Military Logistics Cargo Distribution Management for the Next Conflict

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21 April 2004
Executive Summary

Logistics support at the division-level and below during Operation Iraqi Freedom was neither effective nor efficient. Countless articles, After-Action Reviews, and the results of our survey validate this statement. Leaders throughout the Army, from the senior logistics officer in the Army to current and former company commanders identified two critical shortfalls within the current Army supply chain system at the aforementioned levels: connectivity between logisticians and distribution methods.

To resolve these shortfalls, we recommend the following actions. First, we must implement digital supply requisition capabilities into FBCB2. An inherent aspect of these capabilities is digital inventory management and shipment tracking for each echelon of logistics support. Next, FBCB2 and CSSCS connectivity must be enhanced to allow information sharing at all levels of combat service support. This information sharing must include limited asset visibility of higher and lower echelons.

Augmentation of these existing systems will create, in effect, a logistics internet on the battlefield. Within the framework of this network, logisticians will have automated inventory and shipment tracking resources at their level, visibility of the availability of resources that the level above them in the value chain, and a digital requisition capability providing both a record of submission of the request and feedback on the status of filling that request. The value added to the Army supply chain system, with little implementation or training costs, will be significant, improving effectiveness (how well supported organizations are re-supplied) and efficiency (how well does the Army conduct the business of resource management and support of combat units).
Military Logistics Management Introduction

“During Operation Iraqi Freedom (OIF), the Third Infantry Division (Mechanized) (3ID [M]) moved farther and faster than any other ground offensive operation in history. Victory was accomplished through brute force logistics…However, with numerous logistical challenges throughout the operation…many units operated dangerously low on ammunition, fuel, water, and other sustainment items.” (3rd ID AAR, 2003, p. 197) This collaborative effort intends to assess both user and management level requirements of systems or technologies that meet the identified shortfalls in logistics operations, examine technical solutions to resolve the communications and information flow problems that exist, and recommend implementation options to reduce cost and required training time while maximizing value added to the Army supply-chain. The genesis of this effort was the programming of a cargo distribution optimization scheme and the subsequent determination of demand for this initial capability.

Logistics operations were not a failure in Operation Iraqi Freedom. That the 3rd Infantry Division was able to conduct this move and have sufficient force to secure Baghdad speaks volumes about the broad logistics efforts to ensure Soldiers had critical supplies. However, the Army has learned a number of extraordinarily valuable lessons from this conflict that must be resolved. At the division level and below, these lessons focus on two critical areas: communications within the logistics framework and distribution of available supplies. Failures in the first area derive from a number of sources to include type of equipment used to communicate and the methods utilized to requisition supplies. The second area’s failures span from asset visibility, through inventory management, to shipment prioritization to meet critical requirements.

Across the Army, senior leadership recognizes the need to improve logistics operations drastically. In laying out his strategic vision for all Army logistics operations (Appendix 1.1), the Army G-4 (chief of Army logistics), Lieutenant General Claude V. Christianson, identified four Focus Areas that “address known shortfalls in our current structure that require immediate action…These Focus Areas are the Army G-4’s highest priority, and we will apply our policies, processes, and resources to ensure success.” He has recognized that “If we do not connect Army Logisticians, improve the capability of the distribution system, modernize force reception, provide integrated supply management and give the joint force combatant commanders JTAV [Joint Total Asset Visibility], we will study these same lessons after the next major conflict. The Army G-4 is committed to ensure that we will not have to relearn these same lessons.” (Christianson, 2003, p. 7)
Demand Summary

The role of the demand team was to determine the extent of the need for logistics reform in the Army, and to identify the capabilities required to accomplish this reformation. These tasks were accomplished in two ways: by researching relevant documents on military logistics (mainly focusing on issues during Operation Iraqi Freedom) and by distribution to military personnel of a survey that poses questions on logistics reform. The articles and after-action reviews that were researched ranged from company to division level and rendered a macroscopic view of the current state of Army logistics, while survey results provided a microscopic view of what the Army needs in order to satisfy requirements down to the individual soldier.

Results gathered indicate considerable support for logistics reform in the Army. Four focus areas of reform exist as summarized by Lieutenant General C.V. Christianson, the Army Deputy Chief of Staff for Logistics (Paulus, 2004, p. 4). These are as follows:

- Connect logisticians
- Modernize theater distribution
- Improve force reception capability
- Integrate the supply chain

Of the above, the first two focus areas fall within the scope of this current project. These focus areas indicate that the real-time information sharing and connectivity in theater needs vast improvement. Specific logistics issues in Operation Iraqi Freedom support restructuring along these focus areas. Theater distribution assets and timeliness of delivery were severely lacking. Supplies were ordered multiple times because of the uncertainty of delivery and inadequate communication systems, and thus many times an excess or lack of supplies existed. Once supplies were sent, visibility of the location of these supplies all but disappeared.

Logisticians need to be able to receive requests from units, process these requests, and determine the availability of supplies necessary to meet these requests almost instantaneously. A secure logistics internet at every echelon within the supply chain would supply this connectivity. Not only do logisticians require this capability, but also every level of the Army in theater should be integrated to allow information sharing across the battlefield. Along with improving the connectivity of the battlefield, the distribution system also needs to be upgraded. The Army needs an automated shipping and tracking system that feeds into the logistics internet. With this capability, the supplier can determine what has been sent, when it was sent, where it is now, and when it will arrive. With this information available to the consumer, an optimization program is not necessary. The real-time information network and ability to determine what supplies are where eliminate the need for this capability.

The results of the macro study, conducted first, were echoed throughout the survey results. The 12 respondents had experience from corps to platoon level in executing logistics support, supervising distribution of supplies, and observing and conducting logistics training.
Their collective experience spans combat operations in 1991 (Operation Desert Storm), Bosnia and Kosovo, and recently in 2003 during Operation Iraqi Freedom, as well as countless training events throughout the world. Two critical requirements came to light as a result of the survey, and the respondents offered insight as to how they would like, conceptually, to see these requirements met. The survey and results are included in Appendices 1.2 and 1.3 respectively.

The first capability is a mechanism for submitting requirements and receiving both feedback and confirmation of receipt of the request. The current system is based on unreliable information flow upwards coupled with non-existent feedback mechanisms. This system has eroded both efficiency and confidence in the system and creates unnecessary delays re-supplying units. To resolve this, users want a network-based information management tool, preferably using existing resources. This tool must send a unit’s requirements to its next higher echelon of support, with a digital record, and must feed back availability of that resource at that echelon, or if not available, that the requirement has been sent yet higher. At each subsequently higher echelon, the same process must occur with a simple feedback requirement. Is the asset available? Yes, then when is it being shipped? No, has the requirement been sent to the next echelon? This capability must also track requests by the battalion that submitted them, so that these battalions can be reassigned without losing their requests (or the supplies being delivered can be diverted to their new location or organization). See Appendix 1.4 for a diagram depicting the desired capabilities of a logistics management system.

The second capability is a resource for inventory management and shipment tracking. Logistics executors in the field are currently using at least 8 different systems to track inventories and requests from organizations they support as well as submitting requests to the next echelon higher. Customers want their logistics support units to know, via an automated system that must be linked to the logistics internet, precisely what is on hand and where it is located. This resource must also include a date-time stamp and location capability that tells both the logistics executor at that echelon, and all authorized organizations on the network, where and when the item was loaded, shipped, transshipped, unloaded or delivered. This capability is essential in that it allows the customer to track their required resource as it progresses forward.

A critical aspect of these capabilities, identified in both studies, is the connectivity between the two capabilities at each echelon of support. Users want the inventory and shipment tracking capability to interface with the secure logistics internet to allow visibility on current location of supplies en route, approximate percentage of requirements to be filled and projected arrival time. This capability set serves not only the customer, but the logistician at every level as well by providing a real-time snapshot of the current logistics state: what is where, what is being shipped and to whom.

Two key comparisons came to light within the survey results, and examining these comparisons offers us an excellent model for visualizing the individual capabilities as well as their interface. The two analogies presented were comparing the inventory capability with Amazon.com and the shipment and tracking capability with UPS. For this to be a valid set of
analogies, they must be taken in the context of a secure internet environment. Within that framework, these two comparisons prove especially useful because of the scale of their operations and the notable flexibility each organization provides.

Amazon.com runs a decentralized multi-distributor supply chain system with real-time user interfaced inventory tracking (seen by the user simply as available or not or in advanced queries quantity available). The user does not get, or need, information as to which warehouse has the product or how it will be handled prior to shipment. They simply determine that some specific item is available within their supply system. If the customer demands that item, Amazon.com locates it, handles it, and then provides it to the shipper who assumes responsibility for ensuring delivery of the product within the specified time frame. Our respondents indicated that as much as Amazon.com was a model for inventory, United Parcel Service (UPS) was a model of interest for delivery of goods, and UPS is a frequent shipper for Amazon.com.

United Parcel Service’s delivery model involves distribution centers coupled with individual package tracking. As each package passes through a distribution center or transshipment node, the date time group for the receipt and subsequent outbound shipment are recorded along with destination information - all of which enters their package database. The customer awaiting their product can log on to a different website (using the same internet) to ascertain the most recent delivery information about their package.

These models capture precisely what logistics executors want in an echeloned format. They want visibility of their own inventories (parallel asset visibility) and secure internet-like interface with their next echelon higher. They also want feedback from the next echelon in terms of:

- Have you received my request?
- Is the commodity or product available?
- If so, when will you ship it?
- If not, who has it and when will they ship it?
- Once it is shipped (and by whom), where is it and when can I expect to receive it?

Lastly, they want to ensure that each echelon above them has similar asset visibility and interface capabilities. To facilitate rapid implementation of these capabilities, customers prefer that the capabilities utilize existing hardware and software packages to reduce training time for operators and implementation costs.

These capabilities are best captured when examined as existing models as previously defined. The combination of a logistics internet and an inventory and shipment tracking capability meets the user’s wants (as indicated by our respondents) as well as top management (led by the Army G-4, Lieutenant General Christianson) as indicated in The Logistics White Paper (Appendix 1.1), penned by General Christianson himself, and distributed throughout the Army as his strategic vision for the future of Army logistics.
Feasibility Summary

In order to determine the feasibility of implementing the suggested improvements to logistics flow as given in the demand analysis, we sought to identify the platform, echelon and technical aspects of potential systems through capabilities and cost-benefit analysis. Using the results of the demand analysis, we conducted research on commercially marketed systems and existing Army systems. Comparisons were made of software and hardware, system durability, user interface, system interoperability, and data transmission. Additionally, we identified the training requirements, estimated costs versus Army budgeting, and levels of implementation of this system to aid the Applicability Team in measuring the performance and value added of the system. We also contacted Army commands to determine the duty descriptions and actual utilization of Army Operations Research Officers at division-level so an assessment could be made of their role in system selection and implementation. Given the results of our research, we have identified two feasible systems for the Army to consider. One option involves creating an entirely new system while the second upgrades existing Army technologies.

The first option explored was creating an entirely new system intended to meet the requirements outlined in After-Action Reports and our survey while still allowing for optimization of logistics. Because every other consideration was dependent upon it, hardware options were researched first. Obviously, the durability of the system is strongly related to this hardware choice. Smaller and more flexible devices such as the PDA and laptop will require a higher level of protection while larger devices, like desktops, are easier to protect. Our system would link a Personal Data Assistant (PDA) to a laptop or desktop or would link a laptop to a desktop. A PDA or laptop would be fielded at battalion-level while higher echelons would receive desktops. Below are descriptions of the devices we propose to implement including a discussion of communication and user interfaces for each.

- **PDA:** A protected PDA is attractive for field use due to its small form factor. The small size keeps processor power at a minimum (roughly 200mhz), an issue not expected to be a problem. Since the results of the demand survey and our research indicate that optimization is not needed at battalion-level and below, PDAs will meet the capability requirements of these customers. PDAs would be set up to record, transmit, and track logistical requests in much the same way that UPS drivers use them to make deliveries. Communication would occur wirelessly with a distant organizational structure made up of one or more of the following options: local networking to a communications server, cellular adapters, or satellite links. A custom data-input application would be written to suit the demands of individual battalions. Lacking mice or keyboards, the only real input method is the pen-based direct input. The interface must be designed to support pen-based navigation. In order to limit scrolling on the smaller screen, the interface should display relevant options, allowing future inputs to be based on recent transactions, facilitating its timely use while allowing access to all options through advanced interfaces.

- **Laptop/Tablet:** At maneuver battalion headquarters, laptops would be fielded. Laptops sacrifice processing power for mobility; but, in the dynamic environment of
combat with little to no storage space or time for setup, they present the best combination of performance and ease of use. Processors on high-end laptops are marginally less powerful than a standard desktop computer but are significantly more powerful than PDAs. Communication options would be similar to those outlined for PDAs, but more specialized hardware exists to take advantage of a wider assortment of infrastructures. Laptops are powerful enough to efficiently run linear optimization software, custom applications or off-the-shelf solutions, all of which are attractive capabilities that would allow the system flexibility for future upgrades or changes. Similarly, input software could be custom built, or templates in existing applications such as Microsoft Word or Excel can be utilized. User interface would be facilitated by keyboard navigation, which provides a distinct advantage over a track pad, mouse-nub, or external mouse for instances when the user has limited time to input data or submit requirements.

- **Desktop:** At brigade and division-level, echelons that generally operate logistics nodes in a more static manner, desktops present the best option. Desktops have powerful processors that can quickly assimilate and transmit data via existing local networks, allowing brigades and divisions to maintain accurate databases of logistics on-hand and on-order while simultaneously compiling subordinate units’ requests. Standard applications are likely to be the best option based on user familiarity. In addition, positive transfer and system-wide conformity are features that are easy to achieve and can help greatly with the usability of the software.

Following our examination of hardware and communication options and user interface, we turned our attention to the available operating systems. We discovered four main categories of operating systems worth considering:

- **Microsoft:** The most familiar setup for target users, Microsoft is the primary operating system of most existing Army computers. Therefore, a relationship has already been established between Microsoft and the Army and this choice would require the least amount of training for users. Additionally, a wealth of rebuilt software exists for the Windows platform. One very significant drawback, however, is that all Microsoft operating systems have regular, serious security flaws which have previously prevented its use for the development and transmission of highly sensitive information in the Army and are likely to render it an unacceptable choice for this application as well. (Greer 2004)

- **Apple:** Also familiar but not currently fielded within the Army, Apple operating systems present an alternative. The most recent operating system from Apple, OS X, currently provides several security features that effectively protect sensitive data with little to no extra effort, potentially a very attractive feature. A limitation of Apple is its lack of hardware choices and smaller set of existing software.

- **Linux:** Linux offers the best security features of the four options but is likely the least familiar operating system. The cost of Linux exists in the setup and maintenance of the software to perform the specified tasks. Limited software
currently exists; therefore, the majority of optimization and data entry functionality would need to be custom written, raising the costs of Linux even more. (Keizer 2004, Orzech 2002)

- **Other:** The fourth option for consideration regards minor operating systems available for PDAs. These vary according to the manufacturer of the hardware. For each of them, the functionality of all the components needs to be developed.

After an analysis of the aforementioned hardware and operating systems, we turned our attention to software selection. A key consideration in any software is its ability to interface and function with other software. An array of existing software packages is available for all aspects of this project. Data entry can be handled by various applications. The Microsoft Office Suite of software provides the ability to develop custom forms, templates, and program modules for custom calculations. Analogous systems exist for Macintosh and Linux with varying levels of custom software development needed.

Although communications were considered in the hardware section of our assessment, providing a limited discussion of how transmission of data would occur on the battlefield between components of the system, we will now provide additional discussion regarding software necessary to ensure secure transmission of data. Communications would be the most difficult to incorporate securely with other applications. The simplest solution is to offer a separate application to handle all of the communication needs. A simple file format, such as encoding the information in the Extensible Markup Language format, XML, would allow almost any options for communication to be viable. Ideally, data files could be encrypted using a high-quality encryption algorithm such as Secure Shell, SSH, or Pretty Good Privacy, PGP, and transmitted either through a secure communications line (SSH tunnel through wireless link) or physical transportation of a storage device (flash based memory is recommended for its ruggedness). Current open implementations of software for both laptops and PDAs provide tested code bases and examples with liberal licenses. SSH is better suited to live communications, but existing libraries lack features that would support physically transferring data between computers. PGP would be a better solution in this example, and is already used to encrypt and verify emails (similar in concept). (PGP 2004, Open SSH 2004)

One of the final, but most important considerations in the eventual implementation of this system is the level of training required to implement an entirely new system. Time is an expensive commodity in the Army and one that is in short supply. As a result, a big downfall of a new system is the extensive training it would entail. Primary users, secondary users, and Information Systems support personnel would all need training. The training requirements for a completely new system of this nature would range from 2-3 days for the secondary users to 1-1.5 weeks for primary users and support personnel.

Cost was our last significant consideration that affects implementation. Army projects often reach astronomical levels of cost during their induction, fielding and implementation within units. It is therefore unlikely that the costs associated with a technology of this kind be considered too high. For example, the Combat Service Support Control System (CSSCS),
a developing Army technology and part of its Force XXI initiative, program costs were increased by 21.7% in December of 1998 from $324.6 to $395.1 million. Additionally, during the production phase of the Force XXI Battle Command Brigade and Below (FBCB2) system in May 2001, TRW, Inc., just one of the system producers, was awarded a contract to produce systems at an estimated cumulative total of $45 million. Costs associated with the new system approach are likely to be competitive to this initiative.

In conjunction with our analysis of new systems, we also researched the Army’s existing systems and capabilities. Our first consideration was to identify and pursue the use of Army decision support tools. Unfortunately, those currently in use are complex, making them not user friendly at the Soldier level. It would be possible for Operations Research/Systems Analysis (ORSA) officers to operate them, but it is likely this wouldn’t solve the existing problems at brigade-level and below as only one ORSA officer is assigned per division, eliminating the feasibility of ORSA involvement at lower echelons. Databases, therefore, would have to be compiled by the user, placing weights on those items that are considered of greater importance. It would be difficult to get an unbiased viewpoint with this technique of data entry, so results would be of marginal use.

The most attractive and feasible of the options we considered is the augmentation of the Army’s Force XXI systems. The Army is currently working towards networking and digitizing the battlefield through the Force XXI initiative. We propose that the augmentation of these systems would allow Near-Real-Time (NRT) logistics tracking. Currently, there are two hardware systems in-place that would require augmentation in this approach.

The first is CSSCS, a system designed to “Provide timely situational awareness and force projection information to support current operations and sustain future operations as a key logistical enabler for the Army Transformation." (Weapon Systems 2001, CSSCS) Reading this mission, it would appear that within the Army exists the ability to conduct NRT re-supply now, especially after reading the system description: "The Combat Service Support Control System (CSSCS) is a decision-support system that assists commanders and their staffs in planning and executing CSS operations. The CSSCS will rapidly collect, store, analyze, and disseminate critical logistics, medical, and personnel information." (Weapon Systems 2001, CSSCS) This is not the case, however, since CSSCS is only fielded to brigade and higher support units, therefore, the warfighter cannot communicate logistics needs using this system.

FBCB2 is the second system we recommend augmenting. Its mission to "Provide battle command and situational awareness information from brigade level down to the soldier/platform level" (Weapon Systems 2001, FBCB2) immediately shows promise as it is designed to reach the warfighter. A system description further supports this analysis. “The Force XXI Battle Command Brigade-and-Below (FBCB2) forms the principle digital command and control system for the Army at brigade levels and below … The system features the interconnection of platforms through a communications infrastructure called the Tactical Internet to transmit situational awareness data.” (Weapon Systems 2001, FBCB2)
The results from the demand survey identified a shortfall in the Army’s implementation of these systems. All parties described the problem as a function of receiving requisitions, tracking requirements, and the actual process of distribution. In general, the results outlined the need for a networked battlefield with logisticians having the same communications capabilities as warfighters. Both the FBCB2 and CSSCS systems work toward sharing information across all levels in order to maintain situational awareness and increase communications.

There are problems with this potential solution, however. The most preventive issue lies in the fact that the warfighter has the FBCB2 system for tactical operations and the logistician has CSSCS for logistical and support operations. While both systems are extremely extensive and forward reaching, they are not currently linked. As such, the warfighter requesting logistics does not see the same picture as the logistician supporting him, and vice versa. This fact was evident in the demand survey, where a common warfighter comment was to provide the FBCB2 system to all logisticians. An additional complication arises in the potential customer for these two systems. Recall that the FBCB2 is currently employed at brigade-level and below, while the CSSCS is for brigade-level and above, focusing mostly on Division, Corps, and Echelons Above Corps units.

These two problems exhibit why leaders at all echelons view the problem as requiring a long-term fix and not the application of a quick fix such as optimization. The most feasible method of eliminating wartime logistics flow issues is to link the FBCB2 and CSSCS systems. This would solve the long-term process problem the Army currently faces. Our research did disclose that the Army does have plans to eventually link the two systems (Weapon Systems 2001, CSSCS), however, we believe taking this course of action now, before the next conflict, could address and resolve many of the logistical problems realized during Operation Iraqi Freedom.

Once the FBCB2 and CSSCS systems are adjusted to network with each other, units at all levels could communicate. In addition to the tactical screens that the FBCB2 has, new, logistical functions can be added through coding. Likewise the same can be done with the CSSCS for strategic and GPS information on tactical units. This change would require little additional cost proportional to the current budgets of over $1 billion. FBCB2 users would be able to review their requests' status, receive confirmation of the request, and track delivery of their supplies, all of which were described as desirable to the customer.

Several feasibility issues are eliminated by this option. For example, units either currently have or will shortly be outfitted with the hardware necessary to run these applications. The hardware has already been field tested, accepted and implemented by the Army, removing a major uncertainty that exists in the new system approach. Furthermore, the user interface has proven acceptable and adaptable for the Army's uses, meeting open system standards for interoperability. Lastly, system management and communications planning have already been established for wartime use. This planning includes "loading network initialization data, maps, cryptographic keys, ..., laying out networks, making frequency assignments, and specifying address/circuit assignments." (Military Analysis Network, FBCB2)
One remaining issue that the Applicability Team must consider when examining the option of modifying an existing system is that of training. All users and systems maintenance personnel receive 24-35 hours of training on the FBCB2 as part of their required Army training. (COL Weaver) Users of CSSCS receive even more extensive training sometimes lasting in excess of a week. Should an additional feature be added, training requirements would only increase by a matter of hours, time that could be readily incorporated into the training schedule.

Regardless of the selection made for implementation by the Application Team, we have identified a number of key technicians within the Army that can facilitate the transition; one such group is ORSA officers. These officers introduce quantitative and qualitative analysis to the processes used throughout the military. The kinds of techniques ORSA officers apply include probability models, statistical inference, simulations, optimization, economic models and operational experience. One of the key functions these officers contribute to the US Army is resource management during wartime operations. These officers are usually employed at division-level and above and are tasked to use the aforementioned methods to underpin decisions made by leaders and managers within the Army. Based on this skill set, these officers can facilitate the introduction of new systems to optimize and/or track logistics in the military.

Based on the Demand Team’s results, we already know that top management, including the Army’s senior logistics officer, recognizes the need for change in logistics operations during wartime. The Army Science Board is an organization that reviews, develops and recommends both evolutionary and revolutionary processes and products to the Army’s top leaders. During their examination of potential changes, they often task ORSA officers to conduct research regarding the efficiency of existing logistics distribution systems and to model new technologies to determine which best supports the needs of the Army. Introduction of our findings to The Army Science Board may result in ORSA exploration as a feasible change to the Army’s existing logistics model for wartime. We advocate forwarding our results to The Army Science Board once the Applicability Team has completed its analysis and presented its final recommendation. (Edwards, Miseli, Ostrowski and Stevenson, 2003)

The Feasibility Team did not pursue, to any great extent, the inclusion of an optimization capability, but we will continue to examine the feasibility of implementing that functionality into the adopted system. Optimization remains a possible solution to re-supply issues that arise at division-level and above where ORSA officers are assigned. The management of logistics becomes more complex at each successive level of the Army’s organization, making its management at upper echelons extremely difficult. The optimization technology we developed currently exists solely as a planning tool and is not stochastic. The model can be altered to become dynamic, but at great expense to the solving time and complexity of the optimization. In a highly stochastic, wartime situation however, a flexible model would be most desirable and applicable. As such, the current model can be, and should be, improved to take time into account. From a feasibility aspect, the most effective way to accomplish this task would be to treat time as discrete blocks of time, such as the Army’s common 24-hour
replenishment periods. If our optimization coding were altered to incorporate time, it could prove extremely useful in helping to manage logistics flow to tactical units.

Improving the flow of military logistics during wartime is feasible. While there are many ways it can be accomplished, there are two predominate solutions. The Army can choose to implement a new system or can modify a pre-existing infrastructure. Either option can be shown to have advantages and disadvantages when compared to the other but the method most likely to succeed is the alteration of the Army’s Force XXI systems. There are several reasons for this including the existing acceptance and implementation of the system, considerably lower cost-levels, and minimal additional training requirements. Additionally, this methodology directly addresses the feedback received throughout our analysis. For a complete comparison of the two options, please refer to Table 1.

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<tr>
<th>Component</th>
<th>New System</th>
<th>Existing System</th>
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<tbody>
<tr>
<td><strong>Hardware</strong></td>
<td>PDA, Laptop, Desktop</td>
<td>FBCB2, CSSCS</td>
</tr>
<tr>
<td><strong>User Interface</strong></td>
<td>Stylus, Keyboard</td>
<td>Sensor Inputs, Keyboard, Touchscreen</td>
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<td><strong>Communications</strong></td>
<td>Wireless to LAN</td>
<td>Satellite via Army Tactical/Logistics Internet</td>
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<tr>
<td><strong>Operating System</strong></td>
<td>Microsoft, Apple, Linux, Others</td>
<td>Appliqué</td>
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<tr>
<td><strong>Software</strong></td>
<td>Custom or Off-the-Shelf</td>
<td>FBCB2, CSSCS, Appliqué, Others</td>
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<tr>
<td><strong>Security</strong></td>
<td>SSH, PGP</td>
<td>Army Tactical/Logistics Internet</td>
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<td><strong>Training</strong></td>
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<td>3–5 Hours</td>
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<td>Widely Accepted and Understood, Time to Market</td>
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<tr>
<td><strong>Key Disadvantages</strong></td>
<td>Cost, Time to Market</td>
<td>Limited Flexibility</td>
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*Table 1: Comparison of New and Existing System Options*
Applicability Summary

The role of the Applicability Team is to analyze and assess the proposed logistics management system from managerial perspectives, to include the strategy of technology integration. We organized this into two parts. We initially identified technological characteristics of the proposed solutions presented by the Feasibility Team to serve as the measures of the system’s performance and value added. We then developed an operations strategy for Army logistics management to recommend implementation of the system to improve resupply operations. Part 1 addresses the following key characteristics of implementing a system:

1. Technology strategy
2. Competitive priorities of feasible technologies
3. Sources of innovation
4. Who/what/where/how
5. System measures of performance
6. Remaining technical challenges
7. Push versus pull technology and its likely ramifications

Part 1. Identification of the key technological characteristics

Technology strategy. We have considered the largest panel of technologies available in order to find all the different implementation possibilities to ensure we choose the adequate technology. This parallel research of technologies by the Feasibility Team and a clear understanding of the desired characteristics helped us find a convergence and meet with the requirements.

Competitive priorities of feasible technologies (price, performance, consistency, customization, composability, etc.). The new technology has to cost as little as possible, but cost is not the principal aspect of implementing a system in the Army. Instead, it is much more important to have reliability, ease of use, and effectiveness. Without reliability, the implemented technology will not survive the harsh conditions nor provide the intended value added to the supply-chain.

Customization is also important. Integration of new weapons systems and new supplies is essential. Moreover, we have to consider improvements in communications capabilities and hardware throughout the Army. At the same time, as we want to use a customizable technology, any new system must be able to work within existing systems as much as possible.

Lastly, we have to ensure that the interface is intuitive for two reasons. First, we want to reduce training requirements for operators and supervisors, and we must ensure that operators can utilize the systems despite fatigue and battlefield conditions.
Sources of innovation. This project has multiple sources of input in terms of demand ranging from top management to customers needing supply at the Soldier level. In recommending a system, we have to ensure the customer will utilize the new technology. At the same time, we have to assess and compare the tentative solutions with those demand results. In doing so, the use of existing technologies to support our implementation seems to be fundamental to ensure the reliability and integration among existing Army systems.

Who/what/where/how (Value chain analysis)

Value chain overview.

In the value chain of Army logistics, field troops report their inventory status and request resupply to the logistics node at the next higher echelon. Having prepared detailed estimates and conducted thorough planning and limited optimization, Army logisticians have in place a master logistics plan. This detailed logistic plan, within the framework of the original estimates, translates into a supply distribution scheme and base haul plan to allocate and initially distribute high demand items to the expected customer. As needed, supplies are delivered to the appropriate field troops or organization. The flow of values in terms of information and physical resources is currently limited by this simple pattern, but can be significantly extended by a real-time communication system across the entire Army logistics system. This will enable users and planners to share symmetric information.

Value chain analysis

Fundamental enablers. Two of the fundamental features that maximize value in this chain are mobile communication and computing technology. With the high mobility of Army forces in extended operations, these features are essential, and current IT technology can support the demand. The next feature, a benefit from mobile communications and computing technology, is the information sharing that is essential to logistics operations. The final feature is the physical logistics system, which can be improved significantly with collaboration between the aforementioned features. Automatic location, quantity, and resource status monitoring can be constructed accordingly with the communication and planning systems.

Uniqueness/Sustainability. Army logistics systems can achieve the desired capabilities using the technologies of specialized PDAs, mobile computing, easy-to-operate and high performance planning and tracking software, barcode and RFID tracking systems, and cross-disciplinary education (utilizing ORSA trained personnel) and software and hardware training programs. All sub systems listed above can be customized for the use in military setting.

Value chain transformation.

Each link is reinforced by new information technologies, but the biggest change in the value chain must be within the communication structure in and outside of the chain. Secure, fast and reliable information is the most important value in the Army logistics system, and
imperfect asymmetry of information among the operation entities in previous logistics systems will be improved by the communication innovation.

**System measures of performance.**

Generally speaking, the efficiency is the ratio of output over input, whereas the effectiveness is the measure of particular satisfaction of niche market. Regarding the *efficiency* and *effectiveness* standpoint, most military applications are more sensitive in the effectiveness. The major points of effectiveness are within the context of this study are:

- **Speed:** Fast tracking, diagnosis, command, report, decision, and delivery system are required for the new logistics system. Use of real-time information transaction and decision-making tools will drastically increase the speed of Army logistics operations. The evaluation of speed improvement can be quantified from the operations (resupply) time comparison between the existing system and new system.

- **Accuracy:** The new system should improve the significant inaccuracy of information from conventional types of irregular and manual inventory monitoring and requisition submission, reported by papers, floppy disks, and voice communications. The resource management and shipment tracking using a barcode and RFID system will eventually enable implementation of an automatic monitoring system with improved accuracy.

- **Reliability:** The hardware and software must be reliable and durable against external impact, extreme climatic conditions, and radio frequency disturbance. For example, Rugged PDA (RPDA-88) is a specially designed PDA hardware with heightened durability for military use.

- **Security:** As seen in the example of data encryption using a high-performance algorithm such as SSH or PGP, security is the most important issue for the effectiveness of the Army logistics system. The security performance of a new system must meet stringent testing requirements both in a simulation-based environment and the field.

Quality could be measured on the various dimensions of product-based, user-based, operations-based, and value-based definitions. Significant attributes of technological products and their effectiveness, in terms of user satisfaction, defines the quality of military technologies more accurately.

- **Product-based:** Easy to use and learn, physically sturdy, and lightweight hardware will be considered as high quality in terms of product-based measure.

- **Operations-based:** Stable software, good look and feel, fast and reliable results, easy data entry, and high success rate of connection are some of the operational quality measures.
• **Value-based:** As a minimum, this includes the accuracy of information stored and passed, customized and flexible use of the system, and effectiveness of security measures.

**Analysis and assessment of the remaining challenges.**

At present time, the network architecture does not support adequate wireless voice communications, much less any digital communications for logistics operations. The logistics communication network rests primarily on Mobile Subscriber Equipment (MSE). Unfortunately, this critical network does not exist during movement. And although new network technology is in development, the networking capability that is essential to resolving the current shortfalls must be capable of sufficient data transfer using the current wireless and satellite-based networks. Otherwise, a dependence on medium to high levels of data transfer will impede a system’s applicability in field operations.

One of the indicators of the additional value added from this logistics management system is the notion of a "system of systems" in the form of a total battlespace information network that connects remote sensors, soldiers in the field, weapon platforms, commanders, decision support tools, and a vast array of other automated information systems. The goal of this emerging technology is "total battlespace transparency", a term to convey the nullification of the traditional hindrance of time and space on the exchange of information. The goal also includes being more flexible in adaptivity towards any contingency in an increasingly uncertain world.

There are, however, some risks of such a broad and encompassing network in any operation particularly for military operations, for example, the creation of significant vulnerabilities from a broad network infrastructure. The required increase in the variety and number of access points will bring additional security risks. This could be a dangerous point of exploitation if the military transitions to "just-in-time" re-supply methods. One counter to this issue, however, is the time sensitivity to such information, where it is unlikely for any adversary to actually exploit it while it is still accurate.

There is also the possibility of the development of an over-reliance on information technology as a substitute for the traditional means of information exchange and decision-making. Some of the negative, unintended consequences that could materialize might involve traditional allies, mainly due to an increase in the gap of technology between the U.S. military and their less-funded counterparts. Finally, micromanagement is a concern of any large organization, but such a large communication network could result in the creation of a "hyper-hierarchy", where not only micromanagement but also the presumption of false authority is possible in subordinates who become more knowledgeable than normal of "high level" information.

There remains an issue regarding security that has been inherent to certain operating systems, although this can be somewhat mitigated by network security devices. With new technologies of network infrastructure and a transition of communications systems to a
consolidated network, some of the concerns over data transfer rates and availability in prior logistics communication will have been alleviated.

The current Army logistics systems and processes involve communications, information sharing and distribution techniques that are all relatively primitive. With this relatively low level of technology currently being applied, there are quite a few areas with identified needs for an improved logistics management system, an aspect of which warrants focusing on a "push" instead of "pull" system. Another reason to justify a "push" methodology is the likely occurrence of broad variations of systems, hardware, and software. Providing a centrally controlled set of specifications would help avoid the pitfalls known all too well from the widespread "stovepipe" development and acquisition patterns seen throughout the multiple divisions of the U.S. military.

To a large extent, the use of certain hardware and applications, some through a formal centralized process and some through informal user popularity and choice, has created a "pull" on some specifications for feasibility of future technologies. In this case, the increasing use of Microsoft operating systems, Microsoft applications, and PDA's has resulted in a de facto standard of some sort.

The predominant manual input method remains the keyboard, although it is possible that the Army, like some of the other military services, will field personal data assistants (PDAs). The digital Command and Control, Communications, Computers and Intelligence (C4I) system, Force XXI Battle Command Brigade and Below (FBCB2), already fielded in most units, provides one of the few, if not the sole, digital communications systems available during mobile operations. FBCB2 and other digital C4I systems offer a very feasible means through which supply data can transfer. The input/output methods should follow along similar engineering as the commonly used applications and devices, which include both keyboard and stylus control, as well as relatively small file size for unobtrusive digital transfer on wireless networks.

Interoperability in general means the ability to successfully communicate with others through the interaction of different systems. From a technical standpoint, the challenge to have interoperability has led to the development and integration of application interfaces (API), standardization of shared file protocol, and other similar means to allow different computerized systems to communicate, so there are already in place many successful procedures to address interoperability. A logistics management system in the form of a software application is therefore very likely to be easily integrated into computer-based communications architecture. One such example is the use of .XML formatted data files, which is becoming one of the foundational aspects of interoperability for some of the future simulation systems in the military that are being designed to be platform independent and interoperable with decision support systems.

Administrative tools such as Microsoft Office are widespread throughout the military at almost every level of organization, so any level of integration with these existing applications would facilitate the usability of an automated logistics system. As testified to by Microsoft's general manager of its Federal Systems unit, "The Army is a very good customer, one of the
largest. Actually, the Army and Air Force are two of Microsoft's largest customers. In
general, I’d say the Army has been a great customer for both NT and Exchange"
(Government Computer News, April 26, 1999 v18 i11 p21). Furthermore, there are fairly
rigorous certification and accreditation procedures in place in every major organization in the
Army, which could easily be implemented in an integration and fielding program.

In other areas of technology development and acquisition, it has become more and more
commonplace in the U.S. military to find requirements of software applications to include
operating capability using MS Windows operating systems as well as, the use of .XML
protocol for such parts of applications as data libraries and file transfers. Therefore, it is
quite likely that the most feasible means of interoperability will be take the form of
compatibility with Microsoft Office applications, .XML formatting, or some combination of
the two.

In general, the Army organization as a whole is extensively integrated with computer-
based systems, and has a population with a very high level of average experience with
computer-based systems. Regardless of the type of interface, it is desirable that the
commonly referenced functions do not require more than a few keystrokes, mouse clicks, or
other kinds of steps. For a logistics system that is to be used for management and direct
supervision of supply actions, the system should have a sufficient level of artifacts embedded
in its interface design in order to allow reasonably fast interactions, as well as being easy to
learn to operate.

As with private industry, the most common standard is the Microsoft Windows user
interface, which would then enable new users to use existing skills and familiarity in learning
and operating a new system. It is still yet to be determined as to the value of a logistics
management system that runs on a mobile platform such as a laptop or tablet.

The PDA has obvious advantages in mobility, but integration in this smaller platform
may incur additional costs for smaller, or "lighter", versions of the software. Also, it is yet to
be determined whether the Army will integrate the PDA in its operations. However, the U.S.
Marine Corps has recently awarded a contract for over $2.9 million for RPDAs (Rugged
Personal Digital Assistants), which is to the same company, Talla-Tech that has supplied its
military version of RPDAs to various branches of the U.S. Armed Forces. The use of PDAs
has greatly increased in the current operations in Iraq and Afghanistan, where they are
officially supported (i.e., "issued") in the Navy and Marine Corps, and informally supported
(i.e., "allowed") in the Army. (See articles from The Boulder Country Business Report,

Given the widespread and increasing use of PDA's, and in the case of the U.S. military,
the increase of hand-held personal computers (PCs), the capability of use on a PDA, laptop
or micro-PC is a definite requirement
Technology transfer and diffusion.

Technology transfer and diffusion occurs from technological innovators to the manufacturers or users. Since the technological attributes are highly specialized in the military, the technology transfer should be confidential and secured. In the Army logistics system, the technology transfer involves several important factors such as standardization of technology, training and instruction, and simulation before technology implementation.

- **Standardization:** The logistics system controls the information and physical resources. Most importantly, the data compatibility and interoperability between IT devices and users should be secured within the entire framework of the system. The physical resource transportation must be able to talk with those evolving information technologies. Standardization is the foundation for technology transfer.

- **Training and instruction:** Frequent barriers in technology transfer are the cultural factors. New systems, particularly entire business-wide technology, often suffer from the difficulties in education and instruction. The logistics system includes so many human factors that the training of IT skills and cross-discipline operations are critical activities.

- **Simulation before technology implementation:** A pilot system for the implementation can help prevent and reduce the stresses on system and users. A human-embedded simulation in the pilot system will provide a valuable analysis for the success of new system. Typically, it is an excellent approach to simulate a finite and tractable number of alternatives and make a decision among them. In our case, for example, we have 2 alternatives in cost decision: the development of a new logistics system with large cost investment, and the augmentation of existing C4I systems, which is the standard category in the U.S. military that includes modern computer-based communications systems.

Part 2. Operations strategy for Army logistics management.

The determination of the recommended strategy centered on addressing three questions. First, how can we satisfy the identified demands? From the Demand Team, we gathered the following requirements and desired capabilities:

1. Connect logisticians
2. Modernize theater distribution

The Feasibility Subgroup provided possible solutions in the following areas:

1. Available hardware
2. Available software
3. User Interface
4. System Durability
(5) Interface/Interoperability
(6) Transmission of data
(7) Training Requirements
(8) Costs
(9) Use as a planning tool or in a dynamic capacity
(10) Levels of Implementation within organization
(11) Course of Action Analysis Software/Decision Support Tools
(12) Involvement of ORSA officers

From the proposed possibilities of the Feasibility Subgroup, we then answered the questions, what are the barriers in implementing the technologies in current setting of business (the Army), and how can we resolve the difficulties? Last, we look to answer the questions of what does the value chain model of military supply system look like, what is the weakest link, if exists, and how can we strengthen the value on it?

First, how can we satisfy the identified demands? According to the Feasibility Team’s work, we have two major options: building a totally new system, or modernizing and linking existing systems. Introducing a new communication network for a new use is appealing. This allows the opportunity to choose all the necessary features required. Technology modernization definitely has many benefits, and could include the introduction of new equipment, such as the PDA. This solution offers the most potential of the two proposals to meet the greatest amount of requirements for the various and diverse group of users.

But developing a totally new system means taking on new challenges, some of which are rather unappealing. In addition to having to begin a new system development project, complete with certification testing in multiple areas (e.g., network, operating system, security, etc.), there are many other systems already in use that would require interoperability considerations. Combined with the eventual integration with the overall communications network, this would be a very expensive implementation. Although effectiveness is placed ahead of efficiency, cost remains a factor nonetheless in Army procurement, and numerous projects compete for limited systems funding. Implementation of a new systems also leads to much more training obligations than using existing devices. Furthermore, this is contradictory with what the Demand Team identified as a requirement, the use of existing technology.

The Feasibility Team highlighted that it is possible to link FBCB2 and Combat Service Support Command System (CSSCS). What is interesting in this approach is that those networks already possess the security and reliability required by military use. Also, it would further capitalize on the existence of these networks and allow the connection of logisticians at all level. A new system can eventually be introduced as a separate system to track the shipments. This system should model the methodology of UPS or FedEx, and it must connect with the mixed FBCB2-CSSCS network to make all information available to all logisticians involved. This approach links the information sharing and asset visibility requirements with an automated way to track inventories and shipments via the creation of a new tracking system.
Both of the two proposals identified by the Feasibility Team are capable of implementation. However, the proposition using existing infrastructures and equipments seems more viable because of the difference in cost and the potential of fast adaptation of the users. Ideally, this will eventually include a tracking system similar to those used successfully by FedEx and UPS, but integrated into FBCB2 and CSSCS.

The second question brings our attention to identifying the existing barriers and their likely solutions. The remaining challenges of implementation, considering the greater environment of the Army as a whole, lie in the areas of network and process methodology. Of all the remaining hurdles for a successful implementation of a new technology application, the most likely and significant one is regarding the issue of network infrastructure. This has certain ramifications in the areas of reliability, the size of data transfer, and security. In the context of military operations, the most reliable type of network has become satellite based, mainly due to the fact that most likely areas of military operations suffer insufficient or destroyed communications infrastructure. Unfortunately, this also has the least amount of data transfer capability. Improvements to the amount of digital throughput are forthcoming, but fielding new hardware and software in such a large and diversely equipped organization as the services of the U.S. military is a slow and tedious process. For example, the transformation of just the U.S. Navy to be in compliance with the Department of Defense standards for the multi-tactical digital information link network is scheduled to occur over at least a 6-year period. The secrecy requirement for information related to unit strength and supply status, especially during combat operations, is a highly classified issue, and concerns over its security are warranted. However, the implementation in the near future of the Warfighter Information Network-Tactical, which will support both tactical and logistical communication, will leverage the security capabilities of the current tactical communications network to serve both types of message traffic. And although certification of software for military use can be somewhat of an onerous process, the relatively small and limited scope of the functionality of the proposed technological application should not have to undergo as rigorous of a process as most others. The most likely attempt at resolution, and actually, the only area in which it is feasible to put forth any effort, is in the area of data formatting and transfer by the application, and in such a manner as to have a low requirement for bandwidth to effectively transfer across a satellite based network.

Regarding process methodology, the use of certain hardware and applications, some through a formal centralized process and some through informal user popularity and choice, has created a "pull" on some specifications for feasibility of future technologies. In this case, the increasing use of Microsoft operating systems, Microsoft applications, and PDAs has resulted in a de facto standard to a certain extent. However, it may be the case that the best design of the new application of technology discussed in this study will result in an inherent "pull". As discussed by the demand analysis, the existing need for an automatic logistics management tool is not just limited to the re-supply of ammunition for complex weapon systems, but has many potential applications that span across a large part of the entire Army logistical system, such as fuel, medical supplies, and repair parts for machinery. Therefore, a design that is general and flexible enough to facilitate the management of re-supply for a variety of things besides ammunition would likely be quickly picked up and utilized by
supply chain managers throughout the Army, particularly when it is an application that is easily used on both desktop and laptop computers, as well as PDA's.

As noted, the issue of the network and its immediate ramifications poses a tremendously complex challenge to any new system seeking to use it, especially given that the communications network is comprised of multiple systems and users. Just in that aspect alone, it is advantageous to select the proposal that augments existing systems rather than developing a new one. But additionally, there are many positive reasons found in the wide implementation of current operating systems, software applications, and operator-level hardware that also warrant the choice of augmentation. By selecting such a path toward technological innovation, one would be able to leverage off existing technologies and have to concentrate mostly on the internal engineering of the logistics management system rather than a whole multitude of externally driven challenges.

Lastly, what does the value chain model of military supply system look like? What is the weakest link, if exists, and how can we strengthen the value on it? Exhibit 1 presents the simplified value chain of Army logistics system. The links, minus the physical resource allocation, are all mainly realized by the information flows and IT systems. Typically, many of state-of-the-art management information systems fail in implementing the seamless coordination between human factors and the IT system. In other words, cultural resistance and training difficulties in technology transfer often make the system inefficient. The weakest point is again attributed to the insufficient collaboration of the physical supply system and field users with the IT system. If only one link in the value chain does not function properly, the entire system cannot achieve its mission. To alleviate this problem, management should consider some forms of promoting actions such as rewards and incentives, innovative education, practical training, operations simulation, and gradual deployment of system. See Appendix 3.1 for a diagram depicting the Simplified Value Chain of the Army Logistics System.
Recommendation

Faced with a choice between augmentation of existing systems and the development of a new system, the recommendation from the Applicability Team is to modify the current systems to leverage off their existing capabilities. The pervasiveness of Microsoft Windows, Microsoft Office and other applications, and the pending integration of FBCB2 and CSSCS suggest that the addition of a logistics management tool in the form of another application should be quite feasible and much less expensive than new development. Furthermore, the remaining challenges and their pending solutions indicate that platform-independence of applications is quickly becoming the norm in the U.S. military, though this has been the trend in private industry for a few years.

The treatment on operational and cultural impact should be critically considered in deciding which alternative will be chosen assuming there are no technical difficulties. From the observations on the managerial characteristics in Part I and discussion in Part II, a disruptive and system-wide deployment of new technologies is entirely too risky to perform. To reduce the unexpected and negative results on the value chain of the Army logistics system, it is highly desirable to take a gradual action to new technology.

The applicability of an automated logistics management system in the Army is a strong case, and not just for ammunition re-supply in the combat zone, but also for other types of distribution. This is particularly true for those distribution systems that involve great variance in terms of material shipped, transportation services, customer organizations, factors external to the organization, and just the constant likelihood of unanticipated challenges.
Reference

Appendix 1.1

ARMY LOGISTICS WHITE PAPER

Delivering Materiel Readiness to the Army

December 2003
Delivering Materiel Readiness to the Army

The Army G-4 exists to deliver materiel readiness to our Soldiers - a task that has remained the same for years. Today's operating environment has changed; we are an Army at War... relevant and ready. Our most critical task is to sustain the combat readiness of our Deployed Force and to maintain the operational readiness of the Current Force. The Current Force provides the war fighting readiness that serves our Nation. The Current Force must adapt to a changing enemy and fight and win decisively against any threat. Our fundamental challenge within G-4 is to enhance our current capabilities while transforming Army Logistics for tomorrow. We will accomplish this vital task by focusing our efforts on four clear objectives.

This White Paper describes four G-4 Focus Areas we will hold preeminent over the next two years. It addresses known shortfalls in our current structure that require immediate action, and directly supports our Army's transition to an expeditionary force that is agile, versatile, and capable of acting rapidly and effectively. These Focus Areas are the Army G-4's highest priority, and we will apply our policies, processes, and resources to ensure success.

Focus Area #1

Connect Army Logisticians- Today's Army Logistician cannot see the requirements on the battlefield. Our customers cannot see the support that is coming their way. As a result, we rely on pushing support based on our best estimate of what we think the Soldier needs. Soldiers order the same item several times because they have no confidence support is on the way.
We will solve this problem by connecting Army Logisticians. Army Logisticians will be an integral part of the joint battlefield network with satellite-based communications that provide 24/7 connectivity on demand, enabling them to pass and to receive key data from the battlefield to the industrial base. This connectivity will cover the battlefield, and it will give Army Logisticians the agility and flexibility to quickly plug into and unplug from a dedicated network with an asynchronous (stand-alone) capability.

The G-4, along with the U.S. Army Materiel Command (AMC) and the U.S. Army Combined Arms Support Command (CASCOM), will work with the Chief of Staff of the U.S. Army (CSA) Task Force Network to ensure logistics communications solutions are embedded within the Army's network and will optimize joint and combined operations in an expeditionary environment. Our Enterprise Resource Planning work in Battle Command Sustainment and Support System (BCS3), Global Combat Support System - Army (GCSS-A), Logistics Modernization Program (LMP), and Product Life-cycle Management (PLM+) are critical to implementing fully this Focus Area from foxhole to factory to foxhole. The logistics common operating picture (LCOP) will be improved by this network connectivity, and it will provide the vital link in the joint commander's ability to see his force and to make decisions based upon accurate, real-time logistics information.
Focus Area #2

Modernize Theater Distribution - Today's Army is not able to respond rapidly and precisely when support requirements are identified. We do not have the battlefield distribution system that we need. We cannot provide time-definite delivery schedules, and we cannot effectively control physical movements across the new battle environment. Effective theater sustainment rests solidly on the fundamental concepts of distribution-based logistics. We need a single focus on the simple task of guaranteeing delivery - on time, every time. We must have a distribution system that reaches from the Soldier at the tip of the spear to the source of support, wherever that may be. Our success will be measured at the last tactical mile with the Soldier.

We will build warfighter confidence by increasing visibility and establishing flexible, responsive distribution capabilities. We will not need to store large quantities of supplies forward because we will respond to customer requirements with speed and precision. The G-4 will work with CASCOM and the U.S. Transportation Command, the DOD distribution process owner, to develop this solution from factory to foxhole in the joint environment. Along with AMC and the Defense Logistics Agency, we are committed to enabling an effective distribution-based sustainment process. We will work with the CSA Task Force Modularity to develop this objective in the near term.
Focus Area #3

Improve Force Reception- We have invested heavily over the past 10 years in improving our ability to deploy rapidly from our continental U.S. platforms. The strategic movement of forces by Large Medium Speed Roll-On/Roll-Off (LMSR) vessels and C-17 aircraft has significantly enhanced our capabilities. However, we have not invested at the other end -- in our ability to receive forces in the theater. We are hamstrung by the lack of an organizational construct that focuses on joint theater opening tasks. Today, we build ad hoc support organizations to execute aerial and sea port of debarkation operations, and we depend on forces from several organizations to establish the theater sustainment base. This process of receiving forces in theater takes time, a luxury we will not have as the Army develops an expeditionary structure that is capable of rapidly deploying joint-capable force modules.

In order to effectively facilitate the immediate operational employment and sustainment of the expeditionary force flow, we will design an integrated theater-opening capability that can respond on extremely short notice and can execute critical sustainment tasks immediately upon entry. That theater-opening capability will not be an ad hoc organization. It must be a support organization that has trained to the task. It must be enabled with
the right tools to succeed, and it must have the capacity to expand to meet theater growth. The critical operational tasks for this organization include: (1) providing operational sustainment command and control with reach-back capability and initial network visibility; (2) conducting theater reception, staging onward-movement and integration operations, to include life support, force protection and port of debarkation operations; and (3) sustaining forces in theater with theater distribution and requirements visibility.

**Focus Area #4**

**Integrate the Supply Chain** - Over the past several years the Army has taken supply reductions at many levels for various reasons. We changed Army policy several years ago to reduce the amount of items carried on unit prescribed load listings while simultaneously reducing stock levels in many authorized stockage lists across the field army. Additionally, we took risks at the strategic level by under funding strategic spares programs. The cumulative result of these reductions is a lean supply chain without the benefit of either an improved distribution system or an enhanced information system. As a result, our Soldiers are at the end of a long line of communication with reduced inventories and an old distribution system.

We will view the supply chain in a holistic manner to ensure we understand the impact of actions across the entire chain, not just at a single level or within a single service. This joint, end-to-end view is essential if we are to provide the kind of support our
Soldiers deserve. The solution is an enterprise view of the supply chain, and an agency and a service integration of processes, information, and responsibilities. We are committed to developing the Army's Enterprise Solution to the supply chain in close coordination and alignment with DOD's Focused Logistics Initiative. Ultimately, joint information will be freely and automatically shared among strategic, operational and tactical level headquarters and agencies. Consumers and logisticians from all agencies and services will enter local supporting systems, plug into the sustainment network, and be afforded end-to-end joint total asset visibility (JTAV). As a result of our Theater Distribution efforts, combatant commanders will be capable of seeing inventory in motion, as well as seeing what is available at storage locations, and they will be able to rapidly and effectively execute decisions that meet their requirements.

**Conclusion**

We will build confidence in the minds of the combatant commanders by delivering sustainment on time, every time. We can do that only if we provide Army Logisticians the capability to see the requirements every day and to control a distribution system that guarantees precise, time-definite support. Army Logisticians will be part of joint and combined logistics processes that deliver focused logistics. We will integrate real-time total asset visibility and seamlessly connect to the industrial base. This will give us an LCOP that will enable the kind of end-to-end control that always delivers the right support to the exact location at the precise time needed. If we do not connect Army Logisticians, improve the capability of the distribution system, modernize force reception, provide integrated supply management and give the joint force combatant commanders JTAV, we will study these same lessons after the next major conflict. The Army G-4 is committed to ensure that we will not have to relearn these same lessons.
FOCUS AREAS

Connect Army Logisticians
Modernize Theater Distribution
Improve Force Reception
Integrate the Supply Chain

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Appendix 1.2: Logistics Survey

**Background**

Name (Optional)___________________    Rank____________________

Organization (Current or Most Recent)_______________________

**Survey Questions**

1. What logistics position(s) have you served in/are you serving in?

2. On a scale of 1 to 10, how would you rank the importance of logistics reform to modernization of the Army? 10 is of the most importance.

3. Are you satisfied with current (or during your tenure) logistics support to your organization?

4. Are you satisfied with the means of reporting requirements? How can these be improved?

5. Are you satisfied with the method of order/requirement status updates? How can this be improved?

6. Are you satisfied with the actual delivery of support?

7. Do you think that a logistics software package or electronic device, such as a PDA, would be beneficial in modernizing logistics operations or would such a device be superfluous?

8. What should the capabilities of such a package be? Circle all that apply and add additional performance features. What are the limitations of such a package?
   - Track requirements
   - Submit requirements to your support unit
   - Utilize existing communication equipment
   - Track on-hand cargo/supplies and their current locations

9. Do you think that a program that assisted in allocating cargo/supplies on to available haul asset would be beneficial or unnecessary to logistics operations?

10. Would this capability be more useful as a real-time or pre-operation planning resource?

Add any relevant comments.
Appendix 1.3: Survey Summary

1. What logistics position(s) have you served in/are you serving in?

Responses
(1) HQ Commander, BMO, Company XO;
(2) BDE S1 and HHC Commander;
(3) Support Platoon Leader Company XO S1;
(4) BMO 3-8 Cav (DEC1999-OCT2000);
(5) BN S-4 HHC Commander;
(6) No response;
(7) Currently not Tank Battalion BMO, 21 months 1991-2 HHT Company Commander, 16 months 1993-95 Tank Battalion XO, 17 months (including 6 in Kosovo)2002-3;
(8) Maintenance Platoon Observer/Controller;
(9) HHC OBSERVER/CONTROLLER AT CMTC;
(10) XO, supply and srvc company, FSB; Supply div chief of a corps materiel management center, III Corps; POL supply CO Cdr, CSG;
(11) Map Warehouse Platoon Leader, Central Issue Facility Platoon Leader, TISA Platoon, Company Executive officer, Maintenance Officer, Supply and Services Officer, Support Operations Officer, Forward Support Company Commander (26 months);
(12) AR BN HHC XO AR BN/TF HHC CDR.

2. On a scale of 1 to 10, how would you rank the importance of logistics reform to modernization of the Army? 10 is of the most importance.

Responses
(1) 9;
(2) 10;
(3) 4;
(4) 8;
(5) 8.5;
(6) No response;
(7) 8;
(8) 10;
(9) 6;
(10) 7;
(11) 10;
(12) 10.

3. Are you satisfied with current logistics support to your organization?

Responses
(1) No;
(2) No, We consistently jump through flaming hoops to make the most routine things happen;
(3) TF level and below was always frustrating to execute; but, the system works so long as there is something in the BSA to send forward;
(4) No;
(5) Absolutely not;
(6) No response;
(7) Most recent, yes for the most part (7 on a scale of 10);
(8) Class IX support was better at the organizational level when we were authorized to stock a higher quantity/maintenance essential repair parts. The current system breeds longer NMC times, hindering unit readiness;
(9) Negative. System relies on routine transportations techniques and times which are easily targeted. The routine requirements are easily taken care of, but anything needed on an irregular/infrequent basis is delivered too little too late;
(10) I supplied it but felt it could always be improved upon. Someone has to champion the idea to spend money on it now so it won't be an issue in the future (CSS is typically on the back burner to wpns sys;
(11) Yes but we could maximize some opportunities to make it better;
(12) No. There was too much hierarchy. "Sorry we cannot fix your PVS-7s, we are having [insert CSS echelon] organizational day." click. There was no accountability, self licking ice cream cones, logisticians working for logisticians working for logisticians. The exceptions were combat arms HHCS as they were commanded by green tab combat guys. My company philosophy in HHC began with "rule #1: if they ask for it, we do not say no. Rule #2, if they asked for it, we have already failed once."

4. Are you satisfied with the means of reporting requirements? How can these be improved?

Responses
(1) No - Need electronic means that I maintain and transmit to next higher support unit;
(2) No - There are too many different reports required and too few of them talk outside of their stove-pipe Consolidate all logistics systems and link them via a Blue Force Tracker kind of system;
(3) Absolutely not. First, there are problems underlying the assumptions behind "just-in-time" planning regards accurately forecasting a complex requirement et al. Second, there is currently not enough connectivity to support such systems. In OIF even if we could forecast accurately, we had no one to whom we could send the request. Furthermore, the time-space realities of a LOC that is over 400 kms long must be addressed. If your request for 24 hr fill must travel 400 kms to the provider, one wonders how accurately and promptly that request could possibly come to fruition - FBCB2 type connectivity down to the end user (TF logisticians). Such a system would have army-wide standard reports instead of the circus of "standard" Orange reports by BDE and TF. We have succeeded in creating a common picture for command and control now we need it on the CSS side;
(4) No - We need to transition back to a "push" rather than "pull" system of supply, where BNs and COs are allowed to anticipate supply demands, order necessary excess, and manage their own large bench stock. The advantage we gain from making the adjustments necessary to purchase and haul all this extra Class IX around translates into much higher real O/R rates. Any monetary advantage we’ve gained by eliminating large prepositioned stocks of Class II,IX at the BN/CO level has been more than offset by the disadvantages of "ask and wait" when a unit crosses LD in an operational environment. We can see evidence of this everywhere from summer tank gunneries at Fort Hood to recent experiences in OIF. Demand supported PLL does not work as it depends on two critical assumptions: 1) ALL PLL clerks/ Maint team chiefs/ CO XO's will consistently maintain an accurate accounting of both parts received/not installed and true Class IX usage (seldom accurate because of "parts scrounging" and inaccurate reporting). 2) A perfect PLL box, with a perfect PLL clerk and a perfect record of Class IX tracking in Garrison still does not reflect the truly severe and immediate demands of a unit operating under the strain of combat/ SOSO ops. Home station ops does not equal deployed ops, at any level of the supply chain. We learned this in the early stages of the Korean War and we are relearning this again in OEF/OIF;
(5) Absolutely not - Training is needed to help individual commanders learn how to proper "Forecast" what they need. The current system of utilizing ULLS S-4/G is extremely user unfriendly. Offer better systems or make training in these systems Mandatory at the junior NCO and Officer level;
(6) No response;
(7) Too cumbersome - Mostly it's in the budgeting process. Too many pots of money and too many people having to approval expenditures for needed supplies. Bottom line is that Commanders need to be the final say so on what equipment their command needs, not some GS-something or log officer at Corps or Division;
(8) Yes;
(9) Yes – Logistics support: BN XO's/S4's must oversee requests to ensure legitimacy. FSB's must fulfill requests and follow through on everything ordered, instead of ignoring what they can’t/don’t want to handle;
(10) No - the CSS/CS automated reporting system sucks. III Corps adopted an .xls means of tracking supplies but the info contained was 6-8 hrs old which could mean a lot of difference to those on the front line, Where possible, take out the human factor by leveraging automated sensors for fuel and ammo on all vehicles that relays through satellite to those managing support so that they can be more proactive in sending what needs to get there JIT rather than sending a lot of everything into harms way and having full POL trucks coming back to the log base, because the CA folks didn’t need fuel at that time;
(11) No, reporting requirements should be real time and automated. It takes to much time to constantly check quantities and levels should have a system as it is consumed it is reported - scan systems, level indicators and increased automated tracking systems;
(12) No, too much damn paperwork. Don't worry about my on hand oil cans. If we are so desperate that we are cross leveling individual POL, you don’t need to know, we are already working it, hell you have already failed! I know what I need, don’t make me help you administrate your administration. Somewhere in the AO are stockpiles of what I need. Reporting is not the issue, it is getting it to me when I ask for it! - Automation could help, but what is needed is a mindset change. Place logistics under tactical command and control. I would go so far as having IN/AR officers in command of FSBs, just like the HHN. Moving to FLC’s is a step in the wrong direction. Anticipation, pushing logistics, and more survivable CSS (inspired by a warrior ethos) would put the stuff right up there with the trigger pullers. Additionally, line units need more organic CSS assets. This can be as easy as more water buffalos in the companies and as daunting as how do we cram more food/water/ammun on our combat vehicles. Our tanks and brads are sport cars (bring a change of clothes). They need to be SUVs (pack for a week).

5. Are you satisfied with the method of order/requirement status updates? How can this be improved?

Responses
(1) No, If I submit with an electronic means that I keep (not disks like we do right now), then the support unit should have to give me a status back after 12 or 24 hours;
(2) No, it is antiquated and cumbersome. It becomes the orderer’s responsibility to make sure the person he orders it from does his job. ie...DCR, parts status etc...Training the upper echelon supporter that his job is support of a unit not support of his unit; (3) No -there is no system to maintain a stream of consciousness in the CSS world. Such faults become extremely problematic as TFs begin to jump from BDE to BDE and lose any "status" maintained by losing support element - Tying in CSS reporting to MCS the way FBCB2 reports should fix the problem. What we need is a functioning common picture created by our digital commo platforms;
(4) No - Make the system more immediate in relaying information and requests (preferably same day). Make the system more accurate in its reporting and more accountable when it dumps data. Involving data transfer on multiple disk drops or digital "data blasting" over FM relays on humans who input additional errors depending on how enthusiastic they were about doing their jobs. My experience demonstrated periods of the week where a parts order/requisition was more likely to register and actually make it into the system. Conversely there were also days of the week (typically later in the week) where a requisition was virtually guaranteed to be lost in the system. Status updates also lagged behind or where completely inaccurate, as they depended on the same imperfect requisition request system to report back down how those "hit-or-miss" requisitions were doing;
(5) Absolutely not - Training: There is little if any done in leadership schools. From BNCOC to the advanced course and above. There needs to be a much better plan to train E-5's and above on the Supply System, accountability, Maintenance Parts requesting and updates, etc. Great Supply SGT's are few and far between. A proper recruitment and training program needs to incorporated. These Great Supply SGT's become great S-4 NCO's. The shortage of these personnel seriously hinders Company and Battalion missions;
(6) No response;
(7) For the most part, yes - Biggest improvement would be more timeline update of ORILs (at a Bn level) into the O/H, $$$ cycle;
(8) Yes - my problem is authorized stockage levels, Increase necessary stockage levels;
(9) No. Each company should have its own PLL clerk. SSA's must be more responsible for the follow-up on orders – More supervision over SSA activity;
(10) No - ULLS-S4/SARSS and SAMS all are out of date programs that do not allow for adjusting delivery of ordered supplies to sub-units that may be cross attached to another task force. These programs are also based off of program platforms unfamiliar to the average person who grew up with MAC or MS based software. Why not leverage the software knowledge of the average person by developing a supply program based off of MS Access, MS Excel, etc. Besides the recommendation to have utilized known software to write new log ordering and status programs, need to be able to have a system that allows for easy transferability of units (and what they may have ordered) that are "attached" to a different task force and support unit;
(11) No, same here should be real time when I place an order I should see if it is available locally, how many is on hand and EST. The same should be true if it is not available where is the next point of supply and the delivery means available to you (FEDEX, Truck, etc.) - Integrate into a system that merges all
STAMIS systems together. Currently we have to many stand alone systems and they do not communicate with each other;
(12) No response.

6. Are you satisfied with the actual delivery of support?

Responses
(1) From higher? No;
(2) No, When available the user is the one that must go and get the things he requires rather than having it pushed to him;
(3) Only for CL III. CLV was only met the bare minimum requirements. CLIX was an utter failure. Of special note, personnel support was not even attempted. Fortunately, we did not sustain enough casualties to warrant personnel refit. However, I am skeptical of the army's ability to supply new soldiers to replace losses at the TF level. Given the fiasco associated with personnel accountability above the TF level, I could envision new soldiers left as a BSA jumped and thought that some TF was "getting those guys";
(4) Sometimes. Most of the time its a function of the quality of the mechanic/clerk/leadership with whom you are working in the support world;
(5) No;
(6) No response;
(7) Yes;
(8) Yes;
(9) We do OK with fuel and food. Ammo must be made easier. Transportation techniques must be irregular and treated as a combat patrol. MSR's must be assigned to combat units to maintain;
(10) Yes, and would be even better if real time data was used to send resupply down range as needed rather than using 10 hrs old data to configure resupply packages that can take another 12 hrs or longer to get down range where they are typically desperately needed by the time the resupply ever shows up;
(11) Yes, expedited shipping should be an increased feature;
(12) No response.

7. Do you think that a logistics software package or electronic device, such as a PDA, would be beneficial in modernizing logistics operations or would such a device be superfluous?

Responses
(1) Yes if it captured my requests and submitted them;
(2) Yes, if it combines all of the required systems and can be interlinked. UPS does it;
(3) We need only use present digital systems such as FBCB2 and CSSCS. A PDA-type interface would be helpful at the TF level and above to help track and maintain status reporting;
(4) Yes, especially if I can use such a system to immediately order parts and supplies and immediately get accurate feedback on the status of the aforementioned requisitions;
(5) We need to find a system that is user friendly. ULLS S-4 and ULLS-G are extremely difficult to learn and master;
(6) No response;
(7) Don't know;
(8) Yes, these are necessary. There's nothing wrong with making things easier or more efficient;
(9) Yes. Beneficial;
(10) PDA is nice but limited because of size for expansion, etc, and could easily be misplaced/lost by the average joe. However a notepad computer/touchscreen using wireless technology that's mountable in a cdr/xo and pl/psg vehicle can easily be used to display on hand quantities and be set up to automatically reorder supplies that go below pre-est. reorder points. Also use recommendation from #4 to leverage automated sensors that relay either by satellite or radio what on-hand balances are, etc so that the soldiers out front can worry about fighting the threat and let the loggies take care of what they need before they know they need it;
(11) It would greatly enhance the system if used by the correct personnel;
(12) Yes, but again, you have to change the mindset first.

8. What should the capabilities of such a package be? Circle all that apply and add additional performance features. What are the limitations of such a package?
   a. Track requirements
b. Submit requirements to your support unit

c. Utilize existing communication equipment

d. Track on-hand cargo/supplies and their current locations

Responses

(1) How is it powered? Does it need FM commo or can it go satellite? Will I get statuses into this device or software – All of the above;

(2) Project arrival times based on GPS type systems. Instantly report requirements and status of availability to the user and supplier. Provide historical data for use in projecting requirements. Store usage data – All of the above;

(3) Limitations are the same of any digital system. It has a tendency create reality as opposed to report reality – All of the above;

(4) All of the above;

(5) If this could track the status of supplies at the FSB and beyond and give that status to the individual Commander in a simple and easy to use system, it would greatly enhance the process. Simply updating DCR's daily without having to use disk's or rely on the FSB to update their systems would greatly aid junior and senior commander's alike – A, B, and D;

(6) No response;

(7) Again, don't know, but if we’re presenting the above as "either/or" choices, we're missing the boat. Any system that doesn't consider ALL of the above is not going to provide the needed assistance/info to the customer (the dudes on the ground) – All of the above;

(8) A, B, and D;

(9) All of the above;

(10) All 4 are utilized to some degree but the money has not been available to do more with commercial technology currently used by Fedex, etc to improve upon what the military has. Also, the current automated log systems are all stove piped ie-ULLS-S4/SARSS (CL 1,2,3,4,7), ULLS-G/SAMS (CL 9), SPBS-R (Prop. Book-Non-Ex.Prop.), SAAS-MOD (CL 5), or CSS/CS (All CL of supply) – All of the above;

(11) a. Roll over numbers from the SSA when a item is not available. System should track the number for you. c. Blackberry technology could be used – All of the above;

9. Do you think that a program that assisted in allocating cargo/supplies on to available haul asset would be beneficial or unnecessary to logistics operations?

Responses

(1) Somewhat;

(2) Yes, but I believe that many times cargo is misallocated because useless items are moved around the battle-field at random. This happens because supply elements move too much of their own goods and abuse haul capacity;

(3) Would be great and would avoid wasting empty space on the trucks;

(4) Yes;

(5) Due to the lack of haul assets available at the FSB (Currently), I believe it would be useless. An A company in an FSB does not have enough haul capacity to complete its mission to 100%. At a higher level such as the (current) DISCOM it might be quite beneficial but that information would have to be able to be pushed down easily and efficiently;

(6) No response;

(7) Don’t know;

(8) Beneficial;

(9) Don’t know;

(10) Unnecessary, especially if loggie has real time data to determine what the fighter actually needs and can proactively send out JIT supplies when reorder points are reached;

(11) It would be beneficial to the logistical planners and planning for a company commander. It should not be used below Battalion as a planning factor by other than logistical planners due to hauling constraints that cannot be calculated, such as ammunition compatibility, hazardous materials, petroleum products and food products to name a few;

(12) Superfluous. Aggressive leadership and warfighting focus would do a lot more.

10. Would this capability be more useful as a real-time or pre-operation planning resource?
Responses
(1) Planning more than real-time;
(2) Real Time;
(3) Both. It would help in pre-planning to set up the initial set of the logistics package needed for the first and second log pushes. Subsequent requests would be stream-lined and shorten our CSS OODA loops. It sounds a bit too sexy, but it could possibly turn our CSS ops into a system similar to calling in CAS;
(4) Pre-operation planning;
(5) First we need to upgrade the system, increase the training of the personnel, and increase the haul assets prior to developing a tracking program;
(6) No response;
(7) Don't know--what do you mean by "real-time"? Do you mean the current concept of "just-in-time" logistics system (which has proven to be of dubious worth) or as an execution resource?;
(8) Both;
(9) No response;
(10) Not necessary;
(11) Pre-operation planning and also pre deployment. Gives a close figure for capability needed. The commander on the ground will still have to give you the hard required numbers of assets needed. This program would be close though for planning purposes;
(12) Pre-planning at theater level.

Add any relevant comments.
(1) No response;
(2) No response;
(3) The biggest problem with CSS is theater to BDE level CSS. This should occur on a mass is better concept;
(4) No response;
(5) All good warriors are good logisticians. As an Army we do not train and prepare soldiers properly in the logistics system. NCO's and Officers alike need training in the supply system, maintenance systems, and logistical ordering systems. These systems also need to be upgraded to become more user friendly;
(6) Big Army needs to take some notes from Amazon.com...;
(7) No response;
(8) No response;
(9) No response;
(10) No response;
(11) This system needs to integrate supply, maintenance and transportation requirements on a single source system for the commander on the ground and should feed through the required approval authority process to streamline efficiency. Needs to be modular to add additional units as need. Simplicity should be maintained so the product will be accepted by the community of soldiers as a whole. I know I am asking for quite a bit but we have professional that do this everyday and we should capitalize on their research;
(12) The other pain, that may or may not be part of this survey, is the absolutely painful and shackling process of property management. In Kosovo, I had 6 property books and thousands of lines of property. This is insane for a company supply team/cmd grp. We must either automate the process or make it MUCH more forgiving. The days of measuring sockets with a ruler must go away. We have a system that still assumes soldiers are tool-stealing draftees. Enough, they are volunteer professionals putting their lives on the line. Let us assume any losses are accidental until proven or suspected otherwise. Write stuff off and free commanders to command and supply sgs to handle real world logistics not the infinite paperwork of accountability, cyclical inventories, and turn in docs. Is it PBO, the lawyers, do not know, but property accountability, though important, has become a detractor from a real commander's job. If it is so critical, why are company level commanders the only ones who sign for equipment? In the German Army, BN CDRs must inventory and sign for their BNs. We have already saddled the tactical company commander with much responsibility. We must unburden him from as much admin time waste as possible.
Appendix 1.4: Demand

Desired Process

Resource

Resource Available?

Yes

No

Resource Required

Resource Available?

Yes

No

Resource Required

Resource Not Available!

Resource Expended

Information Network

Next Higher Logistics Node

Company Command Post And Logistics Node

Battalion Logistics Node

Brigade Logistics Node

Resource Required

Resource Not Available!

Resource Expended

Process Repeats Until Resource Is Delivered

Automated Inventory and Shipment Tracking (Interfaces w/ Network)

Status Info

Request

Resupply

Resource Delivered

Resource Delivered

Resource Delivered

Resource Delivered
Appendix 2.1: Feasibility

Proposed Process: Augment Existing

- **Process Repeats Until Resource Is Delivered**
- **Resource Expended**
- **Resource Delivered**
- **Resource Required**
- **Resource Not Available!**
- **Yes**
- **No**
- **Resource Expended**

Information Network: Army Tactical Internet CSSCS

- **Next Higher Logistics Node**
- **Brigade Logistics Node**
- **Battalion Logistics Node**
- **Company Command Post And Logistics Node**

**Status Info**

**Request**

**Resupply**

**Resource FBCB2**

**CSSCS**

**Proposed Process: Augment Existing FBCB2 CSSCS** (Interfaces w/ Network)
Appendix 3.1: Applicability

Identification of the technological characteristics

Value Chain Overview

- Logistics Nodes (Brigade/Battalion/Company Command post)
- Operations Planning System
- Supply Commands and Master Plans
- Inventory Status Report and Supply Request
- Logistics Planning System
- Military Logistics Communication System
- Information Symmetry
- Field Troops
- Physical Resource Allocation
- Resource Supply System
- Optimized Supply Instructions