REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
30-04-2010	Master of Military Studies Research Paper	September 2009 - April 2010

4. TITLE AND SUBTITLE
Going the Extra Mile: Enabling Joint Logistics for the Tactical War Fighter

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N/A

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
Jeremy Scot Thompson, Maj , USMC

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USMC Command and Staff College
Marine Corps University
2076 South Street,
Quantico, VA 22134-5068

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

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

10. SPONSOR/MONITOR'S ACRONYM(S)
N/A

11. SPONSORING/MONITORING AGENCY REPORT NUMBER
N/A

12. DISTRIBUTION AVAILABILITY STATEMENT
Unlimited

13. SUPPLEMENTARY NOTES
N/A

14. ABSTRACT

Lessons learned from recent conflict combined with the shape of current military activities have created an environment that challenges the traditional paradigm of logistics at the tactical level. While doctrine does little to break the constraints of Service based logistics, joint logistical concepts and Service initiatives recognize the changing nature of activities at the tactical level and the need to facilitate greater interoperability and cooperation at all levels. Developing concepts from systems theory, emerging technologies, and the reality of joint, interagency, multinational, and nongovernmental integration in tactical action now and for the foreseeable future all drive toward a new approach to logistics. To meet the anticipated challenges of current and future distributed operations increasingly conducted within a joint, interagency, and coalition framework down to the tactical level, the Department of Defense must spearhead the top-down establishment of a baseline common logistics system to include shared terminology, processes, equipment, and information systems. Emerging concepts such as Sense and Respond Logistics and Distributed Networked Operations in conjunction with advances in technology and equipment will enable the DoD to create a tactical logistics framework that facilitates coordination and unity of effort between joint, interagency, and coalition partners.

15. SUBJECT TERMS
JOINT TACTICAL LOGISTICS, SENSE AND RESPOND, DISTRIBUTED NETWORKED OPERATIONS, INTEROPERABILITY, DECENTRALIZED LOGISTICS, OIF, OEF, KATRINA, HAITI

16. SECURITY CLASSIFICATION OF:	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
			Marine Corps University / Command and Staff College

INSTRUCTIONS FOR COMPLETING SF 298

a. REPORT	b. ABSTRACT	c. THIS PAGE	UU	29	19b. TELEPONE NUMBER (*Include area code*)
Unclass	Unclass	Unclass			(703) 784-3330 (Admin Office)

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

TITLE:

Going the Extra Mile:
Enabling Joint Logistics for the Tactical War Fighter

SUBMITTED IN PARTIAL FULFULLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

AUTHOR:

Jeremy Thompson, Maj, USMC

AY 09-10

Mentor and Oral Defense Committee Member: J W Gordon
Approved:
Date: 5/4/2010

Oral Defense Committee Member: ~~Donald F. Bittner, Ph.D.~~
Approved: Donald F Bittner, Professor of History
Date: 4 May 2010

Executive Summary

Title: Going the Extra Mile: Enabling Joint Logistics for the Tactical War Fighter

Author: Major Jeremy Thompson, United States Marine Corps

Thesis: To meet the anticipated challenges of current and future distributed operations increasingly conducted within a joint, interagency, and coalition framework at the tactical level, the Department of Defense must spearhead the top-down establishment of a baseline common logistics system to include shared terminology, processes, equipment, and information systems.

Discussion: Lessons learned from recent conflict combined with the shape of current military activities have created an environment that challenges the traditional paradigm of logistics at the tactical level. While doctrine does little to break the constraints of Service based logistics, joint logistical concepts and Service initiatives recognize the changing nature of activities at the tactical level and the need to facilitate greater interoperability and cooperation at all levels. Developing concepts from systems theory, emerging technologies, and the reality of joint, interagency, multinational, and nongovernmental integration in tactical action now and for the foreseeable future all drive toward a new approach to logistics. This concept employs the power and adaptability of decentralized logistics decision-making, the reliability and adaptability of distributed networked operations, and the speed of a sense and respond architecture to enable both dimensions of effectiveness and efficiency in logistics at the tactical level. Although current joint and Service-led programs seek greater freedom of logistical action and interoperability at all levels of war, the reality of creating a comprehensive, common logistics system must be driven from the top by the DoD to ensure coordination of Service activities and bridge the gap between those operational partners outside the military.

Conclusion: The management and coordination of logistics efforts will always, like war itself, remain a uniquely human endeavor fraught with uncertainty, complexity, friction and fog. Creative application of the art of logistics will remain the responsibility of the man in the proverbial arena; however, the science of our joint processes, systems, and standards must be driven from the top down to a state of inherent adaptability and interoperability that will best facilitate support to the warfighter at the furthest edge of the battlefield.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

QUOTATION FROM, ABSTRACTION FROM, OR REPRODUCTION OF ALL OR ANY PART OF THIS DOCUMENT IS PERMITTED PROVIDED PROPER ACKNOWLEDGEMENT IS MADE.

Illustrations

Page

Tables

Page

Table of Contents

Page

Preface

The genesis of thought for this MMS study began at the USMC Advanced Logistics Officers Course in early 2009. My interest, as a professional logistician, was piqued when a guest speaker detailed a story (purportedly true) about a unit that faced a difficult operational situation in southern Afghanistan. The gist of the story centered on a basic support need not being met despite the existence of a very simple, locally available solution if the unit's logisticians had been given the right tools, training, and authority to realize it. My hope is that this treatise might contribute to furthering the dialogue on how to meet the unprecedented logistics challenges that military professionals currently and will continue to face in the future.

As capable as our joint forces are today, this will not be enough to meet future challenges as described in this concept. We will need to develop new capabilities and change the capacities of existing ones. We will need to create new joint and Service doctrine, tactics, techniques and procedures. We will need to establish new methods for integrating our actions, both internally and with partners. We will need to select, educate, train, equip and manage our people differently. We will need to envision and create new organizations. We will need to develop new technologies and adapt existing ones to new missions.[1]

-Admiral Mike Mullen, Chairman JCS
Capstone Concept for Joint Operations
January, 2009

Conflict in the current era is expected to be "increasingly unpredictable and sudden, with the potential to expand rapidly into unanticipated locations and continue for unexpected durations."[2] The last decade has borne witness to this prediction where the terms complex, irregular, and distributed find common use in describing military operations unfolding in Iraq and Afghanistan. The military has necessarily adapted its approach by dispersing over increasingly larger battlespace, operating as virtually autonomous smaller units, and integrating activities with joint, interagency, and multinational partners as the norm rather than the exception. Operations has adjusted tactics, task organization, and procedures to facilitate this approach while the logistics system, constrained by doctrine, law, fiscal traditions, sub-optimized systems, and deeply engrained cultural norms, remains slow to do so. Despite awareness of the growing imperative toward coordination and integration of logistical activities which has led to limited progress at the operational and strategic level, little has been accomplished at the tactical level where unity of effort remains arguably the most critical.[3] Tactical logisticians continue struggling to overcome the constraints of an inefficient logistical system through the ad hoc local agreements, resource sharing, "hand-con" arrangements, manual workarounds, and improvisations that have traditionally characterized effective logisticians since time immemorial. Unfortunately, the character of the current operations has rendered this approach increasingly

difficult and potentially unsustainable. To meet the anticipated challenges of current and future distributed operations conducted increasingly within a joint, interagency, and coalition framework at the tactical level, the Department of Defense needs to spearhead the top-down establishment of a baseline common logistics system to include shared terminology, processes, equipment, and information systems.

The Evolution of Logistics

At its core, logistics involves the art and science of matching current and future requirements with possessed and accessible capabilities. More simply, logistics means figuring out what is needed, finding it, and getting it there on time. Traditionally, the idea of the iron mountain has reigned supreme in supporting combat operations. In the age of linear, methodical battles, logisticians accumulated massive stockpiles in secure rear areas from which capability was pulled as required. As the speed of battle increased, the need to push logistics forward so as to avoid constraining the maneuver of combat units grew in importance. Logistical security lied in the effective method of positioning as many resources as far forward as possible. While very few logisticians have ever been fired for having *too much* capability on hand, emerging concepts, fiscal constraints, and simple logic dictated that efficiency still had an important role to play in designing logistical systems. Borrowing from the commercial logistics community, "just-in-time" and precision logistics methodologies promised greater efficiency with less excess and waste. However, as a number of unfortunate logisticians discovered, just-in-time logistics translates equally to *almost-late* logistics, especially when applied to a stovepiped, Service-constrained supply chain system and an unpredictable battlefield. Thus, while efficiency of logistics support remains a consideration, effectiveness reigns supreme and driving stockage levels forward has been standard practice in the recent past.

The current operating environment, given its characteristic unpredictability and constant change, has presented new challenges to this approach by increasing the difficulty of anticipating both future requirements and capabilities. The reality of distributed operations has further complicated the situation by increasing the number of independently operating units that have dispersed over a larger battlespace. Consequently, the finite number of logistical assets has had to subdivide into smaller elements with increased requirements for mobility and survivability while support solutions have become ever more complex. Complicating the situation even further, the tactics of an irregular enemy dictates that units must grow lighter, more agile, and adaptable to take advantage of fleeting opportunities. Positioning large logistical stockpiles forward on the battlefield has grown operationally unfeasible. The efficiency versus effectiveness conundrum has resurfaced.

Addressing this problem requires looking at the situation differently, as is often the case, by addressing underlying assumptions. The first supposition that must be considered involves the linear, zero-sum conceptualization of support with effectiveness on one end of the spectrum and efficiency on the other. This paradigm sets up a false choice between efficiency *or* effectiveness in which gaining one means losing the other. Jamshid Gharajedaghi, an early contributor to 3rd generation systems thinking, offers a way out of this situation by introducing the concept of *multidimensionality*. The principle of multidimensionality dictates that "opposing tendencies not only coexist and interact, but also form a complementary relationship."[4] This approach implies that the efficiency and effectiveness situation allows for both to increase or decrease independently but in a complimentary way. A typological model of logistics systems (see Figure 1) helps identify the various approaches to design. Early logistics systems demonstrated a low efficiency and low effectiveness character which was sufficient to meet the

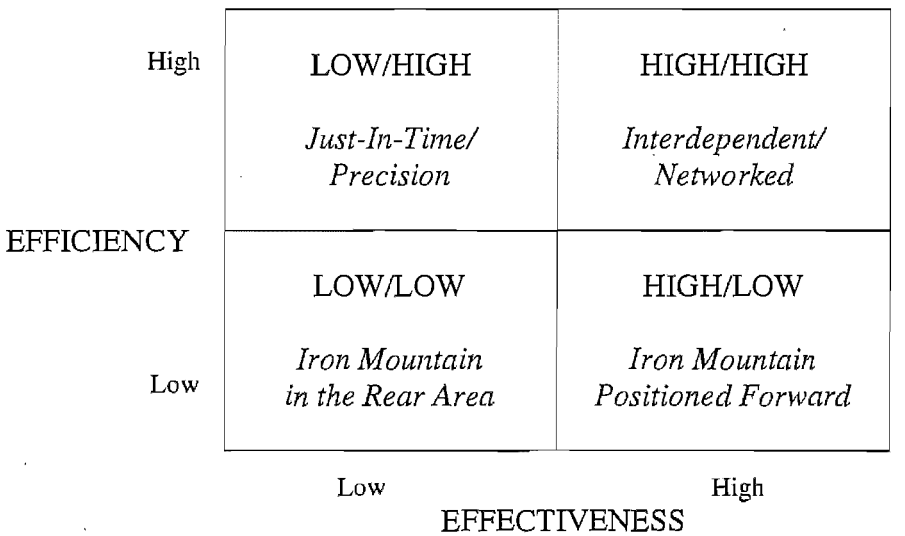


Figure 1. Multidimensional Character of a Logistics System

needs of the time. Greater demands on the system drove exploration into the realms of either high effectiveness *or* high efficiency. In a natural progression common to social systems, the dynamic, irregular character of current and likely future battlefields demands even greater maturity of the logistics system, one capable of both high efficiency *and* high effectiveness. A study of lessons learned over the last decade will help give form and weight to the theoretical dynamic outlined above.

Lessons Learned in OIF and OEF

> *Operations Enduring Freedom and Iraqi Freedom, along with past campaigns, highlight logistics efforts fraught with inefficiency, redundancy, and process gaps. Our success was often dependent on heroic efforts and battlefield ingenuity by military logisticians and the overwhelming capacity of our industrial base to provide virtually limitless support. We cannot depend on this in the future, nor should we.*[5]

Operations Iraqi Freedom (OIF) and Enduring Freedom (OEF) have produced a collection of lessons learned that have been captured to an unprecedented degree for contemporary analysis. While both present arguably very different situations with unique logistical challenges, much of the feedback and lessons learned share common themes. Both

OIF and OEF participants noted the requirement for operating on a non-contiguous battlefield, with no true front and rear areas. Because the enemy evolved toward concerted efforts in targeting logistics activities, multiple lines of communication had to be used. Both theaters witnessed extended distribution routes, use of multiple intermediate logistics nodes, and the requirement to access materials through multiple supply chains simultaneously. Logisticians recommended minimizing the size of logistical footprints at forward operating bases and combat outposts to facilitate rapid relocation.[6] Standard stockage levels of 30 to 60 days of supply (DOS) from previous operations were reduced to 7 to 15 DOS to meet operational needs.[7] The iron mountain approach proved impractical while flexibility and adaptability grew in importance.

According to Lieutenant General Christianson, a former Director for Logistics on the Joint Staff, "there may be near-unanimous agreement that the single greatest gap in the world of defense logistics is visibility..."[8] A Joint Forces Command (JFCOM) report clearly reflects this sentiment, "knowing where material was and how to move it to an end user moving rapidly forward was the greatest challenge for logistics in the last 50 kilometers."[9] According to Theater Support Command (TSC) personnel, limited visibility of tactical requirements impeded their ability to provide support. Also, the unavailability of logistics status reports from tactical units made prediction of their support needs difficult and led to necessary cannibalization of equipment by individual units.[10] Lack of visibility feeds cumbersome processes for staffing issues and leads to the inability for higher headquarters to provide responsive support. Both OIF and OEF witnessed the occasional lack of timely response from the COCOM J4. When the Service mechanisms could not meet unit requirements, requests for assistance were forwarded up the chain of command. By the time responses had been received, the situation had typically been resolved by the units painfully pursuing an alternate course of action or the issue had simply

been overcome by events.[11] The system of working through higher headquarters staffs, despite their good intentions and desire to assist, was unable to respond fast enough to facilitate the adaptation and logistical problem solving tempo required at the tactical level.

Another emerging trend in logistical operations over the last decade is the spontaneous self-organization and cooperative efforts by individuals across the Services to meet local needs. At the operational level, voluntary Service cooperation enabled the Theater Support Command Center (TSCC) to integrate Army and Marine logistical efforts during OIF 1.[12] JFCOM recommends the development of TSCC standard operating procedures (SOP) as an effective model for coordinating logistical efforts at the operational level among the Services. Recent trends also indicate the increasing use of acquisition cross-servicing agreements (ACSA) to overcome traditional barriers to inter-Service and inter-national logistical capability sharing.[13] Additional challenges were noted in the non-traditional requirement to provide direct support to local populations and develop host nation logistical capabilities.[14] These requirements necessitated the ad hoc coordination between small unit logistics personnel and organizations outside the bounds of normal support relationships.[15]

Doctrinal Considerations

What insight and guidance does joint logistics doctrine provide for addressing these unprecedented challenges? Although current literature reveals several slightly differing conceptions of how joint logistics should be defined, the Joint Publication 4.0 gives us this baseline: "Joint logistics is the coordinated use, synchronization, and sharing of two or more Military Departments' logistic resources to support the joint force."[16] Despite common perception to the contrary, nothing in the definition constrains joint logistics to the operational or strategic level of war. However, the JP 4-0 does, in a discussion on the levels of war, proceed to

state that logistics at the tactical level should be conducted by the Services, whereas joint logistics has its greatest importance at the operational level.[17] Given the aforementioned challenges presented by the current operating environment, a Service constrained focus at the tactical level seems contrary to the principles of logistics (responsiveness, simplicity, flexibility, economy, sustainability, and survivability) that are also outlined in JP 4-0.[18]

Additional guidance can be found in the Focused Logistics Campaign Plan signed by the Chairman of the Joint Chiefs of Staff in 2004. The Campaign Plan references the following logistics imperatives as outlined in the Joint Operations Concept:[19]

- A fully integrated, networked and globally synchronized logistics system with unparalleled reach must be agile enough to support continuous, distributed joint operations.
- Distributed forces operating at high tempo must move away from regionally focused, Service-centric planning to a precise, flexible and responsive sustainment system appropriate to this dynamic environment.
- Joint forces must be more self-sustaining though globally integrated, synchronized end-to-end systems which are interoperable with interagency and multinational partners.

This guidance makes clear reference to, and consideration of, the challenges facing logisticians in distributed, joint operations. The concept goes on to advance a vision of the integrated and effective use of the logistics capabilities between the Services, other governmental agencies (OGA), coalition nations, and the commercial sector.

The 2006 Joint Logistics (Distribution) Joint Integrating Concept, derived from ideas expressed in the Focused Logistics Concept, calls for the development of a single, integrated joint deployment and distribution enterprise (JDDE). The JDDE seeks to augment, interact with, and complement Service capabilities and responsibilities in order to enable rapid and effective movement and sustainment of the joint force.[20] The JDDE concept recognizes the traditional divide in joint doctrine between strategic distribution and inter-theater distribution. "Clearly, the

operational and tactical distribution function has not enjoyed the level of advocacy as the strategic segment. As such, the capabilities of the theater distribution segment fall short of what is required to integrate into a comprehensive end-to-end distribution pipeline."[21] While the JDDE calls for a networked system with near real-time operational views to enable augmentation with scalable, agile distribution capabilities, it is clear that focus remains primarily on operational-level distribution efforts.

The current Director for Logistics, Joint Chiefs of Staff, Lieutenant General Gainey, provides another perspective on the joint logistics environment through a July 2008 study that sought to create a vision for the joint logistics community. This concept, known as the Joint Logistics Compass, strives for a future state with three desired conditions: sustained logistics readiness, integrated logistics capabilities, and shared resources.[22] The study also highlights an unprecedented partnership between the DOD, OGAs, multinational partners, contractors, and non-governmental agencies. Unfortunately, the Joint Logistics Compass, representing the most current guidance from the joint logistics staff, appears to stop short of addressing the challenges facing joint forces at the tactical level. Only the Focused Logistics Campaign Plan of 2004 comes close to addressing the needs of the tactical logistician by advocating information fusion and development of agile sustainment capability throughout the joint force.

It is hard to address the topic of joint logistics without touching on the doctrine of Directive Authority for Logistics (DAFL). The article, *Who Rules Logistics? Service Versus COCOM Authority*, written by Col Christopher Paparone, PhD, presents one of the best considerations of the subject. The unquestioned logistical command authority and responsibility by the Services over their respective forces can be found in Title 10 of the United State Code, sections 3013, 5013, and 8013. In chapter 6 of Title 10, Combatant Commanders (CoCOM) are

authorized *Combatant Command* authority, which does include command over administration, support and discipline activities, but only over *assigned* forces. However, most forces at the CoCOM's disposal are placed under operational control (OPCON).[23] The concept of DAFL, a creation of doctrine (JP 1-02) and not statutory, confuses the picture by giving the erroneous impression that a Combatant Commander's authority over logistics extends to those OPCON units. Despite this statutory limitation, Col Paparone identifies several tools that the CoCOM has available to meet obligations delineated in the Unified Command Plan. DoD Directives, Inter-Service Support Agreements (ISSA), Acquisition and Cross-Servicing Agreements (ACSA), pre-existing Executive Agency (EA) responsibilities, Operations Orders, and Operations Plans serve as the primary means for the CoCOM to establish unity of logistical effort in the absence of command authority.[24] However, these mechanisms, and the current systems that support them, have proven too cumbersome and constraining to facilitate effective and efficient logistical coordination throughout the CoCOM's area of responsibility. A senior logistics officer's anonymous quote summarizes the issues that remain with the CoCOM's direction over joint logistics:

> ...logistics in this area of operations is not directed by a single headquarters, but rather by rules and procedures of the separate services. This loosely formed system relies on informal, personal relationships, command intervention and ad hoc requests resulting in inefficiencies, uncertain schedules, and continual retraining and reestablishment of relationships. While the commander possesses directive authority for logistics (DAFL) he is unable to execute it as effectively and efficiently as possible due to this lack of joint rules, tools, and procedures...[25]

Not specifically tied to DAFL, but related and relevant to joint logistics, the application of Common-User Logistics (CUL) has proved to be the norm rather than the exception in nearly all joint operations. As defined by Joint Publication 4-07, *Joint TTP's for Common-User Logistics in Joint Operations*, "common user logistics is material or Service support shared with or provided by two or more Services, Department of Defense agencies, or multinational partners

to another Service, DOD agency, non-DoD agency, and/or multinational partner in an operation."[26] As the early stages of OEF demonstrate, the responsibility for Common-User Logistic support does not necessarily default to the Service traditionally best equipped to handle the tasking. Task Force 58, essentially two Marine Expeditionary Units (MEU's), following early operations ashore in Afghanistan, received the tasking in November, 2002 to provide common item logistics support to personnel at Forward Operating Base Rhino. This requirement grew to include U.S. sister Services (USAF, USA, USN) and coalition forces (Australian, Canadian, German, New Zealand, Norwegian, British, Jordanian), as well as the media. At its peak, 56% of the personnel supported by TF-58 were non-USMC personnel. [27] According to the 2003 Combat Assessment Team report, "in many instances, sustainment of the operation succeeded only due to the ingenuity and workarounds of the Marines and Sailors involved: simply doing without, 'scrounging' supplies, bending the rules, or re-directing supplies intended for later use of other forces."[28] While Common-User Logistics as a doctrinal construct has utility, it clearly does not hold the key to unlocking the logistical challenges faced by tactical units in the current operating environment.

Direction for the Future

Several current documents developed by Department of Defense, Joint Forces Command, and the individual Services provide insight and guidance for the future of military logistics. The 2010 Quadrennial Defense Review (QDR) outlines the need for forward-deployed, balanced joint forces that not only function seamlessly throughout the range of military operations, but will necessarily operate in conjunction with other agencies, civil authorities, and international entities. The QDR also highlights the priority for both effective *and* efficient delivery of logistics support to the field. It encourages ongoing DoD efforts to improve logistics unity of

effort within the joint force as well as with multinational, interagency, and nongovernmental elements.[29]

The Capstone Concept for Joint Operations (CCJO) of 2009 outlines several operating precepts that provide guidance directly relating to the character of future joint logistics activities:[30]

- Achieving unity of effort within the joint force, U.S. Government, international, and other partners
- Combining joint capabilities for complementary rather than additive effects
- Avoiding combining joint capabilities where complexity is added without gaining a sufficient advantage
- Driving synergy to the lowest echelon at which it can be managed effectively
- Operating indirectly through partners as situation permits
- Ensuring operational freedom of action and flexibility

The need for agile, adaptable forces capable of independent operation at lower echelons is discussed as one of the implications of these precepts.[31] The CCJO also indicates that improving the ability to integrate with other US agencies and other partners highlights the need for technological interoperability, common techniques and procedures, and frequent training, coordination, and exercises. The concept goes on to state that "organizational procedures and technologies that improve collaboration within ad hoc groups of diverse, often geographically dispersed members will help [with facilitating integration]."[32] Developing cross-domain interdependencies and new capacities will require close and continuous coordination and may dictate changes to existing structure and historical funding allocations.[33]

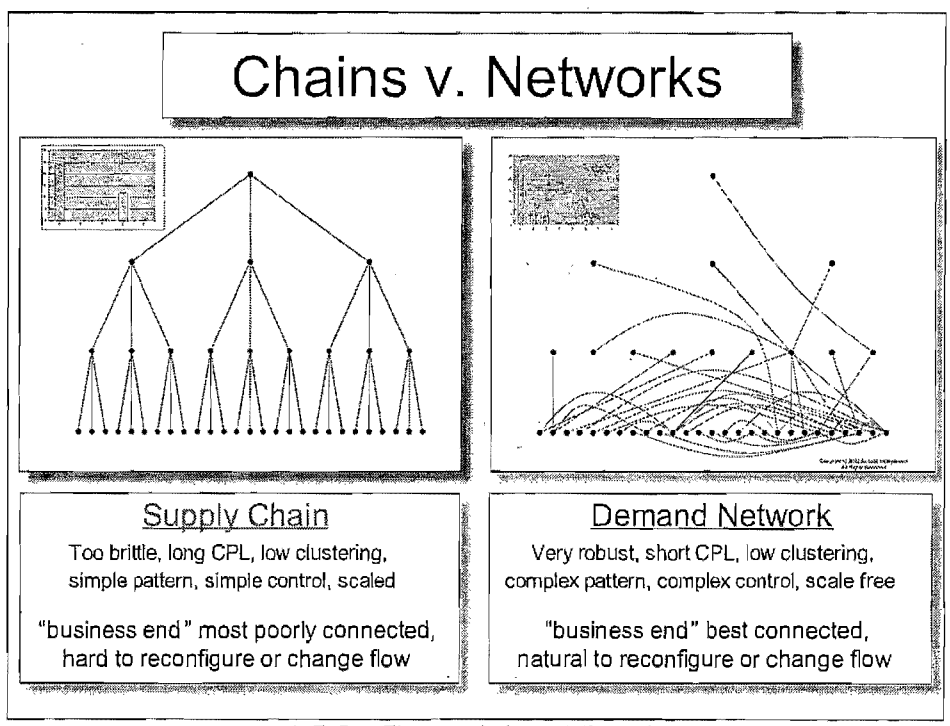
Army and Marine Corps senior leaders have been addressing issues related to interdependent joint operations as reflected in the focus areas of a 2009 staff talk. The first task identified as a priority for both Services involves the review of OIF joint logistics operations in

order to determine lessons learned for OEF and other future operations. Of the eight tasks generated during the conference, half of them relate to joint logistics issues including joint seabasing, ground wheeled tactical vehicle strategy, and vehicle fuel efficiency.[34] As discussed in its *Vision and Strategy 2025* concept, the Marine Corps desires a force that is trained and equipped to lead joint and multinational operations while enabling interagency activities. Developing this force requires building upon the traditional combined arms approach to realize a "combined actions" orientation.[35] Specifically addressing logistics modernization efforts, the Marine Corps desires to "focus on a markedly improved ability to sense what is needed and respond accordingly."[36] In addition to greater integration with naval logistics infrastructure, greater joint interoperability in systems, procedures and organizations will facilitate achieving strategic objectives that include joint seabasing, persistent forward presence, and greater decentralized, complex small unit operations.[37]

A Proposed Concept: Theoretical Foundations

To meet the demands of operational situations currently evolving on the modern battlefield and the vision for change outlined in Joint and Service strategic guidance, the joint logistics community must move past the paradigm of overly optimized, Service-centric supply chains towards a decentralized, robust demand network. Jeffery Cares provides insight in the form a Distributed Adaptive Logistics concept which relies on a self-synchronizing, learning network that provides the flexibility, agility, and responsiveness necessary to handle the current level of tactical complexity.[38] The traditional supply chain consists of a minimally connected network of logistics nodes laid out in series (see Figure 2). While this arrangement allows for simplicity of command and control, the supply chain is not robust, nor agile in adapting to complex situations. Cares' Demand Network, however, employs logistics nodes with a varying

number of arcs (spokes) connecting each node. Only a few of the nodes are highly connected and have a large number of arcs (similar to the intermediate logistics hubs used in Iraq and Afghanistan) while most nodes have a small number of connections or paths to other nodes.[39] This flexibility in the number of connections per node represents a class of network known as "scale-free." A scale-free network requires only a few jumps to get between nodes throughout the network. This facilitates rapid adaptation to complex situations by reconnecting only a few of the links when relocating hubs.



* CPL= Characteristic Path Length

Figure 2. Supply Chain Model vs. Demand Network Model of Logistics[40]

Additionally, the simplicity and inflexibility of traditional supply chains proves easier for the enemy to understand and disrupt. The supply chain model also creates situations where the most forward nodes (tactical units) have the least amount of connections and redundancy. Demand networks, however, promote interconnection (redundancy) and push adaptability to the most forward locations. This adaptability has significant implications for uninterrupted resource

flow through the network in the case of dramatic change. Whereas a supply chain's rate of delivery is disrupted or halted for extended periods of time while the chain is reconfigured, the demand network can more quickly reconfigure or reroute flow through the larger number of alternate links (see Figure 3).[41]

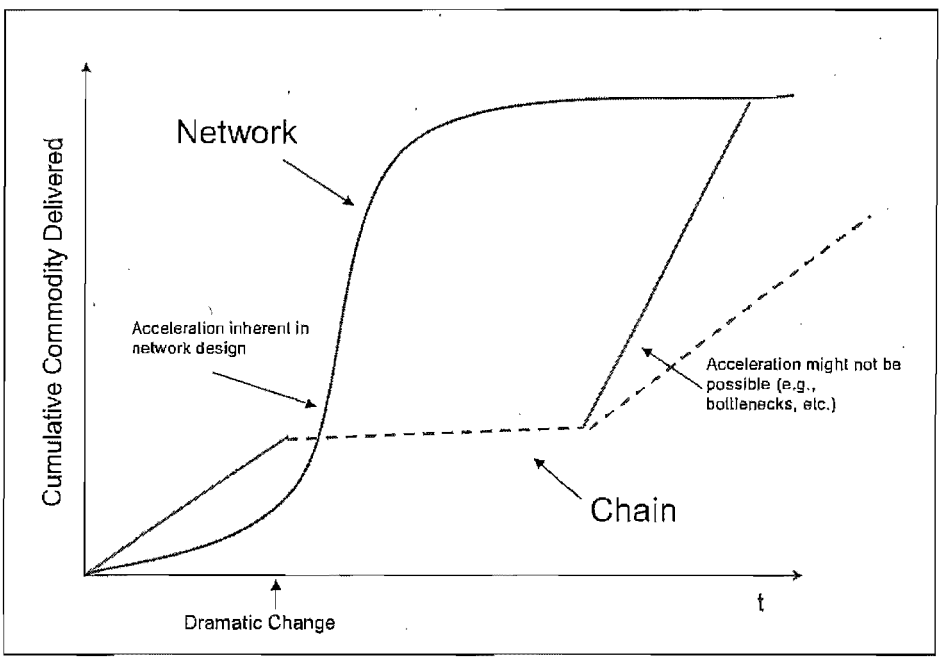


Figure 3. Accumulation of Commodities Over Time Comparison[42]

The decentralized nature of these networks represents an important characteristic that results from the focus on "demand" signals as a means of control. This approach enables the network to reconfigure (self-organize) based on demand signals and the dictates of commander's intent for decentralized mission accomplishment. John Schmitt argues in *Command and (Out of) Control,* that decentralization is the basic nature of warfare. In complex, open environments, command and control is characterized by learning and adaptation. Schmitt goes on to state that:

> Control is an emergent property arising spontaneously: unity of effort is not the product of conformity imposed from above but of the spontaneous, purposeful cooperation of the distributed elements of the force...The critical factor in such a system is to create command parameters and other systems features which provide the necessary guidance and level of understanding to create unity of effort without unnecessarily constraining the activities of subordinates.[43]

The military's deeply engrained practice of issuing mission type orders provides the guidance required for unity of effort whereas the Distributed Adaptive Logistics framework provides the flexibility and freedom of action for spontaneous and purposeful cooperation.

A Sense and Respond Logistics (S&RL) concept in various forms has been actively developed by the Office of the Secretary of Defense, the Joint Staff, the Defense Advanced Research Projects Agency (DARPA), and the individual Services since the early 2000's.[44] As the diagram from an October, 2003 Office of Force Transformation briefing shows, the Sense and Respond (S&R) approach reflects similar principles to those expressed in the Cares'

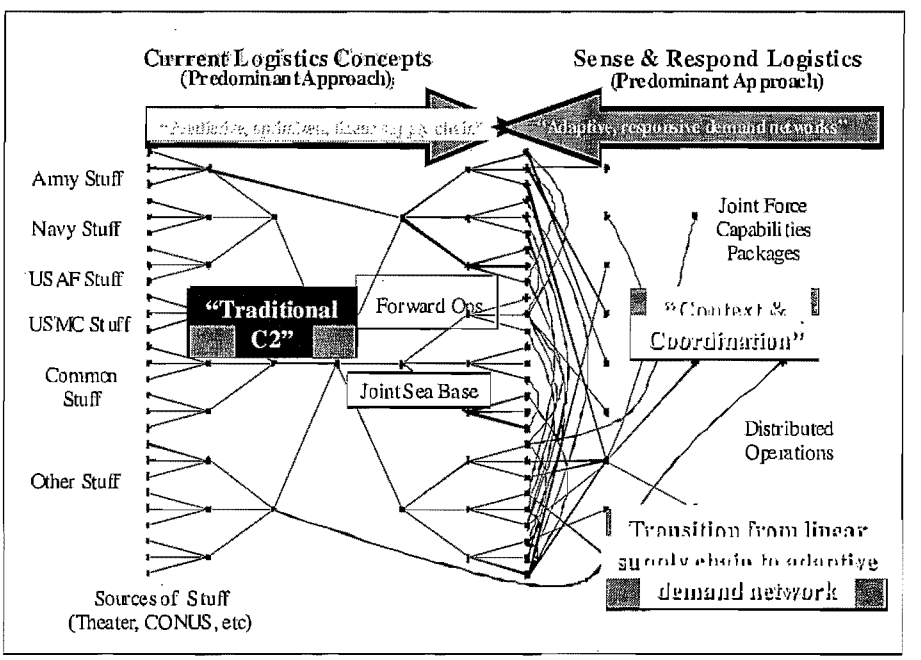


Figure 4. Comparison of Traditional Logistics Concepts to the Sense and Respond Approach[45]

Distributed Adaptive Logistics construct (see Figure 4). Both concepts advocate the transition from linear supply chains to adaptive demand networks.[46] The Sense and Respond concept can be further characterized as follows:[47]

- event-driven, reconfigurable support networks
- commander's intent and shared situational awareness facilitate negotiation-based relationships

- creates networks that are robust and difficult to analyze and attack
- decentralized adaptability supports operational pause-free distributed operations

Steven Haeckel developed the Sense and Respond construct while at IBM in an attempt to adapt business operations to an increasingly complex, fluid, and competitive modern marketplace.[48] He recognized that growing unpredictability and discontinuous change as a consequence of the information age has forced organizations to evolve by grouping into smaller, quick-response units. To avoid losing the traditional advantages of scale and scope, large organizations had to then be managed as adaptive systems that strive to sense early and respond quickly.[49] Haeckel slightly modified Col Boyd's decision-making model to create a SIDA (Sense, Interpret, Decide and Act) loop which illustrates the possibility of shrinking the traditional OODA loop through automation.[50] Technologies currently in use such as radio frequency identification (RFID), remote diagnostics, and dispersed, web-enabled networks are making autonomic logistics constructs an achievable reality.[51]

The first of two key tenets of S&R holds that unpredictable demand drives a reliance on the speed of pattern recognition and rapid response in order to achieve success. The second precept dictates that a common operating environment and shared set of objectives allows networks to self-synchronize, enabling speed and spontaneous unity of effort.[52] In the military, operational imperatives for units to become lighter and more agile must be matched by an equally agile but significantly reduced logistics tail and footprint. S&R logistics goes beyond *just-in-time* and *total asset visibility* approaches by working through networked logistical structures in which complex problems are solved through the ad hoc coordination of diverse organizations based on their expertise and unique capabilities.[53] S&R works best in environments of high complexity such as those presented at the tactical level. It relies on clever

commanders and local information sharing rather than remotely dictated control based upon centrally managed data in order to seize local opportunities as they develop.[54]

A Proposed Concept: Practical Application

> Implemented as a cross-Service, cross-organizational capability, S&R Logistics provides an end-to-end, point of effect to source of support networks of logistics resources and capabilities. Within S&R Logistics, every entity, whether military, government, or commercial, is both a potential consumer and a potential provider of logistics.[55]

One scenario involving the Sense and Respond Logistics approach envisions a unit in the field registering a requirement, potentially via a mobile Blue Force Tracker-like system, a web-based computer interface, over the radio, or in person. Based on this manually submitted requirement (or one generated through automatic monitoring of consumption rates or equipment failure), the logistics network enables identification of all nearby units with the capability to meet the identified need. Support units respond either manually or automatically while the system facilitates identifying which units can best meet the requirement based on time and distance considerations, mission priority, and other relevant variables.[56] Should established supporting/supported relationships prove insufficient to address the requirement, and if local general support units do not voluntarily address the requirement, the shared logistics common operational picture provides a better frame of reference for establishing ad hoc local arrangements or coordination through common higher headquarters. Having the ability to tie into a robust and comprehensive logistics network structure can be particularly useful for those "transient units" without clearly defined support relationships that inevitably surface from time to time on the battlefield.

Both consumer units and potential provider units in this scenario represent local nodes in the logistics network. A node-based system of logistics planning and execution is not foreign to military professionals. Use of terms and techniques such as Repair and Replenishment Point

(RRP), Ammunition Supply Point (ASP), Combat Service Support Areas (CSSA), Maintenance Collection Point (MCP), and Forward Arming and Refueling Points (FARP), to name just a few, all represent the use of nodes or hubs in creating a tactical logistics network. (See Figure 5 for a sample graphic representation of a physical network.) The USMC MAGTF Staff Logistical Planning Reference offers the following guidance:

> The LCE COA must take into account the supported force's requirements and capabilities, and the physical infrastructure of the battlespace, to include characteristics of the MAGTF area of operation and area of interest. Logistics planners must understand and integrate joint and multinational assets and requirements into the COA. The COA should be flexible enough to enable the LCE commander to anticipate requirements, use initiative to meet the requirements during execution, and seek "windows of logistics opportunity."[57]

Traditionally, however, the network of logistical nodes developed by planners only accounts for the capabilities and requirements represented by a single Service. The S&R framework, while

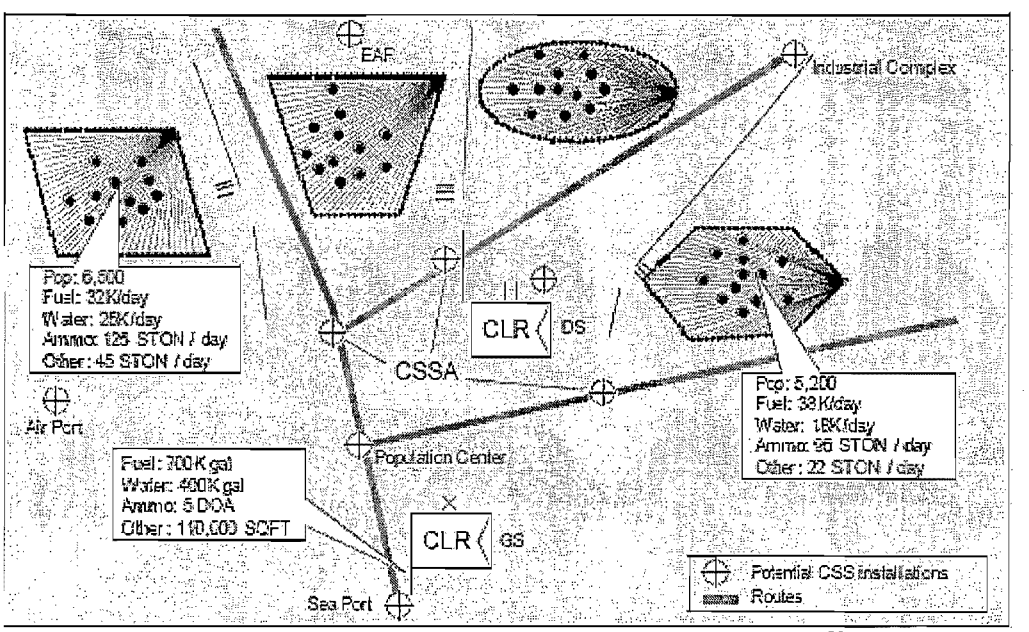


Figure 5. Physical Network Analysis and Planning[58]

equally applicable to single Service scenarios, finds its greatest utility when applied as a comprehensive network that incorporates *all* logistics nodes in a geographic battlespace, regardless of organizational affiliation.

Extending this hypothetical scenario into the paradigm of operational dispositions on the contemporary battlefield, the network of scalable logistics nodes can be shaped to meet the ever changing needs of dispersed units by pushing support nodes forward, adjusting their size and capacity, or retracting them as the situation dictates. The composition of nodes that develop at each location, such as personnel with specific expertise and the quantity of equipment and materials maintained, depends on the size and type of units being supported in the vicinity of that node. Additionally, small teams with a baseline of general logistics knowledge and training on how to access the joint system to leverage specialized support and resources can be pushed to the forward edge of the battlefield. By giving these individuals the ability to tie into a robust support system to access resupply, maintenance, engineering, transportation, Services, and contracted support capabilities, each forward unit no longer needs to stockpile capabilities that are infrequently used or are maintained on hand "just in case". This arrangement maximizes the efficient use of limited logistics personnel and resources while maintaining flexibility, reliability, and overall effectiveness of support. It also frees non-logistics trained combat arms personnel within the company or platoon at FOBs from having to assume duties that detract from their primary mission.

The Why and What

Thoughtful consideration of recent military operations, doctrinal guidance, and the proposed Sense and Respond logistics theory and vision converge to define an emerging situation that calls for the development of a system which integrates, at a minimum, joint logistics down to the lowest tactical unit level. The following factors summarize this imperative:

- The growing collection of after-action reports from current operations combined with projections of the character of future conflict point to a need for joint, interagency, and multinational logistical interoperability at the tactical level.

- The time criticality of future logistical operations in support of exploiting tactical opportunities or quickly coping with disaster relief scenarios demands maximum speed and flexibility in bringing assets to bear while avoiding the commonly occurring bottlenecks and friction of uncoordinated logistical efforts.

- Tactical level planners and executors must be able to leverage joint logistics resources and capabilities when faced with a degree of logistical complexity and speed that is impossible for operational level planners to comprehend and effectively manage in real-time.

- Both common Service doctrine and operational imperatives encourage decentralized decision-making and initiative to generate tempo which the S&R logistics approach facilitates.

- The use of improvised explosive devices and concerted efforts to attack vulnerable resupply convoys have highlighted increasing security concerns associated with logistical movements. S&R logistics networks enhance force protection by routing support from and through a variety of nodes. Patterns of movement and predictability (i.e. vulnerability) of routes are reduced as distribution paths are regularly varied.

- Future concepts envision greater operational mobility and the freedom of access that joint seabasing provides. The constraints and complexities inherent in operating from a seabase highlight the requirement for tactical logistics interoperability across the joint force. Adaptive, distributed logistics has particular application in this continually expanding and contracting network of sea and land-based units.

- The increased likelihood of funding cuts and resource shortages in the near future will drive greater concern for economy and accountability. Unnecessary stockpiling of assets, wasted resources, redundant efforts, poorly managed contracts, and poor stewardship of allocated equipment will become increasingly unacceptable and unsustainable. An S&R based logistics system helps avoid these inefficient practices and maximizes effective use of limited resources.

Achieving a desired future state that addresses these factors requires the development of a joint Sense and Respond logistics system for the entire DoD that enables the employment of maximally inclusive, adaptive logistics networks at the tactical level of war. This system must enable decentralized decision-making and self-organization to quickly match registered requirements with most appropriate and accessible capabilities. It must be capable of rapidly growing and retracting in support of activity on a distributed battlefield. The system should promote economy of force by tying the furthest forward units into a robust logistics support network with minimal footprint and aversion to permanent attachment of logistics resources. It

must also be capable of expanding to include interagency and multinational partners facilitating greater coordination and unity of logistics effort while enabling the contribution of partners' unique capabilities (and requirements) into the overall logistics pool.

To overcome the dilemma of self-interest driven sub-optimization that has plagued DoD logistics programs for so long, the following actions are necessary to realize the proposed logistics system:

1. The DoD must take the lead in a top-down effort to fashion a common logistics support command and control system. As history has shown, without a single unifying, authoritative voice that can articulate a common vision and give direction, the individual Services, despite good intentions, have and will continue to use their limited resources to produce systems that meet only their most urgent and specific needs. This understandable dynamic has directly contributed to the vast collection of stove-piped, non-interoperable systems currently in use. The lead organization must ensure that the new system quickly progresses to meet the following characteristics:

- Maximally simple and intuitive interfaces and procedures in order to facilitate the ability for smoothly incorporating the personnel and assets of those unfamiliar with military systems
- Capable of managing traditional supporting-supported relationships while simultaneously facilitating decentralized freedom of action, adaptability, and creative problem solving at the tactical level
- Enables rapid, layman-understandable, and user-friendly updates to logistics statuses for use by those supported unit personnel with limited logistics background or those that need to update requirements quickly while on the move or in the fight
- Sufficiently scalable to a level of fidelity necessary for fine-tuning Service-specific logistical activities; eventually meeting all the detailed coordination needs of Services without cluttering or confusing the basic functionality and user-friendly interface
- Facilitates comprehensive coordination of common user logistics support items and Services to include those provided by non-military (contracted) organizations

- Secure; employing a SIPR/NIPR bridge to limit access and permissions based on types of accounts and access required
- Accessible via web-based interface by all users to include contracted personnel, OGA's, NGO's, and multinational partners

System evolution must be carefully managed to ensure that missing capabilities are addressed and feedback from all users is continuously and rapidly evaluated in order to field an increasingly user-friendly and useful system.

2. A top-driven lexicon of common terminology and shared procedures must be established that meets the needs of all the Services while simultaneously supporting coalition other governmental and non-governmental agency interoperability.

3. The DoD must lead a top-down alignment of those combat systems which are not inherently unique or specific to particular units or Services. This will likely drive adjustment of funding allocations toward joint systems and enforcing more stringent justification for any Service-unique equipment pursued.

4. Work to adjust necessary doctrinal impediments to Sense and Respond logistics and overcome any statutory hurdles to realigning funding and authorities. The current system of voluntary Service cooperation in developing joint programs does not support the unity of effort required to address joint priorities. Partial control over acquisition and training funds given to the designated joint agency would provide the authority necessary to ensure Service efforts are sufficiently coordinated. An "either-or" solution would not be appropriate. Establishing funding mechanisms that facilitate compliance with joint direction without completely usurping the Services responsibility and means for training and equipping its forces should aim to strike the most mutually beneficial balance.

5. Adopting new systems and procedures without adequate training represents the surest way to foster disillusion, lack of investment in the program, and unwillingness to contribute to refining

what is sure to initially be an imperfect product. Ground-level logistics personnel must receive comprehensive training on the new Sense and Respond joint enterprise to facilitate understanding and comfort with the joint terminology, procedures, and systems that are established at the tactical level. This includes training for planners, both at the operational and tactical level, on integrating joint, coalition, and civilian assets into logistics frameworks and operational concepts of support. Rapid, in-theater training should also be readily available for non-DOD personnel who seek to integrate their organization into the logistics network. Finally, to support the distributed networked logistics approach, all junior logistic occupational specialists should be given a baseline of general logistics knowledge to facilitate employment of small logistics teams that are able to leverage the sense and respond network at forward company and platoon level combat outposts (COPs).

6. Perhaps the most critical factor for successful implementation lies in the leadership actions taken at all levels to develop an appropriate support mindset, one that seeks proactive contribution to overall mission accomplishment outside the confines of dictated support relationships. The sense and respond enterprise is designed specifically to foster freedom of action and tactical creativity. Only if logistics leaders and their units take advantage of the system to work outside the bounds of parochial interests and dictated support relationships will this approach reap the benefits of adaptability, speed, economy, and timely, effective support that it is designed to enable. Additionally, leaders in the logistics community must ensure that each Service recognizes the critical need for and mutual benefit of establishing a joint tactical logistics system so that unity of effort in acquisition and programs can be achieved despite the existence of current funding structures and statutes that inhibit such commonality of purpose.

The Why and What: Advantages

The preceding outline for implementing a sense and respond logistics enterprise throughout the DoD offers several advantages. While situations faced by practitioners at the lowest levels have driven the impetus for a new approach, time has proven that leadership in the form of a unifying vision and consistent motivation toward achieving the desired future state must be present to achieve comprehensive change. In short, top-down works. Having the authority to coordinate activities, affect funding streams and, when necessary, direct compliance in the face of inevitable friction proves essential in surmounting the tipping point of wholesale acceptance.

The adaptive S&R network itself provides flexibility and scalability for enabling coordination among a variety of agencies at the local level while accommodating logistics provision activities across the full spectrum of conflict. The system improves operational effectiveness through increased logistical interoperability and use of the niche capabilities presented by partner organizations. Distributed adaptive logistics networks build in reliability and survivability through visibility and access to the maximum number of resources. The disruption of one node or link does not leave "downstream" supported units stranded as would be the case in traditional logistics chain arrangements. The S&R enterprise increases logistical efficiency by minimizing clogged pipelines and improves cost effectiveness by eliminating unnecessary redundancies and stove-piped stockpiling of material. Smaller logistical footprints and better management of forward resources will help to reduce energy consumption and improve efficiency of resource usage. This equates to force protection improvements by minimizing the amount of bulk fuel pushed forward with its inherent vulnerability to attack. Incorporating contracted support and management of cross-servicing agreements improves transparency in the tracking of funding and facilitates accountability for proper performance of

contracts and agreements. A more seamless linkage between the strategic, operational, and tactical levels also helps to surface and frame those few particular urgent logistical problems that cannot be handled at lower levels and provides a mechanism for quickly resolving them.

The Why and What: Challenges

A 2007 Government Accountability Office report examined DoD's efforts to improve logistics support and supply chain management through various joint theater logistics initiatives. Table 1, which summarizes the joint initiatives and issues related to their implementation, highlights some of the challenges faced in integrating joint logistics. The GAO study additionally found that:

> DOD has not developed a coordinated and comprehensive management approach for guiding and overseeing the implementation of joint theater logistics across the department... the diffused organization of DOD's logistics operations, including separate funding and management of resources and systems, complicates DOD's ability to adopt a coordinated and comprehensive management approach to developing and implementing joint theater logistics capabilities.[59]

A top-down approach where the lead agency has directive authority and a degree of control over program funding provides a mechanism capable of overcoming the longstanding structural impediments described in the GAO report. However, other institutional norms and practical support considerations present additional challenges and obstacles to be overcome.

Area of distribution and supply support	**Related joint theater logistics initiatives**	**Challenges hindering full implementation**
Receiving and processing a large influx of supplies at the beginning of a military operation	Joint Task Force-Port Opening	• Potential redundancy of efforts • Sourcing and use of personnel • Command and control issues
Management of supplies moving across the distribution system	Joint Deployment Distribution Operations Center	• Non-interoperable information technology systems • Container management
Theater-wide coordination of surface transportation assets	Theater and Expeditionary Sustainment Commands, Director of Mobility Forces-Surface	• Fragmented theater logistics operations • Lack of information technology tools • Insufficient numbers of skilled personnel • Unclear position in command structure • Command and control issues • Potential duplication of efforts

Consolidation of supply storage and shipping activities	Node Management and Deployable Depot, Joint Regional Inventory and Material Management, Theater Consolidation and Shipping Point	• Funding of inventories • Security concerns
Exercise of command and control over joint logistics functions	Joint Experimental Deployment and Support	• Statutory requirements for logistics support • Exercising directive authority for logistics • Operational and financial considerations

Table 1. Challenges Hindering DOD's Ability to Fully Implement Joint Theater Logistics Initiatives[60]

Given the massive number of disparate systems of terminology, procedures, software, and equipment used by the various Services, the potential complexity required of a single, one-system-fits-all approach presumes to be insurmountable.[61] The reality that each Service focuses on its unique core competencies and mission sets makes it inevitable that some Service-specific items and procedures, especially maintenance related, will need to be built into the system. However, the provision of logistics in its essence comprises a common set of functions, activities, and principles that represent a baseline of support which, if the verbiage, databases, and procedures are aligned, can be applied effectively to all the Services. By coordinating extensively with the logistics professionals of each Service, this baseline of common terminology, procedures and databases can be shaped to meet the needs of each unit, while incorporating sufficient detail to ensure that truly unique requirements are validated and addressed. In the case of several ongoing Service initiatives, this alignment and integration is already taking place albeit in the slightly larger stovepipes encompassing the two Services involved in the project.

Another concern involves the potential risk of higher headquarters using the visibility and networked logistics infrastructure to impose support requirements on tactical units while not understanding the complete impact that shifting these resources may cause "on the ground." Most logistics professionals recognize that there is some security in obscurity. Manifestations of this principle can be found in something as simple and timeless as the "gunny's wall locker."

This mystical hidden collection of goods ensures plausible deniability for leaders in the case of unauthorized possession or dubious means of acquisition, but has proven invaluable in saving the day when unexpected emergencies arise. The message is clear: if higher knows we have it, they will take it. Ultimately, higher headquarters personnel will have to recognize the self-defeating nature of direct interference in tactical decisions without respecting the inherent understanding and control of resources available to ground level units. If tactical units believe that HHQ will arbitrarily confiscate capabilities, units will simply do what the smart Gunny has always done, which is hide the goods (i.e. stop reporting and take the capability off the grid). This awareness will make manual intervention by HHQ personnel in tactical affairs more of a closely coordinated exception rather than the norm. This self-correcting dynamic and the inherent ability to solve problems locally that the S&R system presents should minimize such situations.

The potential for anyone in the logistics network to consume resources at any time appears to inject a level of uncertainty that makes forecasting future requirements and commensurate on-hand capability levels nearly impossible. However, it is important to recognize that building in adaptive response to the system does not negate the intent to develop stable supporting/supported relationships; it simply enables the ability to quickly respond in cases that fall outside those parameters. Also, the volume of increased potential consumers can be offset by an even larger number of potential suppliers and greater overall speed and efficiency in the system. Facilitating better status reporting and requirements identification by using units through simpler, intuitive interfaces and embedding small teams of logisticians lower level, forward units also will helps to stabilize the support picture. A comprehensive, common logistics system will facilitate better usage rate tracking which will additionally contribute to better management of on-hand capability levels. By enabling the integration of non-DoD entities

into the logistics network, more efficient cost tracking and compensation management will also provide greater flexibility in sharing resources.

Another challenge to growing a system of adaptive joint logistics at the tactical level involves the issue of control. Some tactical logisticians balk at the idea of a general support role for geographically collocated entities outside traditional support lines. If a capability is given away, their concern is that it won't be available should a similar requirement arise for a directly supported unit. Ultimately, the S&R network *enables* creative adaptation and self-organization to solve local problems, it doesn't mandate such behavior. Through leadership, training, and growing confidence in the system itself, tactical logisticians will come to embrace the professional imperative to do everything in their power to support the mission as a whole, especially if evaluations and promotions are tied to such behavior.

This enumeration of challenges could not possibly represent a comprehensive consideration of the potentially endless list institutional roadblocks, engrained cultural biases, and organizational self-interests that have proven sufficient to forestall adopting an S&R joint logistics system previously. However, recognizing the operational imperatives and collective good that this approach offers, these friction points cannot be allowed to halt movement in a direction that makes the most sense for the immediate and long term.

Conclusion

> *Operations Enduring Freedom and Iraqi Freedom, along with past campaigns, highlight logistics efforts fraught with inefficiency, redundancy, and process gaps. Our success was often dependent on heroic efforts and battlefield ingenuity by military logisticians and the overwhelming capacity of our industrial base to provide virtually limitless support. We cannot depend on this in the future, nor should we.*[62]

Necessity is the mother of invention and actions being taken on the battlefield today demonstrate time and time again the need for and viability of joint and coalition logistical integration at the lowest tactical level. However, despite the fact that small unit after action

reports through strategic concept documents continue to highlight the imperative for unity of effort and adaptability in employing logistics resources at every level, the organization, authority, systems, and procedures have yet to be established that facilitate this reality. Institutional constraints, cultural norms, and the sheer effort required to overcome several practical issues in developing a suitable enterprise have prevented forward progress in the past. A combination of top-driven system development, alignment of procedures, terminology and equipment acquisitions, adjusting funding and authority mechanisms, a comprehensive training program, and overall effective leadership must be employed to overcome these impediments in meeting the growing imperative for tactical joint logistics integration.

Recognizing the immense challenges that exist in integrating Service programs and systems, the former Director for Logistics, Joint Chiefs of Staff stressed that achieving integration is of paramount importance, and waiting for the resolution of every issue cannot inhibit the willingness to make sound decisions and move forward.[63] The management and coordination of logistics efforts will always, like war itself, remain a uniquely human endeavor fraught with uncertainty, complexity, friction and fog. Creative application of the art of logistics has and will remain the responsibility of the man in the proverbial arena. However, the science of DoD's joint processes, systems, and standards must be driven from the top-down to a state of inherent adaptability and interoperability which facilitates creativity at the tactical level where the true measure of logistical success is recognized. The Department of Defense must work to overcome the institutional friction and barriers to change in order to give tactical logisticians in joint and coalition environments the best possible tools in their ongoing efforts to support the warfighter at the furthest edges of the battlefield.

---

[1] 1. US Joint Forces Command, *Capstone Concept for Joint Operations*, iv, http://www.jfcom.mil/about/fact_ccjo.html (accessed February 7, 2010), iv.

[2] Headquarters, Department of the Army, "FM 5-0: The Operations Process" (working paper, October 5, 2009), p. 3-2.
[3] C V Christianson, "Joint Logistics: Shaping Our Future," *Defense AT&L* 35, no. 4 (July-August 2006): 11.
[4] Jamshid Gharajedaghi, *Systems Thinking: Managing Chaos and Complexity* (Burlington, MA: Butterworth Heinemann, 1999), 39.

[5] Mark W Akin and George L Topic, "Transforming Joint Operational-level Logistics," *Joint Forces Quarterly*, no. 47 (Fall 2007): 88.

[6] Marine Corps Center for Lessons Learned, *Logistics Lessons and Observations from OIF I to present and OEF*, 11-17.
[7] US Joint Forces Command, *Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations*, ed. Marine Corps Center for Lessons Learned, 90.
[8] C V Christianson, "Logistics Visibility: Enabling Effective Decision-making," *Joint Forces Quarterly*, no. 47 (Fall 2007): 7.
[9] US Joint Forces Command, *Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations*, 89-90.
[10] US Joint Forces Command, *Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations*, 89.
[11] Steven L Martinez, "Baffled by DAFL: Directive Authority History for Logistics," *Air Force Journal of Logistics* 30, no. 3 (Fall 2006): 71.
[12] US Joint Forces Command, *Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations*, p89.
[13] US Joint Forces Command, *Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations*, p97.
[14] Marine Corps Center for Lessons Learned, *Logistics Lessons and Observations from OIF I to present and OEF*, 7-8.
[15] For additional examples of drivers for change emerging from current operations, see the collection of joint logistics case studies in Appendix B.
[16] Joint Chiefs of Staff, "Joint Publication 4-0: Joint Logistics," July 18, 2008, I-2.
[17] Joint Chiefs of Staff, I-5.
[18] Joint Chiefs of Staff, III-3-4.
[19] Joint Chiefs of Staff, "Focused Logistics Campaign Plan," 2004, 10.
[20] Joint Chiefs of Staff, "Joint Logistics (Distribution) Joint Integrating Concept," February 7, 2006, i.
[21] Joint Chiefs of Staff, "Joint Logistics (Distribution) Joint Integrating Concept,"10.

[22] Pat McClanahan, "The Future of Joint Logistics," *Navy Supply Corps Newsletter* 72, no. 3 (May-June 2009): 8-9.
[23] Christopher R Paparone, "Who Rules Logistics? Service Versus COCOM Authority," *Army Logistician* 37, no. 6 (November-December 2005): 52.
[24]Christopher R Paparone, 53.
[25] James Chambers and Mitchell H Stevenson, "U.S. Army Logistics Transformation USMC Logistics Conference Brief," September 24, 2008, G-4, Headquarters, Department of the Army, 14.
[26]Joint Chiefs of Staff, "Joint Tactics, Techniques, and Procedures for Common-User Logistics During Joint Operations," June 11, 2001, I-1.
[27] United States Marine Corps Combat Assessment Team, *Operation Enduring Freedom*, 132, https://www.mccll.usmc.mil/mcclladmin/directme.cfm?db=jointmccllcdrm&id=381&fileID=1289&ftype=Misc&fname=OEF%20Summary% 20Report%20%2D%20Published%20Final%20FOUO%2Epdf (accessed February 17, 2010).
[28] United States Marine Corps Combat Assessment Team, 130.
[29] Department of Defense, *Quadrennial Defense Review Report: February 2010* (Washington, DC: n.p., 2010), 76-77.
[30] US Joint Forces Command, *Capstone Concept for Joint Operations*, 21-27.
[31] US Joint Forces Command, *Capstone Concept for Joint Operations*, 31.
[32] US Joint Forces Command, *Capstone Concept for Joint Operations*, 33.

[33] US Joint Forces Command, *Capstone Concept for Joint Operations*, 30.
[34] Commandant of the Marine Corps, *2009 Army-Marine Corps Staff Talks (2009) AMCST Task Summary*, ed. Marine Corps Center for Lessons Learned, 1-4, https://www.mccll.usmc.mil/index.cfm?disp=cdrview.cfm&doit=display&cdrid=6140 (accessed January 15, 2010).
[35] Commandant of the Marine Corps, "Marine Corps Vision and Strategy 2025," 2008, 17.
[36] Commandant of the Marine Corps, "Marine Corps Vision and Strategy 2025," 2008, 22.
[37] Commandant of the Marine Corps, "Marine Corps Vision and Strategy 2025," 2008, B-1.
[38] Jeffrey R Cares, "Distributed Adaptive Logistics," *Information Age Warfare Quarterly*, Winter 2005, 5, http://www.iawq.com/IAWQ_V1N1.pdf (accessed January 26, 2010).
[39] Cares, 8.
[40] Cares, 9.
[41] Cares, 10.
[42] Ibid.
[43] John F Schmitt, "Command and (out of) control: The Military Implications of Complexity Theory," *Marine Corps Gazette* 82, no. 9 (September 1998): 10.
[44] Office of the Deputy Under Secretary of Defense for Logistics and Material Readiness, *Sense and Respond Logistics Technology Roadmap* (Washington, D.C.: Department of Defense, 2009), 28.
[45] Department of Defense, "Sense and Respond Logistics: Co-Evolution of an Adaptive Enterprise Capability" (Power Point Brief, Office of Force Transformation, October 23, 2003), http://www.senseandrespond.com/downloads/ LL_BRIEFING_SARL-23Oct03_v3_.ppt (accessed February 13, 2010).
[46] See Appendix A for a tabular comparison of traditional logistics to the Sense and Respond approach
[47] Department of Defense, "Sense and Respond Logistics: Co-Evolution of an Adaptive Enterprise Capability," 14.
[48] Russell A Vacante, "Sense and Respond: An Emerging DoD Concept for National Defense," *Defense Acquisition Review Journal* 14, no. 1 (February 2007): 1 (accessed February 14, 2010).
[49] Mark J Menotti, "The Sense-and-Respond Enterprise: Why the U.S. Marine Corps Should Embrace the New Paradigm," *OR/MS Today*, August 2004, http://www.lionhrtpub.com/orms/orms-8-04/frenterprise.html (accessed March 1, 2010).
[50] Menotti.
[51] Autonomic logistics refers to the prediction or automatic reporting of failure in operating systems, monitoring of stockage levels, and automatic requisition of materials enabled by integrated technologies. See *Sense-and-Respond Enterprise* by Menotti.
[52] Department of Defense, "Sense and Respond Logistics: Co-Evolution of an Adaptive Enterprise Capability," 5.
[53] Vacante, 2-3.
[54] Jeffrey R Cares and Linda Lewandowski, "Sense and Respond Logistics: The Fundamentals of Demand Networks" (Unpublished DoD White Paper, 2002), 6.
[55] Vacante, 4.

[56] Army Logistics Management College, "Sense-and-Respond Prototype Could Transform Resupply," *Army Logistician* 36, no. 5 (September-October 2004): 50, http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=14397441&site=ehost-live (accessed February 13, 2010).
[57] United States Marine Corps, "MSTP Pamplet 4-0.2: A Logistics Planner's Guide," February 2008, MAGTF Staff Training Program, 33.
[58] United States Marine Corps, "MSTP Pamplet 4-0.2: A Logistics Planner's Guide," 39.
[59] William M Solis, *Defense Logistics: Efforts to Improve Distribution and Supply Support for Joint Military Operations Could Benefit from a Coordinated Management Approach*, GAO-07-807 (Washington, D.C.: United States Government Accountability Office, 2007), 10-11.
[60] Solis, 19.

[61] See Appendix C for an overview of current joint and service sponsored logistics initiatives to see the emphasis being placed on joint logistics programs by senior leaders despite the limited scope and service-centric nature of most.

[62] Akin and Topic, 88.

[63] Christianson, " Joint Logistics: Shaping Our Future," 13.

Appendix A: Traditional vs. Sense and Respond Logistics

Linear		Nonlinear
Chains		Networked
Service Stovepipes		Cross-Service Mutual Support
Functional Stovepipes		Cross-Enterprise
Title Ten-Driven		Joint Logistics
Pre-Planned		Dynamic Continuous Planning and Execution
Poor Ops/Log ISR Integration		Net Warrior Ethos
Reactive		Anticipatory
Parametric Analysis-Based		Collaborative
Hierarchical	VS	Networked
Monolithic		Distributed, Modular
Poor Scalability		Dynamically Scalable
Not Flexible		Flexible
Consumption-Based		Adaptive, Cognitive
Mass		Speed of Effect
Service Perspective		Joint Coherence
Efficiency		Effectiveness
Highly Optimized		Effective
Brittle, Rigid Supply Chains		Robust, Flexible Demand Networks

Comparison of Characteristics of Traditional Logistics to Sense and Respond (Adapted from a table in *Sense and Respond: An Emerging DoD Concept for National Defense.*)[64]

[64] Vacante, 6.

Appendix B: Joint Logistics Case Studies

OIF and OEF

The following case studies, representative of regimental and below operations, coalition integration, and disaster relief activities, help to illustrate and bring into focus the logistical issues presented by the nature of these situations. Regimental, battalion, and small unit operations in OIF and OEF add to the growing pool of evidence regarding the need for logistical cohesion and interoperability at the tactical level. The 25th Naval Construction Regiment (NCR) deployed to Afghanistan in 2009 as an organization that included five subordinate engineering units staffed by 2000 personnel from the Army, Navy, and Air Force. Immediately upon arrival in theater, they identified a lack of standardized logistical processes and immature systems which required significant manual intervention to procure, deliver, and receive required materials. Tracking of requisitions required the manual development of a shared-drive based spreadsheet and the process and approval authority for material procurement changed three times each over the span of a six month deployment.[65] LT Brian McFadden, currently deployed as the OIC of the Logistics Department for Joint Task Force Paladin South, provides support to Army, Navy, Air Force, Marine Corps and NATO allies (Canada, Great Britain, Australia and the Netherlands). He has noted similar interoperability problems and warns against the unfeasibility of relying on stovepiped systems due to constantly changing enemy actions and support requirements. According to LT McFadden, "It is imperative in these environments that we share resources and develop integrated logistics capabilities to effectively manage the inventory across southern Afghanistan."[66]

In Iraq, the combined Class I (food and water) and Class V (ammunition) supply operations serve as another example of non-directed joint logistics integration at the tactical level.

The 24th Quartermaster Co and Combat Logistics Battalion 1 combined Class I distribution activities at Al Asad and eventually transferred operations to contracted management. The joint Class I center was successful in improving service, reducing transportation requirements, improving visibility, and consolidating security requirements.[67] The Army's 593d Sustainment Brigade and the 1st Marine Logistics Group also worked to establish a joint Ammunition Supply Point (ASP) at Al Asad. By integrating Army and Marine personnel at the ASP and developing common operating procedures, they were able to minimize risk by reducing the number of ammunition resupply convoys for Army units to and from Al Taqqadum.[68] Both examples of spontaneous local reorganization and coordination helped to increase both the efficiency and effectiveness of tactical logistics operations in theater.

Task Force 2/7 deployed on short notice to southern Afghanistan in April 2008. Being a Marine infantry battalion, operating away from the traditional framework of the Marine Air-Ground Task Force presented a situation admittedly outside the norm; however, the lessons regarding logistical interoperability remain valid. Initial common support items came from the Army, while Marine Corps specific supplies had to be requisitioned from CONUS, despite on hand stockages of required items at the USMC supply warehouse in Iraq. The medical officer for 2/7 related a situation where his staff had to conduct medical activities in tents with limited equipment despite the existence of an actual British hospital nearby because of issues over NATO credentials.[69] The logisticians of 2/7 also worked with the British at Camp Bastion for fuel and ground transportation, NATO units for air support, the Combined Joint Task Force for contracting support, and the Air Force for containerized delivery system (CDS) aerial resupply of forward operating bases (FOB).[70] All of this coordination had to be accomplished on a painstaking, deliberate, and manually shepherded basis. As expressed by the logistics officer for

2/7, "Be prepared to do everything yourself with organic resources or via cooperative agreements with coalition forces."[71]

In 2006, the 330th Movement Control Battalion established a Combined Joint Distribution Cell (CJDC) in order to better support their upcoming major offensive, Mountain Thrust, in Afghanistan's Regional Command South area of responsibility (AOR). The CJDC was intended to maximize the efficient use of constrained coalition distribution assets, both air and ground, in a complex combined-joint environment.[72] Food, water, fuel, ammunition, and repair parts were coordinated jointly with the addition of several specialized commodity managers along with air and host-nation trucking planners. Planning involved identifying available distribution assets and then coordinating to meet coalition support requirements with available resources. Eventually, the CJDC became the single point of contact for movement of rations, water, fuel, barrier materials, and major end items. Integration with air planners enabled air-based hub and spoke logistics systems to bridge logistics nodes that were untenable via ground movement. This coordination helped to "reduc[e] aircraft operating tempo, risks to soldiers, and the logistics footprint" while contributing to more responsive support.[73] Coordinated distribution also enabled the comprehensive integration of coalition logistics assets with CJTF operational movements in the assault.

According to the 330th's Battalion Commander,

> ...in a coalition military environment, logistics support is, by doctrine, a national responsibility. This national orientation resulted in the creation of stovepipe national support structures, fostered redundant national logistics efforts, and blinded national logistics staffs to the capabilities and operations of other coalition forces.[74]

Challenges to the establishment of a Combined Joint Distribution Cell included national caveats on the use of forces, lack of tasking authority over assets, and determining the necessary compensation mechanisms for shared support. The use of Acquisition Cross Servicing

Agreements (ACSA) helped to overcome issues with tracking cost and compensation for support among nations through monetary, reciprocal service or supply, and reciprocal monetary-equivalent service or supply means. ACSA's also facilitated the provision of electronic counter measures (ECM) to coalition partners who didn't have them and helped ensure interoperability of equipment by ensuring all nations had the same equipment.[75] The coordination of coalition logistics efforts overcame a difficult and significant problem with fuel pilferage by instituting a coalition-wide point-to-point tracking system that enabled contracting to measure and charge carriers for lost fuel. The 330th's initiative, along with the cooperative spirit of coalition partners, enabled them to overcome the constraints of a logistics system that tends to resist integrated activity.

Disaster Relief and Humanitarian Assistance

Given the expeditionary nature inherent to military operations, the Department of Defense remains the most capable instrument of US national power for overcoming the logistical challenges presented by disaster relief scenarios. The resident capability of military forces to assist in maintaining security when law and order breaks down further contributes to the likelihood that the military will lead relief efforts. When Hurricane Katrina struck the coast of Louisiana in August of 2005, the Department of Defense was called into action to provide humanitarian relief in conjunction with Federal, State and local officials. The scope of the disaster was such that a quarter of a million people had been displaced to shelters and were reliant upon the government for ice, food, and water to meet basic needs.[76] As relief efforts unfolded, it became clear that no effective mechanism existed for efficiently integrating and deploying the significant, numerous resources available from government agencies and the private sector. Despite the fact that the DoD (Guard and Active Duty) proved to be one of the

only Federal Agencies possessing a real operational capability to take prompt and effective action on the ground, the individual Services tended to operate separately in different geographical areas while equipment interoperability issues hampered an integrated response between the Services and civilian leadership.[77]

A 2006 White House report of Hurricane Katrina lessons learned highlighted a significant shortfall in the capacity to integrate tactical logistics response efforts:

> Throughout the response, Federal resource managers had great difficulty determining what resources were needed, what resources were available, and where those resources were at any given point in time. Even when Federal resource managers had a clear understanding of what was needed, they often could not readily determine whether the Federal government had that asset, or what alternative sources might be able to provide it. ...even when an agency came directly to FEMA with a list of available resources that would be useful during the response, there was no effective mechanism for efficiently integrating and deploying these resources.[78]

A logistics system suited to coordinating logistics efforts during a disaster relief situation needs to be scalable and capable of integrating the capabilities of a wide variety of external agencies. It is unlikely that the DoD could predict specifically which organizations will require integration into assistance efforts. However, a suitable approach would seek to anticipate the nature of those organizations and establish mechanisms for integrating them into a holistic logistical support system as operations unfold.

The United States responses to natural disasters in Haiti during 2008 and 2010 highlight the expeditionary character of such activities given that both indigenous aid group capability and the infrastructure within Haiti were disrupted along with the general population. During the 2008 support mission, sea-based operations were identified as a key enabler for the relief effort. Adaptable and scalable capabilities positioned off the coast of Haiti minimized the logistics footprint ashore and reduced the stress on the damaged infrastructure.[79] The military had to take the good ideas and intentions of those willing participants and apply a disciplined military

planning process to generate actual results. However, the lack of a centralized common operational picture for relief efforts led to duplicated, independent efforts to register requirements for food, water, medical treatment and infrastructure repair.[80] In a Council on Foreign Relations special report, Joshua Busby stresses, "Since the United States will be pressured to deploy military forces or at least provide lift and logistic support for large scale humanitarian emergencies, it has an interest in helping countries minimize the adverse effects of climate change through enhanced local capacity to respond to natural disasters."[81] One way to meet the requirement to quickly enhance local logistical capacity is for the DoD to host a framework for coordinating and integrating the wide variety of actors that will inevitably seek to contribute to relief efforts.

---

[65] Colin Engles, "Navy Logistics in Afghanistan," *The Navy Supply Corps Newsletter* (November-December 2009): 19-20.

[66] Brian Madden, "Navy Supply Corps Leads the Way in a Joint - Multinational Logistics Environment," *The Navy Supply Corps Newsletter* (November-December 2009): 24-25.

[67] Carlos E Comas, "Army and Marine GS/DS Class I Storage and Distribution Center," *Army Logistician* 39, no. 6 (November-December 2007): 40.

[68] Glen R Dowling, "Army and Marine Joint Ammunition Operations," *Army Logistician* 39, no. 6 (November-December 2007): 37.

[69] Marine Corps Center for Lessons Learned, *Interview of Commander James Hancock*, ed. Carl Friedrich, 17, https://www.mccll.usmc.mil/mcclladmin/directme.cfm?db=jointmcclldrm&id=5399&fileID=9722&ftype=Interviews&fname=Hancock %20James%20CDR%20%2D%20FRIEDRICH%20Final%20Transcript%2DCDR%2D5399%2Edoc (accessed January 16, 2010).

[70] Marine Corps Center for Lessons Learned, *Infantry Battalion Operations in Afghanistan: 2nd Battalion, 7th Marines*, Lessons and Observations from Operation Enduring Freedom (OEF) April - October 2008: 30 January 2009, 20-21 (accessed January 15, 2010).

[71] Michael Vincent, "Bn Operations in OEF, e-mail message to Jeremy Thompson, February 13, 2010.

[72] Courtney Taylor and Leonard B Della Moretta III, "Integrating Coalition Logistics at the Tactical Level," *Military Technology* 31, no. 7 (July 2007): 70 (accessed January 17, 2010).

[73] Taylor and Della Moretta, 72.

[74] Taylor and Della Moretta, 70.

[75] Taylor and Della Moretta, 72.

[76] The White House, *The Federal Response to Hurricane Katrina Lessons Learned: February 2006*, 44, https://www.mccll.usmc.mil/mcclladmin/directme.cfm?db=jointmcclldrm&id=4447&fileID=7425&ftype=Misc&fname=White%20House%20Report%2DKatrinaLessonsLearned%2DCDR%2D4447%2Epdf (accessed February 9, 2010).

[77] The White House, 43.

[78] The White House, 56.

[79] Marine Corps Center for Lessons Learned, *Haiti HA/DR Lessons Learned 2008*, ed. Kevin Barry Jr, 1, https://www.mccll.usmc.mil/popups/ cdrview.cfm?cdrid=6398 (accessed February 9, 2010).
[80] Marine Corps Center for Lessons Learned, *Haiti HA/DR Lessons Learned 2008*, 3.
[81] Joshua W Busby, *Climate Change and National Security: An Agenda for Action (November 2007)*, ed. Council on Foreign Relations 32, 9, http://www.cfr.org/publication/14862 (accessed February 13, 2010).

Appendix C: Current Joint and Service Initiatives

My third objective--never fully accomplished during my tenure--was to create one logistics command for theater, to control and coordinate the massive logistics effort we would have to undertake in a major crisis. The system of separate and competing service and coalition systems, all putting stress on the limited lines of communications and infrastructure in the region, would really cause us problems if we didn't have one umbrella organization to pull all the support needs together and ensure security for our rear area networks.[82]

-General Anthony Zinni, USMC
Former CENTCOM Commander

An overview of the various programs and initiatives currently underway in the joint community and throughout the Services gives the impression that senior logistics leaders recognize the need for increased cooperation, interoperability, or integration in logistics activities at the lowest levels. However, the scope and disparity of these programs also demonstrates that a single comprehensive direction has not been established for all the Services, nor has a definite strategy been adopted for tying in the military logistics community with commercial, interagency, and multinational partners. A January 2010 white paper published by the Joint Staff J-4 clearly recognizes the need for integration and unity of effort at all levels, both inside and external to DoD; however, the focus of effort for future programs remains on the operational and strategic levels.[83] Additionally, the white paper provides little in the way of specific direction on how to achieve the ends envisioned for their advocated Joint Logistics Enterprise, and may be of limited use in synchronizing the efforts of the Services across DoD.

Sentiments reflected in the comments of General Zinni have spurred attempts to improve the coordination and integration of joint and coalition logistics activities throughout the first decade of the new millennia. Perhaps the most comprehensive and relevant treatment of joint logistics integration can be found in the Focused Logistics Campaign Plan of 2004 and its companion the 2005 Focused Logistics Roadmap. Both documents reflect a clear understanding of the challenges faced by contemporary logisticians at all levels and subsequently outline

specific strategies and associated programs to meet these challenges. However, it appears that the comprehensive nature of the campaign plan's vision has been reduced to the development of a few remaining fragmented systems as advocacy for the plan has waned or departed and new guidance has been drafted.

One approach to meeting the coordination and integration needs of the joint force commander which garnered serious consideration and even prompted test cases involves the concept of establishing a joint force component command for logistics. Joint Forces Command (JFCOM) under the guise of the now obsolete Joint Experimental Deployment Support (JxDS) program sponsored a test implementation of the Joint Force Sustainment Component Command (JFSCC) with the help of United States Forces Korea during exercises Ulchi-Focus Lens 2006 and 2007. Despite some operational efficiency gained through this approach, the costs of staffing the organization proved to be greater than the benefits and the concept has been discarded for the time being. US Transportation Command, in conjunction with JFCOM, initiated in 2005 a series of annual exercises known as Unified View (UV) which seeks to identify gaps in deployment and distribution capability. Although combatant commanders have identified a need for improved capability for end-to-end planning and management of deployment and sustainment requirements for multinational, interagency, and nongovernmental organizations, UV's scope was narrowed to include only military forces in order to keep the project manageable and avoid covering too much ground. One result of the UV series, known as *focus warfighter,* is an ongoing initiative that seeks to integrate all combatant command, Service, and DoD agency requirements into a single coordinated strategic and tactical transportation solution.[84]

The Joint Staff sponsored command and control solution for joint logistics known as Global Combat Support System - Joint (GCSS-J) envisions integrating the various logistics information systems of all the Services to include Army, Air Force, and Marine Corps GCSS programs into a fused joint logistics picture and tool set.[85] Some of the anticipated capabilities of GCSS-J include a web-based portal, interactive mapping, joint engineer planning and execution, shared file space, reports, and logistics watch boards.[86] While GCSS-J generally ties together numerous existing joint systems for joint visibility of assets, it remains incapable of directing logistical execution or tasking assets.[87] Various other initiatives for which detailed consideration falls outside the scope of this thesis contribute to a growing pool of capabilities which will further enable joint logistics integration. A few of note include the development of joint seabasing capabilities, DoD-wide energy efficiency initiatives, the Joint Deployment and Distribution Enterprise (JDDE) , the Joint Logistics Analysis Tool (JLAT), the Joint Modular Intermodal Distribution System (JMIDS), a 2009 National Defense University hosted Center for Joint and Strategic Logistics Excellence (CJSL), and the DLA sponsored Joint Contingency Acquisition Support Office (JCASO).

The joint community has traditionally (and understandably) focused on solving joint logistics problems at the strategic and operational level. The assumption remained that the tactical realm was the sole responsibility of the individual Services based on Title 10 direction and doctrinal guidance. However, the character of current operations is making that paradigm obsolete. No longer does "joint" equate to operational or strategic. Small units are currently conducting operations in truly joint and even coalition organizations at the tactical level. Tactical can no longer be assumed to mean single Service units operating exclusively within the confines of clearly bounded areas of operation. The individual Services are slowly recognizing

this fact and are aware of need for and potential benefits of joint interoperability and integration. This awareness has prompted several "joint" programs among the Army, Navy and Marine Corps.[88] Unfortunately, lacking a cohesive unifying force and clear vision for a common joint logistics system, most of these efforts are limited to interoperability between only two Services.

One such effort, known as the Army-Marine Corps Logistics Interoperability Demonstration (AMLID), seeks to overcome the divide between the two Services' logistics systems by enabling cross-Service fulfillment of logistics support requests through an information exchange architecture.[89] AMLID, as a sub-program of the Army capstone Common Logistics Operating Environment (CLOE), contributes to the bridging efforts between GCSS-MC and GCSS-A while envisioning a potential future integration of the Marine Corps' autonomic logistics and the Army's conditions-based maintenance plus projects.[90] Elements of the program, such as the metadata dictionary and data translation link, may serve as an enabler for use in GCSS-J.[91] The Adaptive Logistics (AL) program is another relevant Army sponsored initiative which seeks the use of intelligent agents for synthesizing large amounts of data to generate better logistical situational awareness and aid decision-making.[92] To date, most of the efforts of the AL program have focused on the operational level and higher to include the Adaptive Logistics Capability Tool (ALCT) designed to dynamically plan, monitor and re-plan theater distribution quickly using BCS3 data and automated tools.[93]

The 2009 Marine Corps Logistics Roadmap, which provides a 5-year plan for future logistics capability, stresses the importance of coordinating with joint forces through increased interoperability and coordination, buts stops short of advocating full integration of logistics efforts outside the Department of the Navy.[94] One element included in the Roadmap, Global Combat Support System - Marine Corps (GCSS-MC), represents the Marine Corps' ongoing

effort to integrate all logistics information systems and processes into a single automated architecture. GCSS-MC seeks to provide a single point of entry for Marine logistics data for cross-battlefield visibility, information integration, and greater operational flexibility within the Marine Air-Ground Task Force (MAGTF).[95] The Marine Corps is also actively pursuing a form of Sense and Respond logistics and Autonomic Logistics at the tactical level which involves the use of sensors and embedded diagnostics for automatic collection and near real-time processing of mission critical data (fuel, ammunition, mobile loads and system health).[96]

In 2003, the Service chiefs of the Navy and Marine Corps sought to move past the state of interoperability toward full integration of logistical capabilities. Out of this desire grew the Naval Logistics Initiative (NLI). The NLI includes 22 different elements that seek to leverage best processes and technologies, and to integrate those where it makes sense. The program focuses heavily on supply requisition, automated tracking and delivery, maintenance, and training while maintaining a placeholder for a potential future expeditionary logistics C2 capability.[97] Other logistics initiatives ongoing in the Navy include the creation of a Logistics Specialist rating with a broader logistics skill set to meet anticipated manpower requirements and several broader programs including as the Global Logistics Support Execution that seek greater integration with DoD, multinational, and interagency partners.[98] While the logistics integration efforts of both the joint and individual Service communities do not appear to be producing the single adaptive, joint Sense and Respond logistics enterprise needed by tactical logisticians in the future, they do demonstrate the viability of concepts and technology that will enable the achievement of this goal.

---

[82] Tom Clancy, *Battle Ready (Study in Command)* (New York: G.P. Putnam's Sons, 2004), 315-316.
[83] Department of Defense, "Joint Logistics White Paper" (working paper, January 4, 2010), 9-10

[84] John Gray, "Unified View: Improving Distribution and Deployment," *Army Logistician* 41, no. 3 (May 2009): 22-24, http://search.ebscohost.com/ login.aspx?direct=true&db=tsh&AN=40506438&site=ehost-live (accessed February 13, 2010)., 22-24

[85] Garth Winterle, "GCSS-J 7.0.1 Quick Look Report" (Power Point Presentation, Defense Information Systems Agency: Joint Interoperability Test Command), http://www.disa.mil/gcssj/ (accessed February 17, 2010).

[86] Garth Winterle, "GCSS-J 7.0.1 Quick Look Report."

[87] Garth Winterle, interview by author, February 17, 2010.

[88] Based on a search of freely available public information, the author is not aware of any major ongoing joint programs involving the Air Force and another service.

[89] Dale E Houck, "Achieving Army-Marine Corps Logistic Interoperability," *Defense AT&L*, November-December 2009, 36, http://search.ebscohost.com/ login.aspx?direct=true&db=tsh&AN=46036595&site=ehost-live (accessed March 7, 2010).

[90] Houck, 37-38.

[91] Houck, 36.

[92] Lee and Melanie A Hughes, "Adaptive Logistics Information Paper," April 3, 2009, U.S. Army Logistics Innovation Agency - Exploration Group.

[93] Jeff Fee, "Adaptive Logistics Briefing" (Power Point Presentation, Logistics Innovation Agency, October 28, 2009).

[94] United States Marine Corps, "Marine Corps Logistics Roadmap," 2009, 5.

[95] United States Marine Corps, "Marine Corps Logistics Roadmap," 2009, 16.

[96] United States Marine Corps, "Marine Corps Logistics Roadmap," 2009.

[97] Expedtionary Logistics, "Naval Logistics Integration: Overview for Senior Leaders" (Power Point Brief, United States Navy: Logistics Operations and Policy-Programs, October 2009), Navy Knowledge Online, https://wwwa.nko.navy.mil/ gear/library/download?document_id=v4doc74800078 (accessed February 14, 2010).

[98] Naval Supply Systems Command, "Global Logistics Support," December 4, 2009, in *Bottom Line*, https://www.navsup.navy.mil/navsup/news/the_bottom_line/Bottom%20Line%20Global%20Logistics%20Support.pdf (accessed February 14, 2010).

Bibliography

Akin, Mark W, and George L Topic. "Transforming Joint Operational-level Logistics." *Joint Forces Quarterly*, no. 47 (Fall 2007): 87-93. http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=27737955&site=ehost-live (accessed January 17, 2010).

Army Logistics Management College. "Sense-and-Respond Prototype Could Transform Resupply." *Army Logistician* 36, no. 5 (September-October 2004): 50. http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=14397441&site=ehost-live (accessed February 13, 2010).

Busby, Joshua W. *Climate Change and National Security: An Agenda for Action (November 2007).* Edited by Council on Foreign Relations. 32. http://www.cfr.org/publication/14862 (accessed February 13, 2010).

Cares, Jeffrey R. "Distributed Adaptive Logistics." *Information Age Warfare Quarterly*, Winter 2005, 4-12. http://www.iawq.com/IAWQ_V1N1.pdf (accessed January 26, 2010).

Cares, Jeffrey R, and Linda Lewandowski. "Sense and Respond Logistics: The Fundamentals of Demand Networks." Unpublished DoD White Paper. 2002.

Chambers, James, and Mitchell H Stevenson. "U.S. Army Logistics Transformation USMC Logistics Conference Brief." September 24, 2008. G-4, Headquarters, Department of the Army. https://www.mccll.usmc.mil/mcclladmin/directme.cfm?db=jointmccllcdrm&id=4281&fileID=7096&ftype=Briefings&fname=Army%20USMC%20Log%20Conf%20%2824%20Sep%2008%29%20V5%201%20on%2018%20Sep%2DCDR%2D4281%2Eppt (accessed January 15, 2010).

Christianson, C V. "Joint Logistics: Shaping Our Future." *Defense AT&L* 35, no. 4 (July-August 2006): 11-13. http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=21531936&site=ehost-live (accessed February 20, 2010).。

———. "Logistics Visibility: Enabling Effective Decisionmaking." *Joint Forces Quarterly*, no. 47 (Fall 2007): 5-8. http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=27737936&site=ehost-live (accessed January 17, 2010).

Clancy, Tom. *Battle Ready (Study in Command).* New York: G.P. Putnam's Sons, 2004.

Comas, Carlos E. "Army and Marine GS/DS Class I Storage and Distribution Center." *Army Logistician* 39, no. 6 (November-December 2007): 40-41.

Commandant of the Marine Corps. "Marine Corps Vision and Strategy 2025." 2008.

———. *2009 Army-Marine Corps Staff Talks (2009) AMCST Task Summary*. Edited by Marine Corps Center for Lessons Learned. https://www.mccll.usmc.mil/index.cfm?disp=cdrview.cfm&doit=display&cdrid=6140 (accessed January 15, 2010).

Department of Defense. "Joint Logistics White Paper." Working paper. January 4, 2010.

———. *Quadrennial Defense Review Report: February 2010*. Washington, DC: n.p., 2010.

———. "Sense and Respond Logistics: Co-Evolution of an Adaptive Enterprise Capability." Power Point Brief, Office of Force Transformation, October 23, 2003. http://www.senseandrespond.com/downloads/LL_BRIEFING_SARL-23Oct03_v3_.ppt (accessed February 13, 2010).

Dowling, Glen R. "Army and Marine Joint Ammunition Operations." *Army Logistician* 39, no. 6 (November-December 2007): 37-39.

Engles, Colin. "Navy Logistics in Afghanistan." *The Navy Supply Corps Newsletter* (November-December 2009): 19-20.

Expedtionary Logistics. "Naval Logistics Integration: Overview for Senior Leaders." Power Point Brief, United States Navy: Logistics Operations and Policy-Programs, October 2009. Navy Knowledge Online. https://wwwa.nko.navy.mil/gear/library/download?document_id=v4doc74800078 (accessed February 14, 2010).

Fee, Jeff. "Adaptive Logistics Briefing." Power Point Presentation, Logistics Innovation Agency, October 28, 2009.

Gharajedaghi, Jamshid. *Systems Thinking: Managing Chaos and Complexity*. Burlington, MA: Butterworth Heinemann, 1999.

Gray, John. "Unified View: Improving Distribution and Deployment." *Army Logistician* 41, no. 3 (May 2009): 22-24. http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=40506438&site=ehost-live (accessed February 13, 2010).

Headquarters, Department of the Army. "FM 5-0: The Operations Process." Working paper. October 5, 2009.

Houck, Dale E. "Achieving Army-Marine Corps Logistic Interoperability." *Defense AT&L*, November-December 2009, 34-38. http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=46036595&site=ehost-live (accessed March 7, 2010).

Joint Chiefs of Staff. "Focused Logistics Campaign Plan." 2004. https://acc.dau.mil/GetAttachment.aspx?id=32577&pname=file&aid=6178&lang=en-US (accessed January 22, 2010).

———. "Joint Logistics (Distribution) Joint Integrating Concept." February 7, 2006. http://www.dtic.mil/futurejointwarfare/concepts/jld_jic.pdf. (accessed January 27, 2010).

———. "Joint Publication 4-0: Joint Logistics." July 18, 2008. http://www.i-mef.usmc.mil/mlg/LMTW/_downloads/signedJP4_0.pdf (accessed January 16, 2010).

———. "Joint Tactics, Techniques, and Procedures for Common-User Logistics During Joint Operations." June 11, 2001. http://www.acq.osd.mil/dpap/pacc/cc/jcchb/Contingency%20Model/FormsPubsRegs/Pubs/jp4_07.pdf (accessed January 20, 2010).

Lee, and Melanie A Hughes. "Adaptive Logistics Information Paper." April 3, 2009. U.S. Army Logistics Innovation Agency - Exploration Group.

Madden, Brian. "Navy Supply Corps Leads the Way in a Joint - Multinational Logistics Environment." *The Navy Supply Corps Newsletter* (November-December 2009): 24-25.

Marine Corps Center for Lessons Learned. *Haiti HA/DR Lessons Learned 2008*. Edited by Kevin Barry Jr. https://www.mccll.usmc.mil/popups/cdrview.cfm?cdrid=6398 (accessed February 9, 2010).

———. *Infantry Battalion Operations in Afghanistan: 2nd Battalion, 7th Marines*. Lessons and Observations from Operation Enduring Freedom (OEF) April - October 2008: 30 January 2009. (accessed January 15, 2010).

———. *Interview of Commander James Hancock*. Edited by Carl Friedrich. https://www.mccll.usmc.mil/mcclladmin/directme.cfm?db=jointmccllcdrm&id=5399&fileID=9722&ftype=Interviews&fname=Hancock%20James%20CDR%20%2D%20FRIEDRICH%20Final%20Transcript%2DCDR%2D5399%2Edoc (accessed January 16, 2010).

———. *Logistics Lessons and Observations from OIF I to present and OEF*. https://www.mccll.usmc.mil/index.cfm (accessed January 17, 2010).

Martinez, Steven L. "Baffled by DAFL: Directive Authority History for Logistics." *Air Force Journal of Logistics* 30, no. 3 (Fall 2006): 63-77. http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=24169721&site=ehost-live (accessed January 17, 2010).

McClanahan, Pat. "The Future of Joint Logistics." *Navy Supply Corps Newsletter* 72, no. 3 (May-June 2009): 8-9. http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=43589948&site=ehost-live (accessed January 17, 2010).

Menotti, Mark J. "The Sense-and-Respond Enterprise: Why the U.S. Marine Corps Should Embrace the New Paradigm." *OR/MS Today*, August 2004. http://www.lionhrtpub.com/orms/orms-8-04/frenterprise.html (accessed March 1, 2010).

Naval Supply Systems Command. "Global Logistics Support." Letter, December 4, 2009. In *Bottom Line*. https://www.navsup.navy.mil/navsup/news/the_bottom_line/Bottom%20Line%20Global%20Logistics%20Support.pdf (accessed February 14, 2010).

Office of the Deputy Under Secretary of Defense for Logistics and Material Readiness. *Sense and Respond Logistics Technology Roadmap*. Washington, D.C.: Department of Defense, 2009.

Paparone, Christopher R. "Who Rules Logistics? Service Versus COCOM Authority." *Army Logistician* 37, no. 6 (November-December 2005): 52-54. http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=18854358&site=ehost-live (accessed January 17, 2010).

Schmitt, John F. "Command and (out of) control: The Military Implications of Complexity Theory." *Marine Corps Gazette* 82, no. 9 (September 1998).

Solis, William M. *Defense Logistics: Efforts to Improve Distribution and Supply Support for Joint Military Operations Could Benefit from a Coordinated Management Approach*. GAO-07-807. Washington, D.C.: United States Government Accountability Office, 2007.

Taylor, Courtney, and Leonard B Della Moretta, III. "Integrating Coalition Logistics at the Tactical Level." *Military Technology* 31, no. 7 (July 2007): 70-72. (accessed January 17, 2010).

United States Marine Corps. "Marine Corps Logistics Roadmap." 2009.

———. "MSTP Pamplet 4-0.2: A Logistics Planner's Guide." February 2008. MAGTF Staff Training Program.

United States Marine Corps Combat Assessment Team. *Operation Enduring Freedom*. https://www.mccll.usmc.mil/mcclladmin/directme.cfm?db=jointmccllcdrm&id=381&fileID=1289&ftype=Misc&fname=OEF%20Summary%20Report%20%2D%20Published%20Final%20FOUO%2Epdf (accessed February 17, 2010).

US Joint Forces Command. *Capstone Concept for Joint Operations*. http://www.jfcom.mil/about/fact_ccjo.html (accessed February 7, 2010).

———. *Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations*. Edited by Marine Corps Center for Lessons Learned. (accessed January 15, 2010).

Vacante, Russell A. "Sense and Respond: An Emerging DoD Concept for National Defense." *Defense Acquisition Review Journal* 14, no. 1 (February 2007): 248-259. (accessed February 14, 2010).

Vincent, Michael. "Bn Operations in OEF."" E-mail message to Jeremy Thompson, February 13, 2010.

The White House. *The Federal Response to Hurricane Katrina Lessons Learned: February 2006.* https://www.mccll.usmc.mil/mcclladmin/directme.cfm?db=jointmcclldrm&id=4447&fileID=7425&ftype=Misc&fname=White%20House%20Report%2DKatrinaLessonsLearned%2DCDR%2D4447%2Epdf (accessed February 9, 2010).

Winterle, Garth. "GCSS-J 7.0.1 Quick Look Report." Power Point Presentation, Defense Information Systems Agency: Joint Interoperability Test Command. http://www.disa.mil/gcssj/ (accessed February 17, 2010).

———. Interview by author, February 17, 2010.