Revolution in Military Logistics:

A Special Report

May 2000

Revolution in Military Logistics

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Revolution in Military Logistics—An Overview

The Revolution in Military Logistics, or RML, represents a continuous process of transformation of Army logistics. In Phase I, Army logistics becomes a distribution-based system, relying on distribution velocity and precision rather than on redundant mass to support strategic responsiveness across the mission spectrum. It leverages information and communications technologies to attain near real-time situational awareness and improved command and control capabilities. A reengineering of logistics processes, organizational redesign, and increased use of best distribution doctrine are important elements of Phase I.

In Phase II, the Army will exploit technologies that afford increased lethality, survivability, reliability, range and capacity, decreased weight, and reduced energy consumption. These improvements will be synchronized with further advances in logistics processes, organizations, distribution management, and information systems.

Support to Army Vision and Combat Support/ Combat Service Support Transformation

The Army vision establishes a requirement for a quantum leap in strategic responsiveness through force projection of lethal, survivable, medium-weight brigade forces to any point on the globe to dissuade or defeat hostile military action. The objective is to put a brigade combat team on the ground in 96 hours, a division within 120 hours, and five divisions within 30 days. Generating this force with available lift requires an aggressive near- and mid-term reduction in the logistics footprint and replenishment demand through control over the numbers and types of vehicles deployed and increased leveraging of reach-back capabilities and split-based operations. The far term requires a systems approach to the weapons and equipment we design, and revolutionary ways to transport and sustain people and materiel.

The Army established the Combat Support/ Combat Service Support Transformation Task Force as one of 10 task forces to implement the new Army vision. The task force is charged with identifying ways to deploy forces more quickly and sustain more efficiently. It has identified requirements for a single Army-wide logistics provider; improved battlefield distribution tactics, techniques and procedures; split-based and reach-back operations; total asset visibility with assured communications; and improved strategic mobility, directly supporting deployment and sustainment requirements associated with the initial brigade prototype development effort underway at Fort Lewis, Washington.

Goals

The Revolution in Military Logistics is structured around six key tenets, or goals. The first four of these goals should be essentially complete by the end of Phase I, although future technology will offer considerable and continuous enhancements.

The first goal is creating a ***single logistics information and decision support system.*** It underpins most of what is considered *revolutionary* in military logistics, leveraging the best of commercial business processes, organizational redesigns, and the emerging global information and electronic commerce market. This single logistics system will have an unprecedented level of interconnectivity, visibility and interoperability. It will connect to the global network of other services, as well as to industry. It will allow us to leverage reach-back and intemetted command and control capabilities, and develop a force structure with a reduced demand for replenishment supplies.

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Distribution-based logistics represents a whole new way of doing business. Under this concept, distribution velocity and precision offsets our traditional reliance on redundant mass to accommodate uncertainty. Redundant echelons of inventory and force structure are eliminated. Faster and more plentiful lift will permit the single logistics system to respond quickly and precisely to anticipated requirements, allowing fewer and smaller in-transit holding inventories.

Total asset visibility (TAV) provides real-time logistics visibility and permits real-time logistics control and distribution management. TAV captures, processes, manages and exploits logistics data to allow managers to know at all times what's in the distribution pipeline. Through the use of TAV, the single logistics system can exploit high-quality, timely data for more responsive and cost-effective management through a distribution-based logistics system.

Army logistics will be supported by an ***agile infrastructure*** that integrates Army capabilities into a single, seamless Army-wide logistics provider at the national level. This command will train, generate, project and administratively control the Theater Support Commands that support the warfighting commanders. It will team with the Department of Defense (DoD), other services, allies and industry partners. Reach-back capabilities will be embedded to control the scope and complexity of the footprint in the area of operations. The "nerve center" in this Army-wide logistics provider will be readiness-driven, with a field-readiness focus. This provider will comprise, in part, the deployment of operational infrastructure such as integrated, intermodal information systems, distribution platforms, and automated materiel handling equipment.

The RML's goal of ***rapid force projection*** focuses on meeting the Army's deployment timelines with forces that are optimized for early, then decisive operations, and capable of operating jointly without access to fixed forward bases. Major improvements are planned in improved strategic airlift and sealift, prepositioned equipment, enhanced port opening, logistics over-the-shore capabilities, and tactical enablers such as palletized loading systems, movement tracking systems, and improved materiel and container handling equipment. Also key is development of doctrine and requirements associated with intermediate staging bases, and advanced deployment planning tools.

Embedded in the RML's last tenet, ***maintaining an adequate logistics footprint***, is a proactive approach to examining footprint "drivers" and identifying ways to reduce that footprint. Reducing the logistics footprint will require synergy along multiple avenues, particularly in ammunition lethality, system reliability, and consumption rates for all classes of supply. The real improvements, however, hinge on revolutionary new materiel systems that are reduced in size and weight, with improved efficiency and survivability.

The Role of Technology

The Army is identifying and targeting technologies with military potential to ensure future U.S. military dominance. The technologies currently under investigation have the potential to radically reduce sustainment requirements and the logistics footprint. These include advanced lightweight materials, compact power sources, alternative fuels, broadband mobile wireless communications, nanoscience (building things one atom at a time), biomimetics (emulating living structures), intelligent systems (robotics systems that reduce personnel requirements and operator danger), and ultrareliability of systems.

Conclusion

The RML is being implemented through the execution of the Army Strategic Logistics Plan (ASLP). The purpose of the ASLP is to synchronize and integrate more than 200 logistics programs. The ASLP will incorporate the expert recommendations of the Combat Support/Combat Service Support Transformation Task Force to capture new requirements and ensure synchronization of logistics initiatives with the new Army vision and modernization strategy. An on-site team presence will be established at Fort Lewis to identify and support advanced logistics concepts and technologies for the initial brigade development effort. The ASLP will capture the results of this and future assessments, and continue to serve as the strategic road map for the RML transformation path, from today through the Army's objective force of 2010 and beyond.

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Army Strategic Logistics Plan—RML Implementation

Introduction

The Chief of Staff, United States Army, has established a new vision for the 21st century Army: *"Soldiers on point for the nation transforming this, the most respected Army in the world, into a strategically responsive force that is dominant across the full spectrum of operations."*

The Army vision states the Army will be capable of placing combat force anywhere in the world 96 hours after lift-off—in brigade combat teams for both stability and support operations and for warfighting. That capability will be built under momentum that generates a warfighting division on the ground in 120 hours and five divisions in 30 days. Organizational structures will be designed to generate formations which can dominate at any point on the spectrum of operations. These organizations will be trained and equipped for effectiveness in any of the missions the Army must perform.

Light force deployability will be retained, while improving the lethality and mobility for decisive outcomes that our heavy forces currently enjoy. Heavy force lethality through combat overmatch will be retained, while enjoying better deployability and employability in areas currently accessible only by light forces. As technology allows, distinctions between heavy and light forces will be erased.

In terms of sustainability, the logistics footprint and replenishment demand will be reduced. For this to occur, the numbers of vehicles deployed must be controlled, reach-back capabilities leveraged, weapons and equipment designed in a systems approach, and projection and sustainment processes revolutionized.

This transition effort begins immediately and will be jump-started by investments in today's off-the-shelf technology to stimulate development of doctrine, organizational design and leader training.

A key requirement for achieving the Army vision of strategic responsiveness and the dramatic deployment timelines discussed above is acceleration of the Army's Revolution in Military Logistics, or RML, as well as those programs which support transformation of combat support and combat service support. The *Army Strategic Logistics Plan (ASLP)* is the modernization strategy for Army logistics and combat support/combat service support transformation.

Purpose of the Army Strategic Logistics Plan

The Army Strategic Logistics Plan synchronizes and integrates the logistics modernization and transformation efforts of multiple organizations and agencies. The current document represents a comprehensive update to the existing plan. It is distinct from earlier versions in at least four respects:

- *It links directly to the Army vision for strategic responsiveness and transformation of combat support and combat service support;*
- *It extends the planning horizon beyond 2010;*
- *It exploits advanced relational databases and visual information management tools to better determine the relationships and linkages among the programs in the plan; and,*
- *It more effectively captures logistics efficiencies underway in business process reengineering and commercial best practices. The time periods used to describe near-, mid- and far-term coincide with those used in Army Regulation 11-32,* The Army Long-range Planning System. *This permits synchronization with The Army Plan, to include the Army Strategic Planning Guidance and associated programming guidance, and The Army Modernization Plan.*

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Supporting Plans

- Total Distribution Program;
- Army Strategic Mobility Program;
- Army Science and Technology Master Plan.

Key Drivers of Logistics Transformation

- Army modernization strategy;
- New deployment timelines;
- Requirement to reduce logistics footprint;
- Requirement to reduce demand on lift;
- Support to joint warfighting;
- Support to DoD and joint modernization.

Required Capabilities Outlined in the Army Strategic Logistics Plan

- Single national logistics provider with tactical-to-strategic command and control capability;
- Improved strategic mobility for early closure of combat capability;
- Optimization for early, decisive operations;
- Operations without access to fixed forward bases;
- Capability for fast-paced, distributed, decentralized, noncontiguous operations;
- Tactically mobile equipment for operations in all types of terrain and environments;
- High system operational ability (reliability);
- Real-time visibility and control of supply chain;
- Agile, smaller in-theater logistics footprint;
- Responsive to CINC warfighter requirements;
- Logistics effectiveness at best value;
- Improved reception, staging, onward movement, integration and port-opening capabilities.

Management

- Executive oversight and management of the plan is the responsibility of the U.S. Army Logistics Integration Agency (USALIA);
- The plan is maintained by USALIA, and updates are completed electronically through access to USALIA's website (www.lia.army.mil);
- A standard template is used to record and display data for all modernization initiatives.

Framework: The framework for management includes three panels or working groups, each chaired by an Army colonel. The three panels are:

- Project the Force;
- Sustain the Force;
- Acquisition Reform and Technology Application.

Each panel meets at a frequency determined by the panel chair. Panel chairs will be responsible for managing those modernization initiatives that fall under that panel's domain. Panel chairs include:

- Project the Force—HQ DCSLOG/TRETS (Deputy Chief of Staff for Logistics–Transportation and Troop Support);
- Sustain the Force—HQ DCSLOG/SM (DCSLOG–Supply and Maintenance);
- Acquisition and Technology Application—USALIA.

Key reporting requirements:

- Quarterly updates are provided to the Army Logistics Triad or similar executive working group comprised of the Deputy Chief of Staff for Logistics (DCSLOG), Commanding General, Combined Arms Support Command (CG CASCOM), and Deputy Commanding General, Army Materiel Command (DCG, AMC);
- Quarterly updates are provided to the Assistant Secretary of the Army for Acquisition, Logistics and Technology.

Integration: Integration and synchronization of initiatives embedded in the ASLP are structured along six investment categories: automation and communications; business process reengineering; organizational change; hardware and platforms; mobility (strategic and theater); and technology insertion. Specific modernization initiatives fall within each of these investment categories and lead to achievement of a specific goal associated with the RML and combat support/combat service support transformation.

Conclusion

Logistics transformation requires an executable plan within an overall business and information systems architecture to achieve logistics efficiencies and improved joint warfighting capabilities. The ASLP is the tool for execution of this transformation.

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Phase I of the Revolution in Military Logistics

Introduction

The Revolution in Military Logistics, or RML, represents a continuous process of transformation. In Phase I, Army logistics becomes a distribution-based system, relying on distribution velocity and precision rather than on redundant mass to support strategic responsiveness across the mission spectrum. Information and communications technologies are leveraged to attain near real-time situational awareness and improved command and control capabilities. The Army will reengineer its logistics processes and redesign its organizations, utilizing modern business practices and joint distribution doctrine. In Phase II, the Army will identify and target emerging technologies to provide both combat support (CS) and combat service support (CSS) materiel systems with revolutionary new capabilities for 2010 and beyond.

Support to Army Vision and Combat Support/ Combat Service Support Transformation

The Army vision establishes a requirement for a quantum leap in strategic responsiveness through force projection of lethal, survivable, medium-weight brigade forces to any point on the globe to dissuade or defeat hostile military action. The objective is to put a brigade combat team on the ground in 96 hours, a division within 120 hours, and five divisions within 30 days. Generating this force with available lift requires aggressive near- and mid-term reductions in the logistics footprint and replenishment demand through control over the numbers and types of vehicles deployed, and leveraging of reach-back capabilities. The far term requires a systems approach to the weapons and equipment we design, and revolutionary ways in which we transport and sustain people and materiel. The Army established the Combat Support/Combat Service Support Transformation Task Force as one of 10 task forces to implement the new Army vision. The task force has validated requirements for a single Army-wide logistics provider; improved battlefield distribution; split-based and reach-back operations; total asset visibility with assured communications; and improved strategic mobility to support the deployment and sustainment requirements associated with the initial brigade prototype effort underway at Fort Lewis, Washington.

Phase I—Reengineering Processes, Redesigning Organizations, Creating the Single Log System

Since its inception in 1997, the RML's mid-term target—*"Phase I"*—has been to reengineer logistics processes to improve responsiveness and efficiency. Phase I of the RML coincides with the tactical development of the digitized corps and the strategic reengineering of the institutional Army as part of the Force XXI process. Dramatic improvements have already been made in increased strategic lift, sharply reduced force closure time, smart inventory practices, improved information systems, and an enhanced Army deployment infrastructure. Logistics response times have improved through business process reengineering in concert with increased partnering and competitive sourcing. Visibility, velocity and precision are replacing stockpiles and layered organizational structures.

Business Process Change: Migration to proven commercial practices, development of partnerships with industry, and establishment of a true 21st century industrial base linked to a single Army-wide logistics provider play important roles in achieving the Army vision. The scope of business process change already underway is extensive. For example, the supply

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process is being redesigned through the Single Stock Fund initiative and supporting automation systems. Single Stock Fund merges financial and logistics systems to cut costs and improve visibility. Velocity Management—a key requirement identified by the CS/CSS Transformation Task Force—is being implemented; to date, it has cut order ship time by 50 percent. Prescribed Load Lists have been cut from 300 lines to 150 lines. Modernization Through Spares cuts costs by linking combat systems with maintainers and focusing on logistics cost-drivers. Administrative and production lead times have been cutover 58 percent through initiatives such as Electronic Data Interchange and Direct Vendor Delivery. For example, acquisition of tank periscopes has been reduced from 450 days to 30 days. System reliability and life cycle cost reduction is being enhanced through horizontal technology integration programs, and best commercial practices and logistics efficiencies captured under Sections 347 and 912 of the Fiscal Year 1998 Defense Authorization Act. A National Maintenance Program will distribute maintenance workload above the tactical level, allowing efficient depot workloading and recapitalization to improve the reliability of the existing fleet. Embedded diagnostics and prognostics will permit more efficient use of maintenance resources and eliminate catastrophic failures; the savings can be reinvested in modernization accounts.

Automation and Communications: The Army will continue to incorporate the business process improvements described above into a single logistics management information system, which is essential to achieving the Army vision. Global Combat Support System-Army (GCSS-A) will provide a business automation enabler for combat service support. It will ultimately feed into joint systems providing management, integration and visibility of logistics assets essential to Joint Task Force members. Closely linked to GCSS-A are Total Asset Visibility and the Combat Service Support Control System, which together move Army logistics toward a single logistics system, providing real-time visibility and control.

Hardware/Platforms: While Phase I focuses on information and communication enhancements, the Army has judiciously invested in current technology to develop new materiel systems which enhance distribution and maintenance capabilities, support improved battlefield distribution and throughput, and reduce the logistics footprint *today*. A partial list includes the Movement Tracking System, Palletized Loading System, Family of Medium Tactical Vehicles, Rough-Terrain Container Handlers, All-Terrain Lifters, Container Roll-On/Roll-Off Platform, Forward Repair System-Heavy, Modern Burner Units, Laundry Advanced Systems, Electronic Repair Shelters, Multi-Capable Systems Mechanic, and Base Shop Test Facility. With the advent of the new Army vision, the capabilities and efficiencies available from these systems assume a prominent role. The first interim brigade, expected to be fielded in 2003, will have a logistics impact far transcending the projectablility of the brigade itself. The interim brigade will require far less sustainment and logistics force structure to provide that sustainment. The resultant synergies will further reduce sustainment requirements and ensure the Army achieves its strategic responsiveness goals.

Implementation

The RML is well underway. Its key programs have been linked to meeting deployment and sustainment requirements established by the Army. The Army Strategic Logistics Plan (ASLP) captures the totality of Army logistics modernization, encompassing business process reengineering, information technologies, platforms, organizations, and new distribution concepts. The ASLP will be updated and revised to ensure continuous alignment with the Army vision.

Conclusion

By the end of Phase I, a single logistics system will access accurate, real-time data; ***horizontally*** and ***vertically*** integrate supply, maintenance and transportation logistics functions from strategic through tactical levels; and manage them holistically in a highly automated mode with minimal human intervention. The radical reengineering of processes will support an equally radical redesign of organizations, resulting in a single, seamless logistics provider. Phase I will transition Army logistics to a system that both supports the interim brigade design and establishes a foundation for deployment and sustainment support to the objective brigade envisioned for 2010 and beyond.

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Phase II of the Revolution in Military Logistics

Introduction

The Revolution in Military Logistics, or RML, represents a continuous process of transformation. In Phase I, Army logistics becomes a distribution-based system, relying on distribution velocity and precision rather than on redundant mass to support strategic responsiveness across the mission spectrum. It leverages information and communications technologies to attain near real-time situational awareness and command and control. The Army will completely reengineer its logistics processes and redesign its organizations, utilizing modem business practices and joint distribution doctrine. In Phase II, the Army will exploit emerging technologies to provide both combat and combat service support materiel systems revolutionary new physical capabilities, and also embed sensors, diagnostics and prognostics in these systems to link them directly to the supporting information and decision support systems.

Support to Army Vision and Combat Support/ Combat Service Support Transformation

The new Army vision accelerates the RML. It establishes a requirement for a quantum leap in strategic responsiveness through force projection of lethal, survivable, medium-weight brigade forces to any point on the globe to dissuade or defeat hostile military action. The objective is to put a brigade combat team on the ground in 96 hours, a division within 120 hours, and five divisions within 30 days. Generating this force with available lift requires aggressive near- and mid-term reductions in the logistics footprint and replenishment demand through control over the numbers and types of vehicles deployed, and leveraging of reach-back capabilities. The far term requires a systems approach to the weapons and equipment we design, and revolutionary ways in which we transport and sustain people and materiel. The Army established the Combat Support/Combat Service Support Transformation Task Force as one of 10 task forces to implement the new Army vision. The task force has validated requirements for a single Army-wide logistics provider, improved battlefield distribution, split-based and reach-back operations, and total asset visibility with assured communications. Most importantly, it establishes deployment and sustainment requirements to support the improved strategic mobility goals associated with the initial brigade prototype effort underway at Fort Lewis, Washington.

Phase II—Global Operations, Platforms, Weapon Systems

Phase I focuses primarily on *process*, encompassing modernization initiatives in automation, communications, business processes, organizations, deployment planning tools to improve strategic mobility, and technology insertion to existing materiel systems. By the end of Phase I, a single logistics system will access accurate, real-time data; *horizontally* and *vertically* integrate supply, maintenance and transportation logistics functions from strategic through tactical levels; and manage them holistically in a highly automated mode with minimal human intervention. The radical reengineering of processes will lead to an equally radical redesign of organizations, resulting in a single, seamless logistics provider.

Phase II of the RML focuses on further identifying and targeting for logistics application those emerging technologies, new organizations, new doctrine, information technologies, and advanced concepts that support reduced logistics demand, enhanced deployability and a reduced logistics footprint. Phase II requirements and concepts link

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directly to the objective brigade force that is the focus of the Army's transformation effort. Technological breakthroughs in propulsion, lightweight armor, power supplies, source data automation and other disciplines will be crucial to achieving the radical changes envisioned for deployment and sustainment of the force.

Throughout this phase we will continue to rely on information dominance and new technologies that further enhance real-time logistics control and source data automation at all echelons. A shared view of logistics will emerge. Critical technologies to this effort include sensors, diagnostics and prognostics, source data automation, micro-miniaturization, robotics, intelligent agents, natural language processors, and voice-activated automation. These technologies will be embedded in new weapons and logistics platforms, and will link directly to the single information and decision support system. The soldier is too important to serve as the primary means to link one machine to another. Technology will radically reduce sustainment requirements, while at the same time increasing efficiency in power and fuel, energy, ammunition, soldier sustainment, system sustainment, mobility and distribution, and communications.

Force Modernization

It is against the backdrop of future conflict and a more acute threat environment that the Army is modernizing the force. The interim brigade will provide a complementary force capability using available systems and technology insertions to provide an interim solution which allows the Army to better deal with small-scale contingencies and stability and support operations without risk to its primary role to fight and win major theater wars. The objective brigade—the ultimate target of the transformation—will be capable of rapidly responding to crises, decisive against both asymmetric and traditional opponents, and dominant in open, close and complex environments; will retain a core capability for the major theater war fight; and will be tailorable for rapid response and contingency operations. It will be characterized by horizontal and vertical mobility, linkage internally and externally through responsive, reliable and mobile non-line-of-sight command and control, and reduced dependence on major airports and seaports which have been the major strategic maneuver bottlenecks in the past.

Implications—Force Projection

Strategic maneuver depends on development of advanced deployment platforms—ultraheavy airlift and high-speed (70--100 knot) fast sealift. Some forces will need limited capability for self-deployment by means of organic lift, to include perhaps a super-short takeoff and landing platform. This would reduce the burden on strategic deployment platforms, expand the number of approaches into a theater, and provide operational flexibility. *Lightening the force* will expedite throughput and provide operational agility. Critical areas for lightening the force include weapon system weight and logistics demands in terms of fuel, reliability, ammunition, unit size, weight reduction for ground combat platforms, reduction of support processes and structures; and reductions in logistics requirements, particularly fuel and ammunition. Advanced command and control capabilities and sophisticated deployment planning tools will be required for en route planning, analysis, simulation, and mission rehearsal. Forward stationing and equipment prepositioning will remain steadfast requirements. Contingency forces must be accompanied by early projection or sustainment and information operations capabilities.

Implications—Force Sustainment

Deployment timelines articulated in the Army vision make clear that the most important requirement to achieving an RML is what is termed *a radical reduction in sustainment requirements*. Key elements of this challenge include:

Reduced requirements. Power and energy pose core limitations on operational and support decisions. The imperative exists to develop alternative fuels or power sources. Solar and nuclear appear to be the best near-term alternatives. Advances in precision munitions (one round/one hit/one kill) offer the potential to reduce munitions requirements.

Ultrareliability. Maintenance is the major driver of sustainment requirements. There are three core requirements to achieve ultrareliability, which is essential to maximize the operational concepts

envisioned for the future: (1) incorporation of ultrareliability into systems, components and integrated assemblies; (2) exploitation of capabilities for anticipatory maintenance---self-diagnostics, programmable sensors, and failure warning; and, (3) ensuring that combat crews have the know-how and on-board spares needed to repair most failures using embedded technical instructions and modular replacements

Improvements in CSS Command and Control (C^2) and core sustainment. Real-time readiness and combat status of systems, unit postures, and in-transit visibility of materiel are essential. Combining logistics situational awareness and command and control, together with advanced delivery systems which can act on real-time knowledge, will expedite and streamline logistics flow. Advanced communications systems will allow full integration of CSS in operational networks across all support levels. These C^2 advances---if coupled with reductions in sustainment requirements—will enhance integration of logistics and operations planning, and reduce the time required for sustainment operations, ultimately leading to a level of seamlessness that blends sustainment and combat operations into a single battle rhythm.

Global Connectivity—From the Platform to the Strategic Level

Major weapon systems can be automated to provide data in real time on operational condition and stores status. Such source data automation can provide a revolutionary operational benefit. Source data automation can reduce the time taken to communicate supply status and operational status, and dramatically improve the logistics planning process at all levels. The combination of platform source data with supply status and estimated time to repair will facilitate planning that is accurate and detailed enough for logisticians to be able to tell combatants when and where they will be resupplied with needed materiel. The resultant *present* and *projected* operational status of systems and tactical organizations communicated in real time will greatly facilitate course-of-action analysis. Integration of source data automation with operational situational awareness opens additional possibilities for improved force effectiveness. Logisticians will be able to better control movement of supplies in the tactical area, and better coordinate the rendezvous of resupply vehicles. A system incorporating source data automation also permits operations planners and logisticians to relocate programmed materiel (such as fuel and munitions) and redirect shipments as operational needs and priorities change—all with predictable impact on operations results. Sentinel systems will alert the soldier or manager when human knowledge or intervention is required. Building warfighter confidence through platform-based, user-friendly information technologies and process changes is an integral part of Phase II of the RML.

Conclusion

The RML process and CS/CSS transformation are long-term processes. New capabilities will not be achieved overnight. Traditional ways of doing business must be challenged, innovation and experimentation encouraged, and concepts with high returns on investment developed. While the range of Army missions will encompass the spectrum of operations, it is the possibility of war that focuses the logistics community's energy and heightens its sense of urgency. Throughout these sweeping changes, one thing will remain constant---logistics will be prepared to support and sustain the force.

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Strategic Responsiveness—Getting to the Fight Faster

Introduction

The Army vision—full spectrum forces that are strategically responsive and dominant—generates force projection requirements significantly more challenging than previously encountered. The Chief of Staff, Army (CSA) envisions deployment of a brigade anywhere within 96 hours, a division in 120 hours, and five divisions in 30 days.

Achieving the capability to rapidly project forces anywhere in the world will require a substantially more deployable Army than is currently available. Regardless of the new force's size, missions or movement timelines, logistics will remain the key driver for deploying faster and sustaining with a smaller logistics footprint. Efforts must continue at optimizing the currently cumbersome support pipelines to assure a future lethal and survivable fighting Army.

Today the Army, through its Revolution in Military Logistics (RML) initiatives and combat support/ combat service support (CS/CSS) transformation effort, has been proactively focusing on exploiting deployment and support capability improvements with current and emerging technologies. The intent is to replace volume with velocity, reduce demand and lighten the load, by supporting smarter, leaner and more efficiently to ensure agile systems are in place to deliver trusted logistics "on demand" to warfighting commanders.

Given the Army's focus, what can be done *now* to deploy more rapidly? Opportunities are available now to complement ongoing strategic movement initiatives for enhancing the "fort-to-foxhole" deployability of its forces.

Projecting Faster

For the Army to remain dominant in the future, the CSA envisions forces capable of getting to the fight two to three times faster than is possible today. However, projecting a transportation-dependent Army faster will require a commitment of resources in an already austere Department of Defense (DoD) budget period.

Having forces quickly in place will be the linchpin to the Army's future ability to fight and win. Regardless of the force's composition, its reliance on prepositioned sets, quicker lift, improved infrastructures, and all-weather/all-terrain offload capabilities will not change. Its success will remain tied to deploying faster and sustaining smarter.

Power projection depends on the mobility of the force. Getting a force to the fight quickly is governed by three factors—size, distance and speed. To improve the Army's projection capability now, the following factors need to be reexamined.

Delivery size. Mobility is determined by how many units and how much materiel require transportation. Even before the CSA's October 1999 announcement of new deployment goals, it was recognized that the Army's "feet are too big," i.e., the amount of personnel, equipment and consumables needed is too large and consumes too many transportation assets. Current RML initiatives are addressing how to make the Army more resource-efficient by reducing the size of its logistical support tail. These efforts, coupled with gaining the warfighters' confidence in support responsiveness, remain the cornerstones to projecting a transportation-dependent Army faster.

Trimming the "fat" from the logistical tail will not occur overnight. The RML and CS/CSS transformation are evolutionary processes of change, but over time, their effect will be revolutionary. New support arrangements will require doctrine, organization, training and equipment changes—a necessary but time-consuming process. In the near term, additional options are needed to get the

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forces alerted, moved, uploaded, delivered and then unloaded faster and more efficiently.

A starting point for improving deployability will be in designing the new initial brigade and division structures. New force size and weight will affect deployment times. For comparison, a heavy division's deployable weight today is 65 percent equipment and 35 percent accompanying consumables, of which all but 5 percent is fuel and ammunition. As the new force's structures are developed, equipment weight objectives, fuel efficiency improvement targets, and ammunition short ton limits---all of which will drive down the aggregate weight (and sustainability requirements)---need to be established that are compatible with strategic mobility capabilities. Establishing clear goals and metrics will ensure force designs meet deployment objectives.

Delivery distance. Mobility responsiveness is determined by how far the materiel needs to be transported. A "closer is quicker" approach--forward prepositioning of equipment sets---continues as a central Army strategy to reduce the distance over which its large "feet" must be moved. Deploying faster over long distances, however, is not cheap. Although the needs for more and faster strategic lift are being worked by DoD, the Army's ability to deploy will remain a constant challenge to a continental United States (CONUS)-based projection force, particularly considering the enormous cost of acquiring sufficient lift assets. There is never going to be enough DoD lift to overcome such inevitable constraints.

Supporting global conflicts will increase the Army's deployment challenges. Current prepositioned equipment packages have been stored in strategic locations as insurance policies for projecting quicker. These sets do provide responsive coverage in meeting a brigade's deployment timeline, provided the operational "hot spot" occurs in the general vicinity of where the sets are stored. The challenge, however, will be in meeting the same timeline to "hot spots" that are not within an acceptable sailing radius of the prepositioned sets afloat and/or that do not have adequate port facilities.

To project faster now, the Army's prepositioned-afloat program needs to be redefined. Whether the new brigade is motorized, tracked or a combination, there will not be enough lift to move the force on time without reliance on the afloat assets.

The core of the Army's mobility strategy—prepositioned equipment afloat—promises the biggest potential for deployment improvements while other initiatives continue to be developed. Current equipment realities, however, provide little opportunity for immediately reducing force deployment weights. Until technology enables substantial reductions in the size and weight of equipment, ammunition and fuel demand, the Army's ability to meet its deployment timelines will rest largely on refining its prepositioned afloat program.

A review of the prepositioned program should address:

- mix of prepositioned equipment based on new force designs;
- need for additional prepositioned equipment sets;
- need for more port opening sets to support off-loading in any sea or land condition;
- reorganization and restationing of afloat sets to support worldwide deployments;
- initiation of movements based on warning orders to reach "hot spots";
- preparation of afloat equipment for immediate use upon offload.

Delivery speed. Mobility is governed by the speed of the modes of transportation that deliver the forces. Based on mobility studies, the defense community continues to think "big" with respect to meeting the Army's heavy equipped force's transportation requirements with more air (C-17) and sealift (Large Medium-Speed Roll-on/Roll-off) platforms. Moving quicker, however, will continue to require more military lift support than is available currently, or in the future. Relying on defense assets alone is not the answer.

To enhance delivery speed, the Army cannot depend only on the Air Force and Navy to ferry its forces. With limited military lift assets, a stronger reliance on the commercial transportation sector will be required. To expand the pool of available lift assets, however, will require deploying loads to be configured to meet commercial airframe limitations.

Size objectives for the new forces must be established as well. These goals may drive the need for acquiring wheeled combat vehicles with smaller-caliber weapons, at least in the short term. These lighter forces will demand less fuel and less ammunition weight to deploy and sustain. Accordingly, logistics units required to receive, store, move and issue these commodities for lighter units could be lightened themselves.

Deploying a smaller support tail will also improve deployment speed. Modularized force packages that can be deployed based upon available contractor, host nation and coalition capabilities are needed. Such reliance does assume a level of risk; however, the risk should be weighed against advantages in speed and affordability. Additionally, the capability to support from other than the theater—split-based operations and support from intermediate support bases—needs to be accelerated.

Deploying a force faster is dependent on more than just lift availability. Getting from the fort to the fight also includes the need for improving speed throughout the deployment cycle. Estimates indicate that it takes about the same amount of time to move from the fort to the port, load, offload and get to the fight, as it does to actually sail the port-to-port leg. To improve on these nonsailing legs of the timeline, $200 million has been programmed for infrastructure upgrades. However, as long as heavy equipment with its large sustainment requirements must be moved by rail, substantial improvements are not likely to be achieved in the near term.

Finally, the CONUS infrastructure improvement program needs to be reevaluated to determine if planned efforts actually speed the deployment of designated forces. Available funds should be reallocated to correct bottlenecks identified during deployment exercises for the early deploying units.

Conclusion

The Army vision sets a path that will transform the Army, enabling worldwide projection of its combat power more quickly, effectively and efficiently without sophisticated port dependence. For the vision to be credible, the Army needs to review its current power projection resources now. *First*, deployment size and weight objectives for the new force are needed. *Second*, prepositioned afloat sets must be optimized. *Finally*, infrastructure improvements must be determined, prioritized, and exercised to assure capability.

Deploying the Army more rapidly will be no easy task. To make it a reality will require time, resources and a total DoD commitment. RML and CS/CSS transformation initiatives will help in the mid- to long term. In the interim, however, the Army needs to review what it can do within its own capabilities to speed up the deployment process.

Revolution in Military Logistics

RML
00-06

May 2000

Communications Technologies for the Revolution in Military Logistics

Introduction

The Revolution in Military Logistics (RML), particularly the transformation of combat support (CS) and combat service support (CSS), requires a dynamic new approach to logistics support. A seamless, single logistics system that ties all parts of the logistics community into one network of shared situational awareness and unified action can only be achieved in an environment dominated by global, wireless, assured communications. Many world-class commercial companies have significantly reduced inventories and now rely on real-time information, coupled with rapid transportation, to meet customer demands on time. Substantial cost savings in acquisition, warehousing, packaging and transportation have been achieved through reduced inventories. Much of the commercial sector's inventories are in motion in a logistics "pipeline." Reliable and assured communications makes this possible. Management of this "inventory in motion" is through employment of global wireless communications systems which provide up-to-the-minute status on shipments and deliveries. In a military context, this kind of management capability will be crucial to achieving real-time logistics control, a reduced logistics footprint, and reduced logistics demand envisioned through the RML and CS/CSS transformation.

The Future

Through a leveraging of information technologies, logisticians must be better empowered to provide the right support at the right time, at the right place. This becomes even more critical with the Army's deployment goals of putting a brigade on the ground anywhere within 96 hours, a division within 120 hours, and five divisions within 30 days. Army logisticians can no longer rely on "historical" data, but will instead require real-time, predictive information to make intelligent decisions and optimize force readiness. Global wireless communications will provide soldiers the capability to reach and "see" battlefield requirements anywhere.

Satellite communications. There are today about 200 communications satellites in earth orbit. It is predicted that by the year 2010 this number will increase to well over 2,000. The market for commercial use of global wireless communications, both voice and data, is growing exponentially; therefore, providers are scrambling to put up more satellites, increase total capacity, and further improve technology to increase the speed of information flow. Competition for market share is driving down the size and cost of mobile equipment, while battery life is steadily increasing.

Commercial expansion. Commercial systems are available now (with more coming on line in the near future) which can provide the reliable communications capabilities the Army, particularly *Army logistics*, requires. Several companies have already begun launching hundreds of low earth orbit (LEO) satellites that provide voice, data and fax communications to global customers. The satellites will communicate with mobile devices on the ground, and also be linked to fixed ground stations or gateways that provide access to existing low-cost telephone systems. Unlike geostationary satellites commonly used a few years ago, newer satellites are of the LEO type. Geo-stationary satellites were usually fixed at about 22,000 miles above the earth. At that altitude the length of time it took for the signal to go from a ground station to the satellite and back to the ground often caused a delay or echo in voice communications. LEOs are

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launched to an altitude just a few hundred miles above the earth, with virtually no effect on voice communications.

Commercial Opportunities

Following are just a few of the companies planning to have a global, wireless communication system capability in the near future:

- ***Iridium*** completed launch of a 66-satellite array, plus six in-orbit backup satellites in the summer of 1998. The 1,500-pound satellites, orbiting the earth in a staggered array at an average altitude of 485 miles in just over 100 minutes, provide a capability for global wireless coverage for a mobile telephone system with voice, data and fax. Subscribers can have one telephone number and be reached anywhere in the world without the caller having to know where the called party is located.
- ***GlobalStar*** has begun launching its fleet of 56 satellites—48 in service and eight spares—to be placed in orbit approximately 750 miles above the earth. This fleet will provide voice, data, fax and other telecommunications service to customers worldwide.
- ***ORBCOMM***, a joint venture of Orbital Sciences Corporation and Teleglobe, Incorporated, planned to launch 36 small LEO satellites by 1999 to provide global personal messaging services.
- ***SkyStation*** plans to launch a fleet of lighter-than-air vehicles which will remain geostationary approximately 13 miles over major metropolitan areas to provide an "internet in the sky" capability. Equipment can be brought down for hardware swaps and upgrades, and also repositioned for continued service.
- ***Teledesic*** plans to launch a fleet of 288 LEO satellites to provide broadband, global, wireless service to businesses, schools and individuals worldwide. The $9 billion project is scheduled to begin service in 2003.

Conclusion

Revolutionary communications capabilities and systems are being developed for a global commercial market. These capabilities and systems clearly have broad applications for military use at the strategic, operational and tactical levels of operations. These technologies can provide the capability to receive, transmit, store and retrieve information in a single, seamless logistics system. This single system is a critical element of the RML and transformation of combat support and combat service support.

Revolution in Military Logistics

RML 00-07

May 2000

Single Logistic System—Key to Achieving an RML

Introduction

Development of what is termed an enterprise-wide *single logistics system* (SLS) is one of the most critical requirements to achieving a Revolution in Military Logistics (RML), and transforming combat support and combat service support. It underpins most of what we consider *revolutionary* in the future of military logistics, leveraging the best of commercial business processes, infrastructure designs, and global information/electronic commerce technologies. Achieving the single logistics system is fundamental to meeting the Army's requirements for reduced logistics demand, reduced logistics footprint, and improved force closure.

A basic premise of the RML is to integrate and connect the Army logistics management framework, communication processes and automation architecture into one seamlessly accessible system that is transparent on one end to the user, or on the other end to the supplier. It should make no difference if we are fulfilling requirements from the combat soldier, or if we are buying widgets from a commercial vendor.

The concept of a *single logistics system*, coupled with enabling information technology and a single Army-wide logistics provider, is so tightly intertwined that it must be discussed as a single integrated concept. Beginning in 1996 and continuing through 1998, the Army's Deputy Chief of Staff for Logistics (DCSLOG) hosted a series of three seminars attended by industry executives and experts, active and retired military leaders, and members from academe. Among the key results and insights that emerged from this series of seminars was a recognition that industry considers logistics to be *information*, and that it is viewed as a *strategic asset*.

Since *logistics* has become synonymous with *information*, the definition and description of a *single logistics system* takes on the characteristics of a *single* integrated information system. All of the functions, missions and organizations—including an Army-wide logistics provider—will be connected and integrated by an enterprise-wide, end-to-end information system.

This single, seamless logistics system is more than just an information system, though without it, the seamlessness would not be possible (or even desirable). The information system—reliable and assured automated systems and communications—is absolutely the essential ingredient, and underpins not only the RML but also the current effort aimed at transforming combat support and combat service support. Being able to see, know, anticipate, model, link and trade off alternative available resources to fulfill support requirements allow for a never-before-envisioned capability. This seamless logistics system capability will revolutionize not only logistics operations but also Army logistics thought and doctrine.

Why a Single Logistics System?

The Army will get the greatest synergy from the entire logistics system by integrating its parts—*vertically*, from tactical through strategic, and *horizontally*, across multiple logistics functions. When achieved, the result can then be accurately described as a single, fully integrated, seamless, distribution-based, end-to-end logistics system. It is this seamless system that will enable the logistics force to provide world-class, focused logistics support to the warfighter. In planning, it will translate the commander's concept of operation directly into logistics terms with the aid of tools such as natural

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language processing. In execution, the single, seamless, distribution-based logistics system will anticipate losses, monitor supply consumption and automatically generate replenishment to a predetermined level based on operating tempo (OPTEMPO) and subsequent battle requirements.

In the past, the Army logistics community typically has developed communication/automation systems, separate logistics functions, and institutional layers and levels of support that only optimized local and separate logistics systems, thus suboptimizing the entire logistics system. In contrast, the RML's seamless logistics system concept is enterprise-wide. Moreover, it is a new way of thinking, a new way of doing business, a new logistics paradigm. It will fundamentally change how we support the warfighter. This overarching concept and its descriptive components provide unprecedented capabilities—an agile infrastructure, integrated business processes, dynamic decision support, real-time responsiveness, and distribution-based functionality. These capabilities are so tightly intertwined that they must be discussed as a single integrated synergistic concept, the SLS.

Required characteristics: **The objective single logistics system must:**

- be distribution-based. Real-time communications connectivity and situational awareness will produce this new paradigm;
- be served by an enterprise-wide, end-to-end logistics information system capability;
- be more predictive and more responsive to anticipated and unanticipated needs;
- interface with the combat commander's command and control system, translating the commander's concept of operation into logistics terms with the aid of sophisticated tools such as natural language processors;
- be able to anticipate combat losses, both personnel and materiel, monitor consumable item usage, and automatically generate replenishment to a predetermined level based on OPTEMPO and follow-on requirements;
- be able to apply the whole of its capabilities to achieve consistently *balanced* support across all functions;
- integrate and optimize—across the entire logistics system—business processes, functionality and commands, by focusing the enterprise on the warfighter;
- incorporate enterprise-wide, warfighter-focused performance metrics.

What's needed to achieve a single logistics system: Basic technologies required to achieve a single logistics system are available now. Most are being used by industry. Examples include enterprise information technology solutions, prognostics, modeling, enterprise resource planning, and global communications infrastructures. Transition to a single logistics system will require investments in the right information technologies, organizational redesign, and business process reengineering changes. Establishment of a single Army-wide logistics provider represents the critical component of organizational redesign.

Conclusion

The concept of a *single logistics system* represents a new way of thinking, a new way of doing business, and a new logistics paradigm. It will fundamentally change how we project and sustain the force. It will focus the entire logistics system in anticipation of the warfighter's requirements, achieving a consistent and predictive level of effectiveness and responsiveness. Coupled with information technologies, organizational redesign, business process changes, improved platforms and new distribution concepts, the single logistics system will be crucial to meeting the Army's deployment requirements, reducing logistics demand, and reducing the logistics footprint.

Revolution in Military Logistics

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00-08

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Army Total Asset Visibility— Achieving Real-Time Logistics Control

Introduction

Army Total Asset Visibility (ATAV) is an automated logistics management tool that is currently managed by the U.S. Army Logistics Integration Agency (USALIA). Recognized as a key requirement for the Revolution in Military Logistics (RML) and combat support/combat service support (CS/CSS) transformation, it dramatically improves the ability of soldiers, logisticians and managers to obtain and act on information about the location, quantity, condition and movement of assets through the logistics pipeline. ATAV is designed as a distributed, multi-database system with user telecommunication access to the capability provided by log-on scripts from existing personal computers located at Army commands and activities. A panel of judges selected the ATAV program as one of the 1995 winners of the Technology Leadership Award. This award recognizes federal agencies that have demonstrated extraordinary leadership in using information technology to improve service to the public, to lower government costs, and to improve the ability of agencies to meet their mission requirements.

Why Was ATAV Developed?

In every major military deployment, military forces have been plagued by a lack of visibility of materiel and equipment entering the theater of operations. The sheer volume of materiel moving through the logistics pipeline has taxed the ability of soldiers, logisticians and managers to manually track the materiel, maintain accurate records, and provide timely information to commanders. During Operation Desert Shield and Operation Desert Storm, thousands of containers had to be opened, manually inventoried, resealed and reinserted into the pipeline because of a lack of visibility of their contents. A dedicated effort has been underway since 1990 to ensure problems like this do not reoccur. Reduced resources also contribute to the need for ATAV. The Army needs to maximize the utilization of all its resources prior to making procurements. Visibility of those assets is critical so that dollars are spent for those things needed most.

Where Does ATAV Get Its Data?

The ATAV capability obtains wholesale and retail data on all classes of supply from various Standard Army Management Information Systems (STAMIS) and other source systems. External ATAV data is received from source systems via communications transference, and through uploading reconfigured data resident on logistics systems at the U.S. Army Materiel Command (USAMC) Logistics Support Activity, located in Huntsville, Alabama. The data are loaded into ATAV as they become available. Access to external source systems is transparent to the ATAV capability user and requires no programming activity. ATAV does not create any new databases. ATAV-provided information is only as current as the information contained in the STAMIS. Some examples of these STAMIS include: the Standard Army Retail Supply System (SARSS), the Worldwide Ammunition Reporting System (WARS), Army War Reserve Deployment System (AWRDS), Standard Property Book System-Redesigned (SPBS-R), Commodity Command Standard System (CCSS), Army Materiel Command Installation Supply System, Standard Army Maintenance-Installation/Table of Distribution and Allowance (SAMS-I/TDA), Materiel Returns Data Base and the Logistics Intelligence File (LIF).

Why Should ATAV Be Used?

The ATAV capability should be used by Army commands because it provides timely information

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from the strategic level through the tactical level, totally transparent to the user, in a format that soldiers, logisticians and managers can readily use to support their routine operations. Managers can routinely use ATAV information to make materiel management decisions, such as redistributing excess items or diverting materiel in transit. ATAV-related business rules and policy have been developed at the Department of Army level. In addition to asset information, ATAV data sources provide unit authorization data, basis of issue plans, procurement, distribution priorities, and catalog data. Soldiers, logisticians and managers can query the ATAV capability by various means to find information on requisitions, shipments, voyage numbers and/or flight numbers.

Where Is ATAB Being Used?

The ATAV capability has been successfully implemented throughout the Army. ATAV provides visibility of all Army-owned and Defense Logistics Agency assets (strategic through tactical). In support of the Office of the Secretary of Defense (OSD)-directed Lateral Redistribution and Procurement Offset Initiative, ATAV provides asset data to all services and the Defense Logistics Agency (DLA). Managers supporting the Program Manager Paladin production use ATAV to determine potential line stoppers and availability of possible redistributable assets to prevent work stoppage. ATAV-Enhanced (ATAV-E), an application utilizing ATAV data, provides users visibility of redistributable materiel. Various reports supporting Headquarters, Department of the Army, and major command requirements have also been developed in ATAV-E. Examples of these reports are: Authorized Stockage List (ASL) Requisitioning Objective (RO) Dollar Value Report, ASL Zero Balance Report, and Percent Fill of Army Prepositioned Stocks (APS). Prototypes were successfully used in Somalia, Rwanda and Haiti, and ATAV is currently being used in support of Operation Joint Forge (OJF) in Bosnia. During the deployment to Bosnia, ATAV was used to identify cold-weather clothing and equipment locations, and in some instances was used to divert equipment to forces scheduled for deployment.

ATAV Support of OJF. Intransit visibility (ITV) is a major element of the ATAV program. As part of the Army Logistics Integration Agency's (LIA's) ATAV/ITV initiative, several Automatic Identification Technologies (AITs) have been implemented throughout the Army. Three of these technologies are being used extensively to support OJF in Bosnia. Optical memory cards, as a part of the Automated Manifest System, are being used to enhance receipt processing of multipacks at Supply Support Activities (SSAs) in Hungary and Bosnia. At the depot or distribution center, multipack content data is stored to the card and the card is attached to the multipack. At the SSA, the card is scanned through a reader and the data posted to the supply system, eliminating hours of manual receipt processing time. Radio Frequency (RF) tags and interrogators are being used to enhance visibility of pallets'/containers' locations and contents flowing into Hungary, Croatia and Bosnia. At the depot or distribution center, container content data is stored to the RF tag and the tag attached to the container. Omnidirectional interrogators, installed at key transportation nodes, read the tagged containers as they arrive and depart those nodes. The interrogators pass that data to a regional server for user access. Logisticians at a container yard can also use a handheld interrogator to read tag data and determine container contents. This technology has been implemented throughout Europe and Korea. Implementation at U.S. Army Forces Command (FORSCOM) power projection platforms began in Fiscal Year 1999.

DoD AIT Operational Prototype

DoD is capitalizing on the successes achieved by the Army's use of AIT technologies. A DoD operational prototype, hosted by U.S. European Command (EUCOM), will focus on four specific scenarios: unit movement, seavan, air cargo, and ammunition. Both the unit movement and air cargo scenarios will directly support operations in the OJF area of operational responsibility. Key benefits resulting from the DoD AIT prototype include easier distribution of assets, contributing to reduced inventory; reduced receipt processing time; improved in-the-box visibility and location of theater sustainment shipments; improved visibility of in-theater truck convoy and rail movements; minimized manual data entry tasks; increased source data accuracy; increased nodal throughput; and potential

interoperability with commercial vendors and shippers through the use of a commercial standard shipping level.

Conclusion

ATAV represents an automated capability that requires minimal resource expenditure by Army commands or activities. It has been designed to be installed and operated from existing organizational personal computers. A Graphical User Interface (GUI) ATAV version is also available and can be downloaded from the LIA homepage. ATAV uses existing Army STAMIS as its source data. Perhaps most importantly, ATAV enables soldiers, logisticians and managers to provide real-time, and/or near real-time, information to commanders, allowing the commander to make informed decisions using the most current Army logistics management information available. ATAV, along with reliable communications, represents a key step in achieving the RML, transformation of combat support and combat service support, and reduced logistics demand.

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Digital Maintenance Environment—An Overview

Introduction

Improved weapon system readiness through enhanced maintenance procedures and capabilities represents a key requirement of the Revolution in Military Logistics (RML) and transformation of combat support and combat service support. Diagnostics, prognostics and electronic technical manuals/ interactive electronic technical manuals have significant potential for contributing to real-time logistics control and reduced logistics demand.

A 1994 Army Forces Command (FORSCOM) Inspector General Report maintains that 6 percent of all maintenance-generated requests for repair parts are erroneous. These clerical errors result in more than $77 million worth of excess parts annually, according to a 1997 Logistics Integration Agency (LIA) Cost and Economic Analysis Center-approved cost benefit analysis. More recent interviews with FORSCOM units reveal similar, or even greater, occurrences of clerical error. The point is clear: When soldiers are required to enter data manually, errors are certain to occur. Those errors ultimately result in excess parts and wasted taxpayer dollars.

Building on the Army's successful efforts to digitize its library of technical manuals, LIA developed two software packages---the Electronic Technical Manual-Interface (ETM-I) and the Digital Preventive Maintenance Checks and Services (DPMCS)---that move the Army closer to realizing a digital maintenance environment. Both packages contribute to automating the flow of maintenance data from the weapons platform to the mechanic and their supervisors and supporting parts clerks.

ETM-I: Eliminating Clerical Errors

ETM-I enables mechanics to submit maintenance data, including requests for parts, from their motor pools to the Prescribed Load List (PLL) or shop stock clerk. This interface eliminates clerical error in ordering Class IX parts; eliminates inaccurate inputs to the Unit Level Logistics System (ULLS) and the Standard Army Maintenance System (SAMS); and provides an instantaneous digital blast of data to the ULLS and SAMS environment in lieu of manual input.

LIA first tested ETM-I in May 1998 at the National Training Center (NTC) with the 15th Forward Support Battalion, 1st Cavalry Division. Mechanics assigned to the 15th used ETM-I to electronically submit more than 270 faults and 170 parts requests directly to the PLL clerk. The PLL clerk could then upload that data into the Unit Level Logistics Systems-Ground (ULLS-G) rather than entering it manually, reducing normal processing time from three hours to 15 minutes. Soldier feedback was very positive. More recent ETM-I studies performed at Fort Campbell, Kentucky, revealed man-hour savings of 33 hours per week transferring digital requisitions from the motor pools to ULLS-G with no clerical errors.

DPMCS---Assessing Weapon System Readiness

A July/August 1997 *Army Logistician* article entitled "Preventive Maintenance Checks and Services (PMCS) Redesign" highlighted recurring observations of PMCS inefficiencies within maneuver units during NTC rotations. The article pointed out that weapon system PMCSs require a good deal of time (two-four hours) to perform; that it takes 48-72 hours for crews to receive feedback from ULLS; that turn-in rates for 5988E/2404 forms are traditionally low; and that the data quality of the 5988E/ 2404 is suspect, at best. After reading this article, the Chief of Staff, Army, directed the Headquarters, Department of the Army, Deputy Chief of Staff for Logistics (DCSLOG), to identify PMCS solutions as

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part of a Six Sigma management philosophy and the Revolution in Military Logistics (RML) transformation process. The DCSLOG tasked LIA to conduct a six-month project to identify an interim fix.

Digital Maintenance Environment Becomes Reality—NTC 9905

Working together, LIA, the Combined Arms Support Command (CASCOM) and the 4th Infantry Division recommended the NTC Logistics Focused Rotation 9905 as an ideal scenario for a proof-of-concept assessment with two participating units. LIA leveraged its recently developed ETM-I, developed an M1A1 Digital PMCS interface, and used Single Channel Ground and Airborne Radio System (SINCGARS) radios to improve the movement of maintenance information among deployed tank crews, the supporting maintenance team, and the unit's PLL clerk. One armor task force supported the proof of concept assessment. Four M1A1 tank crews were provided a DPMCS capability. The combat repair teams (CRTs) supporting the tank companies were provided automation, ETM-I, printers, and the ability to transmit PMCS and maintenance data back to the ULLS-G location via SINCGARS radios.

The results were impressive. PMCS data cycle times, which normally take 36-72 hours, were reduced to less than 12 hours. Turn-in rates for the 5988s, which usually average 32 percent, improved to nearly 100 percent. ETM-I significantly improved maintenance data quality and drastically reduced clerical errors. M1A1 DPMCS improved PMCS data quality and reduced the time to conduct PMCS. Additionally, the use of wireless local area network (LAN) technology significantly improved PMCS data input capabilities, resulting in significantly more correct parts being received in much less time. SINCGARS radios, when used, significantly reduced PMCS data transit times to the ULLS-G location. Again, soldier reaction was favorable. In its overall assessment of the rotation, HQ CASCOM identified the DPMCS and ETM-I as a Force XXI Logistics Enabler. As the HQ Training and Doctrine Command (TRADOC) Analysis Center's Combat Service Support Analysis Initial Insights Memorandum points out, "ETM-I has great potential to increase the speed with which units identify maintenance deficiencies and place parts on order."

ETM-I & DPMCS— The Future

The positive NTC results and ETM-I's potential resulted in USALIA, the U.S. Army Ordnance Center and School, HQ CASCOM, and Program Manager, Test Measurement Diagnostic Equipment, teaming to integrate ETM-I functionality into the emerging Global Combat Support System-Army (GCSS-A), the logistics community's planned business automation system for the first part of the 21st century. In the meantime, LIA will coordinate with the major commands (MACOMS) to make ETM-I available to units with the necessary hardware. Additionally, LIA will transition its concept for DPMCS to HQ TRADOC for doctrinal and requirements analysis. As these efforts reach fruition, one can begin to envision the days when manual entry and clerical errors become a thing of the past.

Conclusion

Achieving the deployment timelines established by the Chief of Staff and meeting the Army's requirements for reduced logistics demand and transformation of combat support and combat service support require different approaches to weapon system maintenance and logistics processes. Migration of Army logistics to a digital maintenance environment supported by reliable, assured communications is a fundamental element of the RML and transformation of combat support and combat service support.

Revolution in Military Logistics

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May 2000

Weapon System Support Concept—An Overview

Introduction

The Army vision establishes requirements for improved force closure, reduced logistics demand, less demand on lift, and a reduced logistics footprint. The future force envisioned by the Chief of Staff will conduct distributed, nonlinear operations on a digitized battlefield in the context of a fully internetted and shared data environment. This environment establishes a seamless exchange and movement of information, and provides for the ability to maintain a clear and accurate vision of the battlespace necessary to support both planning and execution. Phase II of the Revolution in Military Logistics (RML) focuses on platforms, readiness and weapon systems. Simplistically, it focuses on achieving near-total real-time visibility and shared situational awareness of the logistics pipeline from a platform through all levels of logistics—strategic, operational and tactical. Paramount to the success of both will be the fielding of systems that employ onboard diagnostic and prognostic capabilities to provide critical, timely and accurate information necessary to reduce logistics demand and the logistics footprint, while enhancing force readiness.

Digital Maintenance Environment and Weapon System Support Concept

The Weapon System Support concept starts at the weapon system platform with a digital maintenance environment, advanced diagnostics, and real-time prognostics visible through a variety of communication conduits. This visibility provides the Forward Support Battalion (FSB) the tools to sustain; command and control with battlefield situational awareness; and the Weapon System Manager (WSM) information for resource allocation decisions, all in a seamless environment.

Shared situational awareness. On-board sensor suites (diagnostics and prognostics) with prognostic frameworks for major weapon systems will provide readiness condition on a real-time basis to any designated need-to-know user. This source data automation will predict failures for the entire system/unit, thereby enabling the combat commander to plan missions based on current readiness condition of assets. Given this knowledge, the FSB will proactively schedule where the maintenance will take place, skills and man-hours needed to repair the failure, and requests for essential repair parts necessary to perform the maintenance task. State-of-the-art communication systems will transmit the same battlefield information to numerous interested sources simultaneously, (e.g., the Weapon System Manager, Global Materiel Manager and manufacturer). A prognostic capability is synonymous with scheduled maintenance, and is the key to reducing maintenance requirements *and, by extension, logistics demand and logistics footprint.*

Real Time Engine Diagnostics-Prognostics (REDI-PRO). The Logistics Integration Agency (LIA) sponsored the development of an operational prototype health monitoring and prognostic system for the AGT1500 gas turbine engine used on the M1 Abrams tank. This system is called Real Time Engine Diagnostics-Prognostics *(REDI-PRO)* (formally Turbine Engine Diagnostics Using Artificial Neural Networks, or TEDANN). REDI-PRO comprises (1) a set of sensors mounted to the turbine engine of the M1 series vehicle; (2) electronics for collecting and processing sensor signals; and (3) a microprocessor running artificial neural network and rule-based programs. REDI-PRO senses and records engine operational status and will, when fully implemented, perform diagnosis and prognosis of engine condition.

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Prognostic framework. USALIA is currently working with the U.S. Army Advanced Technology Office, Aviation Missile Command and Giordano, Incorporated, to develop an overall system "health monitoring" architecture that will provide proper crew notification, data collection and logging, and centralized processing of monitored data. This effort will extend the prognostic capability in REDI-PRO into a total health management system by augmenting its reasoning capability to include prognostic indications.

Shared data environment. Prognostic framework output is provided to the operator and via remote maintenance to the FSB and WSM, providing for immediate access to battle readiness information and maintenance requirements. Additional supports to this shared data environment are SPAR™ and Post Fielding Support Analysis (PFSA). SPAR™ is a proprietary reliability simulation model that utilizes Monte Carlo methodology owned by the Clockwork Designs Corporation. It uses product oriented, iterative integrated modeling to assess the impact of logistics decisions on fleet cost and performance in an environment with ambiguous and incomplete data. The PFSA initiative identifies process improvements and subsequent functional requirements for improving and streamlining logistics support for fielded systems. PFSA will provide the Army the capability to analyze logistics support implications in response to deficiencies, problems and support requests received from military forces and provide a basis for forecasting future improvements to reduce operating and support costs.

Conclusion

The real-time ability to monitor materiel status, predict failures and anticipate and deliver timely supply and maintenance support is critical to achieving the RML, and transforming combat support and combat service support. Real-time awareness of the readiness condition of weapon systems provides the warfighter a combat multiplier as essential as fuel and munitions. Building warfighter confidence through platform-based, user-friendly information technologies and process changes is an integral part of Phase II of the RML.

Revolution in Military Logistics

RML
00-11

May 2000

Deployment Stock Package

Introduction

Redefining and changing logistics processes, to include deployment of forces to a theater of operations, is fundamental to the Revolution in Military Logistics (RML) and transformation of combat support and combat service support. Significant progress has occurred through the Army Strategic Mobility Program, but further improvements are necessary to meet the deployment profiles, and requirement for reduced logistics demand, established by the new Army vision. Development of the Deployment Stock Package (DSP) represents an example of efforts currently underway that will support achieving an improved force closure capability.

In April 1996, the U.S. Army Logistics Integration Agency (USALIA) and the U.S. Army Materiel Systems Analysis Activity (AMSAA) conducted a study to outline a supply management process that provides increased flexibility and responsiveness for a variety of operations, reduces the generation of excess stocks, and provides the best mix of supplies when needed.

The Anticipatory Logistics Program Management Plan was completed and published in April 1997. This plan defined the anticipatory logistics system to include processes, interaction, hardware and software requirements, and methodology changes.

The second phase of this project was completed in July 1998. This phase introduced the Deployment Stock Package Analyzer (DSPA) and demonstrated the improved supply performance and readiness provided with the Deployment Stock Package process.

Deployment Stock Package

DSPA is a software tool that allows a unit to easily and quickly compare a DSP to its current Authorized Stockage List (ASL), and allows the unit to make any changes to the package deemed necessary. DSPA can be loaded on any computer that uses a 486 or higher microprocessor and operates under Windows 95. It uses object-oriented visual programming tools, in the form of graphical user interfaces, to allow the user to easily select any of the many different features provided.

DSPA facilitates deployment stock generation, modification, evaluation and requisitioning. Timely updates to requirements can be made whenever needed based on anticipated changes during peacetime deployment or during operations. DSPA provides the following capabilities: It walks a user through each step of the automated DSP process; it designates a factor to optimize DSP (i.e., weight, cube or cost); it allows the user to view and/or modify an initial DSP; it modifies deployment parameters for new DSP development; it easily compares the developed DSP versus the unit's Availability Balance File (ABF); it identifies weapon systems that DSP parts support; it sorts the DSP and/or ABF by National Stock Number (NSN), price, weight or cube; it makes cost decisions based on the plus-up price shown on the screen; and it automatically generates a requisition order based on a developed DSP.

A demonstration to measure the performance of a DSP developed to support the 1st Cavalry Division during a National Training Center rotation proved the merit of the process. The supply fill rate for the DSP was almost twice the fill rate of the division's ASL, which in turn would have provided a 3 to 6 percent increase in readiness for the M1, M2/M3 and M88.

Tiering Concept

There was concern that the DSPs, while necessary to provide the weapon system availability required by units, were too large and may have a negative impact on the unit's mobility. To determine the DSP's impact

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on a unit, a mobility analysis was conducted on the DSP developed for the division. Storage for peacetime ASL, combined with the DSP, requires two additional vans. Also, there is a significant increase in the bulk items that must be transported on flatbed trailers.

Based on this analysis and input from the Headquarters, Department of the Army, Deputy Chief of Staff for Logistics, and the commanding generals of the U.S. Army Combined Arms Support Command and U.S. Army Quartermaster School, a concept to provide support, either partial or in full, from the corps level was developed. The original thinking for this concept, termed the *tiering concept*, was that providing support from the corps level to several ASLs should significantly reduce the cost of the DSP, while providing the same level of support. To examine the validity of this concept, all of the end items for the 3rd Infantry Division (ID) were combined to develop one DSP, rather than four, to support the division from corps. There was only a 3 percent decrease in the total cost for the tiered corps DSP, as compared to the four combined DSPs of the 3rd ID. The reason this occurred is because the DSP engine, the Optimum Stock Requirements Analysis Program (OSRAP), stocks the repair parts that are expected to fail during the 15-day exercise based on their failure rates. While there may be some economies of scale by combining the DSPs, the repair parts that are expected to fail will still need to be stocked and available to insure weapon system readiness.

Since there were little savings with the pure *tiered approach*, but still a need to ease the mobility burden on the divisional ASLs, the concept was refined. This approach has the added benefit of units being able to include some of the DSP levels in their peacetime ASLs with minimal monetary impact on the units, and places the mobility and cost burden on the corps. Under this approach, only DSP parts that have had demands in the last 18 months and cost less than $100 would be stocked in the unit ASLs. The remaining DSP parts that have had demands in the past 18 months would be stocked at corps. It was decided to use demands as a discriminator because past analysis has shown that repair-part usage varies from unit to unit depending on several factors, to include maintenance philosophy, vehicle age and training. Any part that has not had a demand will need to be available from wholesale.

This *tiered level approach* will provide the unit with a plus-up to their peacetime ASL that is affordable and will have minimal impact on mobility. The unit can add these DSP parts to their ASL at any time, and when the notice comes to deploy, the majority of the Class IX planning will already be complete. When the notice to deploy comes, corps will be required to order, store and ship the DSP repair parts, although much of the Class IX planning should have been completed with the divisional units, and only minor adjustments necessary. Additionally, the tiered DSP approach will be compatible with the Army's Single Stock Fund initiative which merges the wholesale and retail levels of logistics.

Wholesale Links

As part of the Deployment Stock Package process, the possibility of including wholesale asset availability of DSP stocks on the DSPA has been investigated. The reason for this is threefold: (1) to assist units in planning for deployments by allowing them the visibility of wholesale stocks; (2) to alert the wholesale level of possible shortfalls that will result from a deployment; and (3) to provide wholesale managers with a planning process with which to build the national requirement.

One of the reasons for rolling the DSP requirements up to the wholesale level, besides assisting units in the analysis of their DSPs, is to aid national level managers in justifying the retention of stocks. Currently, there is a war reserve that is rarely used to support the Army during peacetime. This large stockpile of repair parts is set aside to provide support only during times of declared war. Today's Army has not been in a declared "war" for some time, although units are constantly deployed around the world on "peacekeeping" missions and for disaster support. These are just the types of missions which the DSP process can help units prepare for.

Conclusion

Based on the success of DSP concept demonstrations, as well as positive feedback from field units and senior leaders of the Army, efforts to further refine this concept are continuing.

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Potential Basic Research Applications for Reducing Logistics Demand

Introduction

Imagine taking no supplies or repair parts to the battlefield, but instead making them out of available resources through the process of rearranging molecules—one atom at a time. Imagine wounds and fractures being healed in extremely short periods of time—or weapon systems that report readiness and reduce the maintenance requirement to "condition-based" repairs. Better yet, imagine systems that never fail during the entire mission. How about batteries that last days and weeks? Better still, how about creating power by converting human energy? Or how about a computer so small it fits in a package the size of an ammunition pouch, weighs ounces and has supercomputing power? Need supplies sent somewhere? No problem! Have unmanned ground vehicles loaded by unmanned forklifts, and then sent under the watchful eye of a command and control system that has constant real-time visibility of the entire battlespace. Possible? Probable? That depends on where the Army invests its money and what research proves out.

The Army's process of focusing basic research on issues directly related to future warfighting is designed to work toward that end. We must project and sustain the force, while at the same time reducing logistics signature and demand. We should understand the possibilities to reduce the demand on the logistics system that could be available if the research conducted in support of the Army Strategic Research Objectives (SRO) proves to be "doable."

Research—Key To Transformation Success

A key element of the Revolution in Military Logistics (RML) and combat support (CS) and combat service support (CSS) transformation is the integration of technologies to improve logistics processes, streamline logistics, reduce logistics demand, and reduce requirements on the battlefield. We need to define, evaluate and adopt logistics applications from new technologies showing exceptional promise for reducing the amount and costs related to combat support and combat service support requirements. A portion of the solution lies in the application of technologies under investigation within the SRO program. The Army Science and Technology Working Group has selected nine basic research areas for special emphasis.

To appreciate the importance of these SROs with regard to logistics, the reader must understand that in the logistics business, we will continue to change the "how we do it," while keeping the "what we do" constant. The RML depends on the infusion of applications of these new and exciting possibilities. In a recent *Parameters* article, Thomas K. Adams writes, "There is a tendency among strategic thinkers, especially in the military, to ignore or discount the potential effects of technology beyond its short-term applicability to military systems."

As logisticians we need to at least be aware of what these SROs can do. The next several paragraphs briefly define each, and make a case for their application in logistics. These applications are focused on reduced force structure, reduced costs of operation, and dramatically improved support to the warfighter.

Nanoscience simply put, is building things one atom, or molecule, at a time. It is an area with almost unlimited potential. Nanoscience is a rapidly developing research area. Its applications and implications are almost universal. Just think of the possibilities! It is conceivable to picture a situation where we take nothing to the fight but "nanobots"

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that are programmable to make things like food, fuel and parts from the resources in the area. This technology could reduce the logistics footprint significantly.

Biomimetics is the process that enables us to develop novel synthetic materials, processes and sensors through advanced understanding and exploration of design principles found in nature. Biomimetics is *imitating* nature. The uses extend across the spectrum of logistics and combat support and combat service support. Medical applications in use today include immediate repair of broken bones. How about using biomimetic adhesives to "fix" broken or combat damaged equipment? Better yet, how about lightweight structures and components that are "ultrareliable" and frictionless?

Mobile, wireless communications is an area enabling rapid and secure transmission of large quantities of multimedia information from point to point, broadcast and multicast over distributed networks for command, control, communicaitons and intelligence (C^3I) systems. It gets at the need for better communications capabilities. This is the ultimate enabler for split-based logistics operations.

Intelligent systems is an SRO focused on the development of "advanced systems" able to sense, analyze, learn, adapt and function effectively in changing and hostile environments while completing assigned missions or functions. Systems that "think" through the use of knowledge bases and artificial neural networks fit this category. These take the burden off of the combat service support soldier and improve capabilities to provide support. We see in this area the capability for weapon systems to have the "brains" to monitor operational performance and prevent failure by warning the logistics system. These systems can be designed to reduce hazardous exposure during critical repairs or operations.

Smart structures is the SRO which is expected to demonstrate advanced capabilities for modeling, predicting, controlling and optimizing dynamic response of structures. This is a science to study the ability to keep bridges and buildings from routinely collapsing during earthquakes. This SRO investigates improving containers we use to move "things" by making them "smart." These containers would sense shocks, vibrations and temperature. Improved fuel storage capacity and capabilities are not beyond the realm of this research.

Compact power sources is a concern to the logistics and combat service support communities. An important RML franchise area is a reduction in logistics demand and improved performance of compact power. This includes batteries and other power-generating methods, such as human energy conversion, concentrated solar power and miniature microturbines, as well as dramatic improvements in power management design. Research needs to focus on reducing the number and kinds of batteries, the amount of power required and the soldier's ability to safely handle the replacement of power cells. We need to develop more compact power sources. We are moving in that direction!

Microminiature, multifunctional sensor research looks at ways to explore integrated circuit technologies, e.g., integrated microminiature sensors on a single chip. It includes chemical and biological detection, inertial navigation, visual sensing, health monitoring and environmental monitoring. It is logistically important because it improves situational awareness. Also, active protection of people and things means fewer repair requirements. This research will enable better decisions based on better information regarding locations of supplies and capabilities.

Enhancing soldier performance is an area of human research aimed at increasing knowledge. It investigates mental and physical performance, endurance enhancement, stress mitigation, and leadership and training.

Armor material by design is a research effort aimed at making heavy forces lighter and more deployable, and making light forces more survivable. The research will focus on technologies for design, processing system integration and manufacturing to meet performance requirements for mobility and survivability. This will reduce weight, give better fuel efficiencies, provide better protection, and impact on the survivability of CSS soldiers.

Conclusion

These SROs must become "household" terms in the Army logistics community. The RML and combat support/combat service support transformation stretching through 2010 and beyond depends heavily on the successful applications of these SROs as well as other research issues.

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Army Recapitalization Program

The Army's modernization strategy consists of two primary methods to modernize Army equipment: Acquisition and Recapitalization. Recapitalization of aging equipment is the Army's strategy to achieve and maintain an average fleet age at half or below the system's expected service life.

Recapitalization is defined as: "The maintenance and systemic upgrade of currently fielded systems to ensure operational effectiveness and a zero time/zero mile system." The objectives include 1) extending the service life, 2) reducing operating and support costs, 3) improving system reliability, maintainability, safety and efficiency, and 4) enhancing capability.

Recapitalization may include preplanned product improvements (P^3I), extended service programs (ESPs) and major modification. However, these programs alone do not constitute recapitalization unless the system is restored to a zero time/zero mile condition. Equipment fleets whose average age exceeds half of their expected service life and are not programmed for modification, modernization or replacement will undergo a depot rebuild with technology insertion as part of the recapitalization strategy.

The depot rebuild recapitalization standard is defined in Army Regulation 750-1, *Army Materiel Maintenance Policy and Retail Maintenance Operations*, as: A complete end item total tear down and replacement or refurbishment of all expendable components, all aged components, reconditioning of structural components and the procedures identified for overhaul of the end item. Restores the item to a standard configuration installing all outstanding MWOs/ECPs [Modification Work Orders/Engineering Change Proposals] in the process; allows for technology insertion.

Initial recapitalization candidates have been identified and prioritized by the Office of the Deputy Chief of Staff, Operations and Plans (ODCSOPS). A limited number of systems will begin the recapitalization process in Fiscal Year 2001 within the existing depot maintenance budget. However, full-scale production will not begin until FY 2002 with requirements programmed in the FY 2002-2007 Program Objective Memorandum (POM). The following systems have been identified as initial candidates: Abrams FOV, AH-64, UH-60, CH-47, M88A1/A2, M48/M60 AVLB, M9 ACE, M2/M3 Bradley, MLRS, Patriot, M113 FOV, HEMTT, M915, HMMWV, and AN/ASM-190.

In preparation for the recapitalization program, initial work has to be done on the Technical Data Package (TDP). The necessary engineering services needed to assess and revise the Depot Maintenance Work Requirements (DMWRs) and other technical documentation to ensure they meet the recapitalization standard will be funded from the Sustainment Systems Technical Support (SSTS) account. The SSTS requirements have been identified in the FY 2002-2007 POM.

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