question based on the analysis and insight gained from this study is yes. Modularity as a concept is geared toward supporting force projection operations dependent on responsive and efficient sustainment support. The fact remains that the Army can no longer afford a logistical system based on mass, and must search for systems that are both rapid and efficient. Modularity has and will continue to have a significant impact on future split-based force projection operations. The Army is currently experimenting with the further integration of modularity into the current sustainment force structure from the strategic to the tactical level.[43] The results of the experimentation clearly favor the widespread application of modularity within the future Army logistical structure.

The focus of the research centered on the systematic assessment of modularity and it's relationship to force projection operations. The critical functions of modular logistical units as they relate to organizational design, automation, and command and control were reviewed to determine the effectiveness of modularity as a force design methodology for building and sustaining combat power during split-based force projection operations.

A review and analysis of current and emerging doctrine has identified the requirement for a logistical force structure that maximizes capability while minimizing cost. With a renewed focus on velocity over mass logistical

procedures, future doctrine seeks to balance functional logistical capabilities with the future force projection sustainment issues.[44] To effectively link logistical force structure with functions and capabilities, modular structures and organizations are now being integrated with traditional logistical force structure designs. The concept of modularity compliments clearly the logistical demands associated with future force projection operations.

The review of current and proposed logistical units in relation to their capabilities and limitations reveal a growing desire by the Army to build command and control structures based on the concept of modularity. Experimentation and analysis has shown that conventional logistical structures designed to support mass logistical functions can support force projection operations.[45] Even so, it has been determined that by integrating the tenets of modularity as outlined in TRADOC Pamphlet 525-68 with future technologies and logistical enablers that enhance distribution based logistical systems, command and control activities can be structured and deployed with the functional capability to more responsively and efficiently sustain a wide variety of future force projection operations.

Modularity has proven to be both an efficient and responsive force design methodology. Units designed in a modular configuration are well suited for force projection operations that require the rapid employment of critical logistical functions. The organizational design of modular logistical structures is an efficient means of providing the appropriate logistical capabilities while deploying a minimum of personnel and equipment. In addition, modularity allows for the

deployment of multiple portions of organizations without rendering the parent unit incapable of performing primary mission functions.[46]

While the concept of modularity is well suited for sustaining a wide variety of force projection operations, analysis has revealed that the concept is limited by technology. The modularity concept cannot be implemented without a robust automation capability. Future force projection operations supported by distribution based logistical systems will require both assured communication and the integration of existing automated sustainment systems. Automation in support of modular logistics is also vulnerable to information warfare that could inhibit essential communication and data links. To achieve seamless support as demanded by logistical systems founded on velocity, the command and control aspects of modularity must have uninterrupted connectivity and assured communications from the strategic to the tactical level of operations.[47]

Modularity, in principle, offers one force design methodology which allows for the rapid deployment of the capabilities required to sustain multiple force projection operations. The primary benefit offered by the integration of modularity is efficiency and responsiveness. While responsiveness is essential to force projection operations, efficiency has utility only from the standpoint of reducing the costs associated with military operations. Efficiency cannot and should not replace capability or be the principle rational for building future sustainment structures. In addition, modularity in itself cannot be the sole design methodology used to support and sustain all future force projection operations. While modularity is well suited to limited operations where specialized functions are

necessary to support critical operational sustainment considerations, the capabilities offered by modular units are limited by organic size and resource constraints. Warfighting in large scale force projection operations and major theater wars require a robust sustainment system that integrates both active and reserve forces with the national infrastructure sustainment base.[48]

Modularity as a stand alone replacement for existing logistical systems is at best questionable for the foreseeable future. In time, the advent of new technology could very well support the full integration of modularity as the sole force design methodology for future split-based force projection operations. In retrospect, the current logistical support structure with the integration of modularity has the capability of supporting force projection sustainment requirements in the foreseeable future. What is of primary concern is the future. Success for future operations will depend on the ability of the force to generate and sustain combat power. To generate the required combat power required for future force projection operations, sustainment enablers like modularity must continue to evolve, change, and adapt to new environments the U.S. Army will encounter in the future.

ENDNOTES

[1] U.S. Army Field Manual 100-5, Operations, (Washington D.C.: U.S. Government Printing Office, 1993), 3-6.

[2] United States Army Training and Doctrine Command, TRADOC PAMPHLET 525-5,
Force XXI Operations, (Fort Monroe, VA: 1994), 3-13.

[3] TRADOC PAMPHLET 525-68, Concept for Modularity, (Washington D.C. U.S. Government Printing Office, 1995), 3. The tenets of modularity are; responsive, economical, effective, flexible, selective, and identifiable.

[4] TRADOC PAMPHLET 525-5, Force XXI Operations, 1994, 1.

[5] Ron Sanchez, "Preparing for an Uncertain Future," International Studies of Management and Organization, vol 27, no 2, Summer 1997, 71.

[6] Alvin and Heidi Toffler, War and Anti-War: Survival at Dawn of the 21st Century, New York: Little, Brown and Company, 1993, 77.

[7] TRADOC PAMPHLET 525-68, Concept for Modularity, 1995, 3.

[8] Ibid ,3.

[9] Ibid, 4.

[10] Ibid, 5.

[11] U.S. Army Field Manual 100-5, Operations, 1993, Glossary-6.

[12] U.S. Army Field Manual 9-6, Munitions Support in the Theater of Operations, (Washington D.C.: U.S. Government Printing Office, 1998), is the basics reference for ammunition operations under the MOADS/PLS doctrinal concept.

[13] TRADOC PAMPHLET 525-5, Force XXI Operations, 1994, 3-1.

[14] U.S. Army Field Manual 100-10-1, Theater Distribution Operations, (Washington D.C.: U.S. Government Printing Office, 1998), 1-6. Chapter 3 gives specific details on the organization and functions of the proposed Theater Support Command.

[15] Ibid, 1-4.

[16] Ronald N. Cussins, "The Case for the Theater Support Command", Army Logistician, July-August 1998, 1.

[17] Ibid, 2.

[18] U.S. Army Field Manual 100-10-1, Theater Distribution Operations, 1998, 1-5. The term "TFOP" is still under review, however, the functional mission requirements of this modular task force are recognized.

[19] Ibid, 1-5.

[20] Cussins, 3.

[21] Ibid, 5.

[22] TRADOC PAMPHLET 525-5, Force XXI Operations, 1994, 3-1.

[23] John J. Cusick, "In Search of Focused Logistics", Army Logistician, May-June 1997, 3.

[24] Norman Williams, "The Revolution in Military Logistics", Army Logistician, November 1997, 2.

[25] Global Combat Service Support System-Army (GCSS-Army), Final Draft, (Fort Lee, VA: 1999), 1

[26] Ibid, 1.

[27] TRADOC PAMPHLET 525-5, Force XXI Operations, 1994, 10.

[28] James P. Smith, "Division Experiment Evaluates Force XXI Logistics" Army Logistician , March-April 1998, 1.

[29] Ibid, 2.

[30] Joyce Rudd, "LSE Fly-Away Package" Army Logistician, January 1997, 2.

[31] Ibid, 3.

[32] TRADOC PAMPHLET 525-68, Concept for Modularity, 1995, 3. Responsive and economical support are fundamental tenets of modularity.

[33] U.S. Army Field Manual 100-16, Army Operational Support, May 1996, 3-8.

[34] TRADOC PAMPHLET 525-68, Concept for Modularity, 1995, 3. Efficiency and responsiveness are not only doctrinal tenets of modularity, but the primary focus of anticipatory logistics.

[35] TRADOC PAMPHLET 525-5, Force XXI Operations, 1994, 4-5.

[36] Ibid, 4-5.

[37] Global Combat Service Support System-Army (GCSS-Army), Final Draft, (Fort Lee, VA: 1999), 2.

[38] Howard M. Barrett, Standard Army Ammunition System-Modernization (SAAS-MOD), 1998, 4.

[39] Ibid, 6.

[40] James W. Mclendon, Information Warfare: Impact and Concerns, 1995, 189.

[41] Jeffery McKitrick, The Revolution in Military Affairs, 1995, 83.

[42] TRADOC PAMPHLET 525-5, Force XXI Operations, 1994, 4-3.

[43] Williams, 6. Modularity currently is being experimented with in a number of force re-design initiatives. The basis for the experimentation comes from future force design requirements published in TRADOC PAMPHLET 525-5, Force XXI Operations, 1 August 1994.

[44] Michael G. Dana, "The Legacy of Mass Logistics" Army Logistician, March-April 1998, 1.

[45] Cussins, 1.

[46] TRADOC PAMPHLET 525-68, Concept for Modularity, 1995, 5.

[47] Ibid, 5.

[48] TRADOC PAMPHLET 525-5, Force XXI Operations, 1994, 3-13.

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