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Strategic Logistics for Intervention Forces

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In keeping with its habitual practices of binge and purge--the cycles of mobilization and disarmament that have marked its history for nearly a century--the United States in times of relative peace has tended to disregard the business side of its armed forces. When we eventually confront a threat to vital interests, we spare nothing to provide our warfighters the wherewithal for victory. This practice has produced heroic efforts to create the materiel needed to win--production of liberty ships and aircraft in World War II come to mind--preceded and accompanied by horrendous waste of lives and materiel because we had lacked the means to equip our forces in the first place. And from the Korean War to the 1990-91 Gulf War, apart from prepositioning substantial quantities of materiel on land and at sea, there was little new or creative thinking about how we would sustain a deployed force in the absence of a national emergency.

The post-Cold War force, greatly reduced in size, is now garrisoned primarily in the United States. The Army, with its Title 10 responsibilities to the other services and its involvement in various humanitarian interventions since 1989, has been particularly hard-pressed to improve on Cold War logistics procedures in response to this shift in locations and priorities. We have spent millions to automate existing logistics processes--the acronyms roll off the tongue all too easily--but there has been little refinement of the 20th century's industrial age logistics concept: "Send us a lot of everything and we'll sort it out over here." It was too hard to do otherwise, especially facing interdiction of the sea lines of communication.

The post-Cold War Army is proclaimed to be a "force projection" army, one that can wait in the United States for the call to duty overseas. The problem is that current logistics procedures have not been equal to that mission. During operations in the 1990s, the effectiveness of our automation systems was degraded by our inability to keep track of personnel, equipment, and requisitions. Moreover, an enormous amount of the material shipped to our forces on operations was not readily available to them because of poor visibility of assets in the theater, one of the lingering effects of the misguided "tooth-to-tail ratio" debate. Following the transfer of much of its required logistics support to the reserve components, ostensibly to preserve fighting formations, the Army cannot operate in large numbers overseas without augmentation, notionally from the reserve components, to provide logistics support. Those forces, in turn, may not be made available in the numbers sometimes required without mobilization, and that could require a declaration of national emergency. Civilian contractors in Haiti and the Balkans have been doing the work of many of those reserve component forces; wizards nod and declare it to be a good thing.

This article analyzes the strategic logistics support of several recent force projection operations--Desert Shield and Desert Storm, Restore Hope, Support Hope, and Joint Endeavor--that cover the entire spectrum of post-Cold War interventions. It identifies problems with developing and managing data needed for the interventions, and looks also at compatibility among existing logistics data processing systems. Problems in command, control, and communications and associated training problems are included in the assessment, for all have contributed to the lack of asset visibility in recent operations. The conclusion suggests ideas for modifying existing materiel management systems and for developing new logistics concepts to support Army operations through the first decades of the next century.

Doctrine

Asset visibility, a term roughly equivalent to inventory management, encompasses inventory in motion, including controls during transit of an item of equipment that are supposed to allow the sender and receiver to know the location and status of specific items in that inventory at any time. It also includes the management of materiel items at points of origin and destination. If this sounds a bit like what Fed Ex and its competitors do for a living, that's about right.

Army doctrine on the movement and visibility of assets--passengers and materiel--is found in FM 55-1, which examines transportation requirements and procedures at the strategic, operational, and tactical levels of a deployment. This manual describes the goal of "in-transit visibility" as the "capability, through the range of military operations, to identify and track the movement of defense cargo, passengers, medical patients, and personal property from origin to final destination."[1] Because we are a deployable Army, strategic mobility and strategic movement control loom large in every contingency plan in every one of the joint and service headquarters around the world charged with this planning. Automated management procedures obviously form the backbone for much of the planning. Key among them are these:

. The Joint Operation Planning and Execution System (JOPES) is a command and control system that provides the policies, procedures, and automated support used to develop, maintain, and execute contingency plans. JOPES allows users "to monitor, plan, and execute mobilization, deployment, employment, and sustainment activities associated with joint operations."[2] This system is linked to the Time Phased Force and Deployment Data base.

. The Time Phased Force and Deployment Data base (TPFDD) is the JOPES database for an operation plan. It contains "time-phased force data, non-unit-related cargo and personnel data, and movement data for the operation plan."[3] The TPFDD allows each supported regional commander to develop and refine continually his requirements for units needed to carry out the contingency plans developed through JOPES. The TPFDD is supposed to contain current data from all the services according to unit type, transit time, and the movement priority that places forces in a theater when needed to accomplish a mission. This system, which takes into consideration joint staff and service guidance related to the availability of specific units of all the services, is supposed to be updated continually during planning or when conducting deployments. Because it sustains the planning processes underway in every overseas headquarters, its users strive to ensure that the TPFDD database reflects real priorities for units in all of the services that could be called upon in a crisis as well as the air and surface transportation assets available to move and sustain them during an operation.

Once deployment begins, changes occur in the data contained in the TPFDD: aircraft are delayed, unit equipment is not at the ports of embarkation on time, weather alters flight plans, aircraft encounter maintenance problems, and updates to the system lag behind the flows of personnel and equipment into the crisis area. All such variances contribute to turbulence within the flow of deploying personnel and equipment. This turbulence can be managed only through timely and accurate exchanges of information among participants throughout the deployment and sustainment system. The following analyses of four recent contingency operations suggest that turbulence in the logistics aspects of each operation is attributable largely to three causes: incompatibilities among automated management systems; persistent failures in communications within and between the logistics and operational elements of the deployments; and creative, ad hoc alternative means of communicating between suppliers and consumers--generally developed to overcome the consequences of the first two conditions.

Operations Desert Shield and Desert Storm (Saudi Arabia)

On 2 August 1990 the Iraqi army--battle tested, the fourth largest army in the world--invaded Kuwait and seized control of the Emirate within 24 hours.[4] In response to the invasion, the US military began deploying equipment, supplies, and personnel to strategic seaports and airports in Saudi Arabia.[5] The short notice of deployment, the massive size of the arriving coalition forces, the lack of prepositioned equipment, and the distance between the United States and Saudi Arabia required US logisticians to mass an enormous amount of strategic lift in a very short time.[6]

The US Central Command (CENTCOM) was responsible for logistics management in the theater of operations. It developed policy, and monitored and coordinated transportation and distribution operations. CENTCOM tasked the Army component command with in-theater management of seaports, common-user land transportation, airport operations, and the distribution of common items such as food, clothing, lubricants, and conventional munitions to all services. All are among the functions performed by the Army under the provisions of Title 10 USC for all deployed US forces.[7] US Army headquarters in the region (ARCENT) planned for the ground operation and managed the theater communications zone, which was responsible for coordinating joint, combined, and coalition operations,

including host nation support activities.

Operations Desert Shield and Desert Storm revealed significant limitations in deploying the force and maintaining visibility of the equipment and supplies shipped to the theater. Because of the immediate threat from Iraq, the CENTCOM commander decided early to give first priority for movement to Saudi Arabia to mobile combat units rather than phasing logistics units throughout the flow. That decision to schedule combat service support units late in the deployment sequence seriously affected ARCENT's ability to provide common-user support to other services. Consequently, ARCENT initially had to rely heavily on host nation (Saudi Arabian) assets to support the operation, because US forces had limited in-country capability to store and retrieve equipment and supplies. The decision also allocated the most readily available and fastest strategic lift aircraft to deploying combat units. The low priority assigned to logistics units resulted in a haphazard buildup of the theater support structure; as a result, the inserted force was unsustainable in certain respects during the initial period of Operation Desert Shield.[8]

Weaknesses and shortfalls in theater infrastructure meant that the Army had a significant shortage of surface transportation assets, including heavy equipment transports, tractor trailers, and material handling equipment. And because the Army initially could not fulfill all of its Title 10 responsibilities to the other services in the theater, the Air Force and Marines had no choice but to establish their own transportation systems, further complicating the management of transportation assets.[9]

An automated data management system was supposed to regulate the massive movement of cargo and people into the operational theater. But because CENTCOM did not have a complete Saudi Arabian plan when the Iraqi army struck, the data required to manage the flow of personnel and materiel into the theater were not available in automated form. Most of the movement was controlled manually, with planners improvising the force deployment list even as they called units forward. This lack of automation combined with unanticipated revisions in the deployment sequence of some units to prevent airlift and sealift from operating at full capacity. Some deploying units did not know where and when they were to meet aircraft or merge equipment with departing ships; some planes had to fly empty or with low-priority cargo, while a single unit's equipment might arrive piecemeal on several ships.[10] While the Saudi Arabia deployment was not a real test of JOPES--planners started the operation with an incomplete database--it demonstrated once again the truism that a large intervention operation needs a robust automated management system for the orderly deployment of military units, equipment, and supplies.

Logisticians acknowledged at the time that they were unable to maintain visibility of equipment and supplies arriving in theater. They knew when a ship was scheduled to arrive, but they had only a general idea of its cargo; some ships had incomplete manifests and delivered mislabeled pallets. During the initial phase of the deployment, logisticians at the ports frequently had to empty containers in order to determine the destination of the contents.[11] Because of the constant changes in the deployment sequence, some equipment arrived before the units to which it belonged. Logisticians at the ports of debarkation sometimes did not have advance notice of unit arrivals in Saudi Arabia, nor did they necessarily know their location in country after the units had moved through the airport or seaport. A backlog of supplies piled up at the ports, and inventory control suffered as the iron mountain grew larger with each passing day. Supply personnel quickly became overwhelmed.

During the operation, it is fair to say, whatever system was intended to be used to manage ocean shipping containers, it was ineffective; planned throughput of the entire contents of individual containers became impossible. The Army had no reliable materiel tracking systems, used sloppy documentation procedures, and lacked sufficient materiel handling equipment to move the containerized cargo to appropriate distribution centers. Shippers filled each container, regardless of destination within the theater, to assure maximum use of each ship's capacity. Containers were filled with supplies addressed to several consignees, or their contents were unidentifiable because of inadequate or missing documentation. Because the personnel who were needed to manage and control receipt of the material had not been deployed early, stacks of unprocessed containers piled up in the ports. Lack of documentation further affected the tracking of the supplies. At least 50 percent of the containers arriving in the theater had to be opened to identify and reallocate their contents. And as the lack of material handling equipment and transportation assets caused the backlog at ports to increase, units lost confidence in the system and reordered items they thought had been lost in transit, thereby compounding the resupply problem throughout its entire cycle.[12] Finally, logisticians themselves bypassed the supply system and established direct links with their home bases to obtain high-priority items.

The airlift system also became overloaded and could not keep up with demands; by December 1990, 7000 tons of cargo were on the ground at Dover awaiting shipment to Saudi Arabia, six times the total airlift capacity.[13] Units saturated the airlift system with high-priority demands because they had lost confidence in established logistics procedures and systems. Cargo and supplies were not properly prioritized, which produced backlogs at airports and seaports. In order to clear the ports, the only priority given to cargo was first in, first out. And once the normal airlift system became overloaded, high-priority items were delayed in reaching deployed units. To partially correct the problem, US Transportation Command established the Desert Express System and the Desert European Express System with the mission of delivering overnight from the United States and Europe repair parts designated "critical." Although this management adjustment was successful, it meant that logistics personnel had to bypass established procedures to ensure they could resupply the force.[14] Ingenuity, initiative, and hard work by many dedicated men and women, rather than consistently applied logistical practices, saved the day.

Lack of synchronization in automation contributed significantly to loss of visibility in transit. The major breakdown--between the requesting forward units and the source of supply--had several direct causes in addition to the harsh climate in the region. First, the operation occurred while the Army was upgrading its automated supply requisition system. Second, most of the Army's automated reporting and supply requisitioning procedures worked well in peacetime using commercial communications systems. But the lack of telephone infrastructure in Saudi Arabia quickly produced serious problems for systems that were designed for the US telephone system. Units deployed with automated systems whose software was incompatible with that of supporting systems, resulting in the establishment of at least 26 separate vertically oriented logistics databases within the theater of operations. These "stovepipe systems" ranged from manual to batch processing to on-line systems.[15] Visibility and confidence in the supply system quickly deteriorated.

Operation Restore Hope (Somalia)

In April 1992, UN Security Council Resolution 751 established the UN Operation in Somalia (UNOSOM) with the mission of providing humanitarian aid and facilitating the end of hostilities in Somalia.[16] During the next six months, UN forces, which included a US contingent, delivered and distributed supplies in the effort to end starvation that had killed hundreds of thousands of Somalis before the UN intervened. By December 1992, the security situation worsened, forcing the UN to initiate Operation Restore Hope. The UN accepted the US offer to lead and provide military forces to the multinational coalition established to conduct Restore Hope; to secure air and naval ports; to provide security for key installations and food distribution points; and to provide security for convoys and relief organizations in support of humanitarian relief efforts of the UN and nongovernmental organizations. Between 9 December 1992 and 4 May 1993 this operation involved more than 38,000 troops from 21 nations; it finally succeeded in improving security and providing food throughout much of the country.[17] In May 1993, the UN resumed the mission to provide humanitarian support under Operation UNOSOM II, at which time US participation decreased to logistical support and provision of a quick reaction combat force.[18]

Immediately upon notification of Operation Restore Hope, US Central Command deployed a humanitarian assistance survey team to Somalia and activated a joint task force (JTF) to conduct emergency airlift of food and supplies into that country. In December 1992, CENTCOM ordered the 1st Marine Expeditionary Force to become the nucleus of a combined task force that would support a large-scale humanitarian intervention. Concurrently, the 10th Mountain Division was alerted for deployment with the mission of serving as the headquarters for all US Army forces in Somalia while conducting military operations to provide security for the relief effort underway.[19]

The deployment of forces and equipment to Somalia encountered problems comparable to those that had plagued operations in the Mideast in 1990 and 1991. During the planning phase, the 10th Mountain Division had to contact four different headquarters to determine required force strengths for deployment. Plans for the operation had been developed without input from tactical units, which caused significant problems because the strategic planners did not anticipate the large number of logistics personnel required to support "bare base" logistics operations, particularly at sea and air ports of debarkation.[20] Transportation personnel who were trained to solve transit problems--the "throughputters"--did not deploy early enough to deal with problems at air terminals and seaports. Once again a decision to defer the deployment of logistics personnel in favor of warfighters deprived the force on the ground of the on-site expertise needed to receive, process, and move onward both personnel and equipment. Delays became

inevitable, especially because the host country lacked even the rudimentary infrastructure necessary for terminal operations.

The 10th Mountain Division deployed to Somalia expecting to provide logistics support to its own units, but discovered that it was initially ill-equipped to overcome the logistical nightmare it encountered. It was required to solve quickly many problems associated with the offloading of prepositioned ships and the slow operations of sea and air ports of debarkation, all directly attributable to the late deployment of key transporter personnel. The division was also faced with rapid arrival of Army units, which soon overwhelmed the support capability provided initially by the Marine Corps Force Service Support Group. Therefore, 10th Mountain Division logistics units, which were organized, trained, and equipped to support troops in the field, had to be consolidated and reoriented to perform wholesale logistics functions for the entire theater of operations.[21]

Here the Army discovered again the fact that the Time Phased Force Deployment Data base lacked the flexibility to support a contingency operation such as Restore Hope. Because there was no plan for organizing and deploying a force to Somalia when the need to do so occurred, the deliberate process that was to have controlled the planning for such a deployment failed as those managing the TPFDD tried to cope with continuous change.[22] Participants claimed that the TPFDD remained valid for only a few days at a time; as fast as CENTCOM created a deployment plan, subordinate units made uncoordinated changes. The lack of control and discipline which created changes in the TPFDD meant, for example, that some loaded cargo never left the port of debarkation or had to be unloaded at another port because it was no longer needed in Somalia; there were instances when airlift sent to carry cargo never appeared, and some materiel sent to the country was immediately returned to the United States.[23]

The lack of links among automation systems caused significant problems in asset visibility in Somalia. Unforecasted cargo and inaccurate data were as prevalent as in 1990 and 1991 in Saudi Arabia. The inability of the Joint Operations Planning and Execution System and military standard transportation and movement procedures to exchange data electronically aggravated the loss in visibility, creating conditions in which items could be found only through physical checks of large numbers of containers. For example, at one time the US Army had identified as excess some equipment that the Marines were requesting because of shortages.[24]

Six separate supply support processes emerged during the Somalia intervention; some were both the cause and the consequence of the loss of asset visibility.

. Units used the standard Unit Level Logistics System (ULLS) to request supplies, which transferred requisitions through the direct support logistics unit to the Defense Automated Addressing System for routing to the appropriate national inventory control point.

. Units used email and telephones to pass requests directly to colleagues at their home stations, which meant that the requests were never identified by logistics managers responsible for inventory and movement of materiel.

. Units bypassed local logistics centers and called depots and National Inventory Control Points to obtain the priorities needed to accelerate order processing and to reduce shipping time; while wholesale managers honored the requests, tracking the subsequent shipments was difficult, if not impossible.

. Some units used the UN system to obtain common use items, which was slow to produce materiel of uncertain quality on unpredictable schedules.

. Action officers and general officers in Somalia also used the direct request system, which triggered the movement of supplies without the knowledge of logistics personnel in the theater.

. The Army Materiel Command (AMC) established a backup system among their logistics representatives to obtain supplies in response to direct requests from those in Somalia or others in the resupply chain.

These systems got the job done, but it is obvious that the logistics ADP infrastructure did not perform as expected.[25] Without a senior logistician on the ground in the operational area with the requisite authority, there was no way to discipline the supply system; temporary, nonstandard systems proliferated. Without a centralized theater logistics management system, we not only lose visibility of materiel in the pipeline and in storage at either end of it, but lack the ability to "cross-level" supplies in the theater. In such circumstances, iron mountains inevitably appear on the horizon even as units try to obtain from friends in the United States material already hidden in those mountains.

Operation Support Hope (Rwanda)

On 4 July 1994, Kigali, the capital of Rwanda, fell to the Tutsi-dominated Rwandan Patriotic Front. Thousands of Hutus, fearful of genocide, began to flee to Zaire or to French safe zones in south Rwanda and Burundi. Most fled to Goma in Zaire; camps that appeared almost overnight eventually held an estimated one million refugees. The influx of refugees overwhelmed the humanitarian organizations trying to provide food, medical assistance, and clean water to the camps. By 24 July, US military personnel had deployed to Goma and Kigali in Zaire and to Entebbe in Uganda to establish an infrastructure for humanitarian support operations. Civil-military operations centers (based on a useful lesson learned from operations in Somalia) were established immediately in Goma and Kigali to enable US personnel to synchronize support requirements with the nongovernment organizations operating in the region. US policy at that time can be stated simply: assist the humanitarian effort, take no casualties, and leave as soon as possible. The US logistics effort was carried out under UN control; the primary US mission was to provide clean water, and thereafter to collect and distribute food and other necessities.[26]

Upon notification of the crisis, the US European Command deployed a survey team to provide a continuous on-the-scene assessment of the situation.[27] This early assessment provided essential information to those planning the flow of follow-on forces needed to accomplish the mission; nevertheless, the joint task force commander on the ground found it very hard to influence the deployment of forces as requirements were being identified by personnel in Zaire. The deployment, which was managed primarily by phone, produced the by now familiar delays and inefficient use of airlift. The JTF commander lacked authorization to enter the JOPES system in order to build his force to accomplish the required mission, since existing procedures required that the Time Phased Force and Deployment Data base be used to build force packages, and then only by unified commands. The operation demonstrated that in these types of contingency operations, the joint task force commander--working through the Joint Staff--needs the ability to reach deep into the inventory of US unit structures to tailor the appropriate force.[28] Recognition of this requirement could cause the Army to review how it structures forces and provides data to the TPFDD.

As in Desert Shield and Restore Hope, several commands and agencies provided input to the TPFDD, which created problems in identifying units appropriate for the mission and in planning for their deployment. As the JTF's forward headquarters was trying to adjust the TPFDD and pull units they needed for the mission, the JTF rear headquarters and various supporting commands were pushing units into the theater based on the most recent statement of requirements reflected in the database. Additionally, peculiar to this operation, international relief and nongovernment organization requirements for personnel and materiel were added on top of an already confusing deployment plan without consideration of timing, flow, and dates of arrival. All this resulted in a backlog at ports of embarkation, unnecessary movement delays, and loss of asset visibility. The JTF eventually gained control of the movement by circumventing the TPFDD, substituting teleconferences and daily airlift messages for the automated system that had been designed to support Cold War mobilization and deployment to Europe.[29]

Operation Support Hope experienced problems in asset visibility similar to those encountered during previous contingencies. Once again, logistics units were not adequately prioritized in the deployment flow. The Material Management Center and the Arrival/Departure Airfield Control Group, both of which were required for the Army to provide Title 10 support in the operational area, were displaced by higher-priority units and did not arrive in theater until 21 days after the operation started. Before their arrival there were no transportation specialists in place to receive, process, and move onward the supplies and equipment arriving in Zaire or Uganda.[30] Second, established in-transit visibility procedures could not be followed, which meant that personnel did not use standard cargo documentation and manifesting procedures at departure airfields, resulting in the loss of visibility during the airlift. These problems forced the JTF commander to employ untrained personnel at local airports to meet each aircraft, identify the cargo, break it out, and route it to the intended destinations.[31]

The JTF commander also encountered problems with automated logistics management systems. The commander had no way to track precisely individual aircraft loads and to forecast arrivals because of a problem with the electronic interface between the Global Decision Support System (GDSS) and JOPES. These systems could not provide accurate and timely data on load movement because data from the GDSS was not being loaded into the JOPES to update the TPFDD in a timely and correct manner. Headquarters, Air Mobility Command was responsible for transferring data from GDSS to JOPES, but poor quality input led to the problem identified above. This situation could recur unless we improve the links among strategic airlift, the JTF commander, and customers on the ground, whatever their service or mission.[32]

The automated systems required to sustain the force on the ground in Africa also suffered. During Operation Support Hope, a new tactical requisition system was introduced ahead of schedule in an effort to overcome problems identified in previous interventions, but it could not be used effectively because of delays in establishing the required communications structure. For several days, therefore, the Army was unable to transmit supply and materiel requisitions to the appropriate agencies in the United States or overseas.[33]

Operation Joint Endeavor (Bosnia)

The mission to implement the Dayton agreement of December 1995 fell to NATO, and the United States committed the 1st Armored Division to the operation. The United States also provided augmentation to the headquarters of NATO's Allied Ready Reaction Corps and established a national support element in Hungary and Croatia.[34]

The Joint Endeavor concept envisioned a single US division organized with multiple brigades, numerous corps-level support units directly under division control, and a US Army Europe forward headquarters as the national support element in Hungary and Croatia. The first phase of the deployment of US forces from garrisons in Germany called for establishing a forward headquarters for US Army Europe in Hungary. The commander then expected to deploy engineer and combat units from Hungary to establish lines of communication and bases in Bosnia. Thereafter the bulk of the force would complete deployment to that area. The commander had planned a deliberate and balanced deployment so that he could tailor his forces once in country.

Strategic ambiguity plagued the operation from the start. It did not become clear until the actual signing of the peace agreement what types of forces would be needed to accomplish the mission. When the peace agreement called for the immediate entry of a sizable combat force into Bosnia, deployment plans had to be reconfigured. As in previous intervention operations, this change deferred the planned movement of the essential logistics support personnel to the theater of operations, disrupting deployment activities and once again--all the preparation notwithstanding--creating a logistics shortfall which took considerable time to correct.[35]

The decision to deploy combat forces in the theater at the cost of logistics forces directly affected the sustainment of these same forces once they arrived in theater. Headquarters, European Command used the Logistics Civil Augmentation Program (LOGCAP) to contract with civilian firms to build forward logistics bases as forces arrived in the area. Unfortunately, when LOGCAP's requirements to move supplies on military aircraft conflicted with requirements to move the combat forces, the conflict once again was resolved in favor of combat forces. The ensuing deployment caused a shortage in logistics support; some units delayed deployment or were diverted to other locations until the planned and required logistics bases could be established. In this instance also the task force arrived in country without the majority of its support and Class IX (repair parts) stocks, which meant that if it had been required to transition to combat operations, the force could have found itself with severely reduced combat power.[36] We had again deployed a force with less than desirable sustainability.

Several automated management systems designed to help deploy the force were either overlooked or used inefficiently. A significant failure occurred when we did not use a new system--the computerized movement planning and status system--that could have accepted unit movement data and generated deployment equipment lists needed in the JOPES system. This failure prevented JOPES from automating construction of the TPFDD and precluded designing the projected force in accord with the needs of the JTF commander, planning its movement, and managing its deployment.[37]

Operation Joint Endeavor did, however, benefit from improvements derived from lessons learned during earlier intervention operations. Logisticians sought to achieve total asset visibility by tracking the location, condition, and consignee of supplies and equipment from the factory to the foxhole. For example, logisticians planned to use radio frequency tags, detection devices, and computer systems to track the movement of items through the entire distribution system.[38] Even though radio frequency tags were in fact used during the deployment, for several reasons they did not produce the anticipated visibility of materiel in transit. First, only one station was set up to "load" the tags with the data needed for tracking containers and supplies, which proved to be inadequate to handle the number of containers to be tagged. Second, hardware--in this case, machines to interrogate the tags at various points in the flow of materiel--was not available at all major intersections along the lines of communication to Bosnia, which disrupted the tracking of even those items that had been tagged with radio frequency data. Third, the automated manifest system used by Army direct support units to improve accuracy and to expedite processing of materiel requisitions did not arrive in country until late in the deployment. Therefore, containers received prior to the system's arrival were not processed correctly. Once the automated manifest system became operational, however, personnel using it were able to track and distribute supplies effectively and efficiently.[39]

Trends and Consequences

The US Army has encountered recurring problems in deploying and maintaining visibility of personnel, equipment, and supplies in support of four recent contingency operations. During Operations Desert Shield and Desert Storm, visibility of equipment and supplies arriving in the theater was lost because of incorrect documentation procedures, continuous changes in deployment sequences, incorrect loading and shipping of containers, and lack of standardization in ADP systems--to say nothing of the magnitude and complexity of the operations themselves. The deployment forced CENTCOM to use a manual system to monitor the force planning process in lieu of the inadequate automated system. Lack of automation, along with revisions in unit movement sequences and front-loading of combat units at the cost of deploying key logistics units, produced an austere combat service support environment throughout the operation. It also led to loss of visibility of those personnel and equipment which were not processed correctly; the loss of visibility caused users and logisticians alike to lose confidence in the systems that were supposed to prevent such outcomes.

The same types of problems occurred during Operation Restore Hope. The high priority given to early deployment of combat forces precluded the arrival of transportation personnel to help with the arrival of follow-on forces at aerial ports of debarkation. The TPFDD was dysfunctional; the plan it should have produced had to be built as the units were deploying to the theater of operations and not, as designed, before deployment began. Once again the TPFDD changed continuously; when there was a significant disruption of automation in Somalia, more off-line automation systems emerged than could be managed effectively by those responsible for theater logistics support. All this led to an undisciplined logistics system.

During Operation Support Hope, logistics units were once again not among the first to arrive in the operational area, so the JTF commander was unable to influence from the operational area the onward movement of forces and the arrival of other units. There were significant interface problems with automated management systems along with some careless documentation by those responsible for shipping supplies to the theater of operations. Logisticians once again lost visibility of supplies, equipment, and personnel.

During Operation Joint Endeavor the TPFDD was adjusted three times during the predeployment phase. Combat forces were once again sent forward at the expense of essential combat service support units, producing an unsynchronized deployment and a force in theater whose sustainment initially could not be assured. During the operation, the TPFDD automated system was abandoned and replaced by a manual system for managing the movement of personnel and materiel. Although a system needed to maintain visibility over supplies was deployed, it was not used to its design capacity. Once again we lost visibility of much of what was moving and where it was in the system.

By now we have unquestionably identified the problems, so the challenge is to figure out how to fix them. If we are going to provide adequate logistical support for such operations, we need to make fundamental changes in four areas: structuring the deploying force; data processing; concepts of command, control, and communications; and technology. Improvements in each of these areas are necessary but not sufficient to provide total asset visibility to future planners

and commanders. The whole--in this case total asset visibility--is not only greater than the sum of its parts, it is also different. So in addition to improving the constituent parts, we must eventually develop a more supportable holistic concept for sustaining a deploying force whose home base is the United States.

Structuring the Deploying Force

History has shown that, regardless of the type of operation, combat forces will generally deploy first, even at the cost of the forces needed to sustain them. The TPFDD or its successor will always be subject to modification to meet mission requirements, and human errors will always play havoc with deployment documentation and manifests. We can, however, mitigate the consequences of these circumstances and deploy forces that are sustainable while at the same time meeting the commander's intent regarding the deployment. To do so, logisticians need to consider building a modular combat service support structure within the active and reserve components of the Army. These would be self-contained modules tailored to perform specific functions, such as an aerial port receiving unit or a seaport unloading unit. Each such unit could deploy in small, functionally self-sufficient subsets. The services could then equip the modules with the technology and assets needed to perform their missions anywhere in the world.

Logistics units in the future should be able to talk directly to the national provider in the United States and to the JTF commander, in the first instance to obtain follow-on support, and in the second to keep the commander aware of his logistics capabilities in the operational area. The proposed functional logistics modules will need the mobility to navigate the operational area quickly in response to mission changes. Modules so structured and equipped should then deploy with the combat forces as part of a force package, capable of performing the specific function they were organized and trained to do, austerely to be sure, but at least providing some support where there has been little or none in recent deployments. This approach to force structure is not new; US European Command attempted to use it during the initial deployment for operation Joint Endeavor in Bosnia. It is up to the logistics community however, rather than a deployed headquarters, to build units in accordance with the functions they must perform, while keeping them small and technologically at or near state-of-the-art.[39]

Improvements in Data Processing

Even if the modularity of some logistics assets will allow planners to develop a deployment plan that is as agile as it is responsive, commanders always must be able to alter the sequence of modules within the flow once advance elements of the force arrive in the deployment area. The problem we face is that the present system--the TPFDD--is still linked to Cold War operational concepts; it lacks the ability to handle contingencies such as operation Support Hope on an ad hoc basis. It must evolve into a more responsive system ready to interact not only with service force planners, but also with combatant commanders, joint task force commanders, and the services on a near-real-time basis. That goal requires new concepts for managing assets and new means to so do; what we need, in effect, is a business plan and the means to implement it.

The commander's ability to manipulate the current automated force deployment system or its successor is directly linked to the level of automation support he can count on having available. The proposed goal is simple: enable commanders to obtain and maintain visibility of all assets at all times during an operation, allowing their staffs to influence not only the movement and deployment of initial entry forces but also the flow of logistics throughout the operation. The Joint Total Asset Visibility (JTAV) program, developed in response to the growing importance of asset visibility to a restructured DOD logistics system, has a plan for integrating data sources throughout DOD. The objective of JTAV is to develop a responsive system, easily understood by all, and capable of rapid deployment to contingency areas. And because changes in strategic objectives must be accommodated throughout an intervention, combatant commanders and JTF commanders would be able to use the system to improve planning, deployment, and control of forces and materiel in transit without placing at risk the force already deployed. The concept is to allow commanders to track orders from units, vendors, shipping activities, and port operators throughout the JTAV system; such a system would give materiel managers at the strategic level visibility of all assets not only throughout the JTAV but also throughout service systems.[40] Commanders of joint task forces must have the information base that will allow them to maintain such visibility in an operation from the outset of planning to the arrival at its home station of the last returning unit.

A plan exists to synchronize four existing or planned national logistics systems to meet some of the foregoing objectives. The Logistics Information Processing System would serve as DOD's central depository for information on the status of requisitions. The Inventory Control Point Automated Information System would be the permanent data repository for information on all assets managed by the inventory control points, maintaining visibility on all stocked items from retail to wholesale levels by location and codes. The Global Transportation Network developed by Transportation Command would provide visibility of personnel, equipment, and supplies in transit, to include medical patients. Finally, the joint total asset visibility program would produce the Joint Theater Logistics Automated Information System, which would provide the location and status of in-theater logistics assets.[41]

JTAV will develop, in conjunction with the combatant commanders, a deployable element capable of supporting a large force, one that includes an Army corps, a Marine expeditionary force, a Navy Fleet, and a numbered air force. Deployed units will be able to access JTAV with existing military automated systems, and the staff of a joint task force will be able to access information on supplies in transit and in storage.[42] The system is being designed to process information from US-based sources and merge it with information from in-theater logistics modules, thereby giving the joint task force commander the visibility of all his assets and the capability to manipulate logistics to meet mission requirements.

Command and Control

The objective of controlling agile combat service support modules on the battlefield and of harnessing the power of information technology identifies a requirement for a centralized logistics command and control system. Command structures, such as a joint task force, should include a logistics commander with the automation and trained personnel needed to manage the entire process of sustaining a deployed force. This commander would deploy early to assess the situation, would be able to access data on all logistics assets in the theater of operations, and would have the authority to take immediate action at the strategic level concerning movement of military and civilian personnel and equipment to respond to changes in mission. The proposed automated system described in the previous section would give the deploying force's logistics commander the ability to modify the central planning database--TPFDD or its successor--upon arrival in theater; it would also allow visibility of personnel, equipment, and supplies en route to and from the area of operations.

However, although technology has the potential to give logisticians the ability to know where the assets are at all times, it likewise imposes severe constraints on manipulating or bypassing the system. Given the new capability, a JTF logistics commander will have to establish strict guidelines for local authorization of changes to the deployment of forces and for the reception, processing, and onward movement of logistics assets. Such real-time, on-site control and authority over logistics will be revolutionary. In the past, the big logistics tail could unfortunately wag the much bigger dog of a joint command. With these changes, the bigger dog should be able to wag his tail any time, any way he sees fit.

Technology

Improvements in data processing and management, a subset of the revolution in information technology, can allow logisticians to examine new ways of doing business during contingency operations. Current technology promises to improve logistics systems by giving us total visibility of all assets and by enabling us to process information at unprecedented speed. Careful analysis of the primary logistics requirements in a conflict reveal that, as always, fuel, ammunition, food, and in some instances water create the largest volumes and tonnages required to support any deployment of forces. These requirements will not be affected by the revolution in information technology. Prior to a genuine logistics revolution, the US Army will undergo a deeper technological revolution, one that will reduce requirements for "industrial age" volumes of fuel, ammunition, and food. In other words, an Army After Next will need systems that require very little or no logistics tail in contrast to traditional systems that require extensive logistics support. Once the appropriate systems have been redefined and redesigned, all services will join in procuring and using most of them, rather than each service designing, developing, and deploying unique models. Trucks, helicopters, small arms, and similar common-purpose items of equipment would be likely candidates for evolution and common use. The result will be a less complex logistics system, a small logistics tail, and smaller, lethal, and supportable contingency forces when we deploy them.

Conclusion

Problems in asset visibility, in building and managing time-phased force deployment plans, in automation compatibility, and in concepts of command and control have hampered logistical support to varying degrees in each of the four post-Cold War interventions examined here. Logisticians are aware of the challenges they face to overcome them; the concept of total visibility of the assets of a deploying force is the premise of the emerging Joint Total Asset Visibility system. We can continue to reduce identified problems by building a centralized and permanent command and control system that includes a logistics commander and a logistics force that features tailored logistics modules. This new capability would enable logisticians to take full advantage of the emerging total asset visibility system. To the degree that change can capitalize on the revolution in information technology, it will improve today's logistics systems.

What these improvements will not do is to create the revolution in military logistics which is needed by 2025. That revolution will occur only after our research community provides us with combat equipment that minimizes the logistics tail needed to support it. Inherited forms and functions of combat and conflict resolution must be challenged if we are to reduce the size of the logistics effort needed to support ad hoc military deployments. We need a sustained commitment to design, test, and procure the equipment identified by a comprehensive assessment of how we intend to provide for the common defense in 2025.

NOTES

1. Department of the Army, Field Manual 55-1, *Transportation Operations* (Washington: US Department of the Army, October 1995), p. A-1

2. "DOD Dictionary of Military Terms," on-line at http://www.dtic.mil/doctrine/jel/doddict/data/j/03216.html, accessed 8 October 1997.

3. Ibid., at http://www.dtic.mil/doctrine/jel/doddict/data/t/06049.html, accessed 8 October 1997.

4. Scott W. Conrad, *Moving the Force, Desert Storm and Beyond*, McNair Paper 32 (Washington: National Defense Univ., December 1994), p. 13.

5. US Senate, Subcommittee on Oversight of Government Management, Committee on Governmental Affairs, *Desert Storm Transportation and Distribution of Equipment and Supplies in Southwest Asia*, report prepared by the General Accounting Office, 1991, p.1. Hereafter GAO.

6. Conrad, p. 3.

7. GAO, p. 1. Few inside the military, and far fewer outside it, are aware of the scope of logistics support provided under Title 10 by the Army to the other services. For a representative list of Army Title 10 responsibilities, see David Fastabend, "An Appraisal of `The Brigade-Based New Army,'" *Parameters*, 27 (Summer 1997), 81.

8. Conrad, p. 28.

9. GAO, p. 4.

10. Conrad, p. 25.

11. GAO, p. 7.

12. Conrad, p. 36.

13. Ibid., p. 26.

14. US Senate, *Desert Shield/Storm Air Mobility Command's Achievement and Lessons for the Future*, report prepared by the General Accounting Office, 1993, p.27.

15. Greg R. Gustafson, *Logistics Management Systems in Desert Shield/Desert Storm: How Did They Do?* (Carlisle Barracks, Pa.: USAWC, 1992), p. 12.

16. Kenneth C. Allard, *Somalia Operations: Lessons Learned* (Washington: National Defense Univ., 1995), p. 14.

17. Ibid., p. 16.

18. Ibid., p. 18.

19. Ibid., p. 3.

20. S. L. Arnold and David T. Stahl, "A Power Projection Army in Operations Other Than War," *Parameters*, 23 (Winter 1993-1994), 11. This situation reflected the short reaction time between decision and deployment; it probably indicates that TPFDD records to support such a deployment had not been created. Furthermore, recent operations have clearly demonstrated a need to establish adequate logistics infrastructure in places where one does not exist. The Army has recognized this need and addresses it in the new draft version of FM 100-10-1, *Theater Distribution*.

21. Jeanette K. Edmunds, "Organizing Logistics for Peace and War, the Necessity of a Trained Joint Logistics Support Command Headquarters," in *National Defense University, Essays on Strategy XIII* (Washington: National Defense Univ., 1996), p. 235.

22. David B. Kassing, *Transporting the Army for Operation Restore Hope* (Santa Monica, Calif.: RAND, 1994), p. xii.

23. Ibid., p. 13. See also Arnold and Stahl.

24. Allard, pp. 46-47.

25. Department of the Army, *UNOSOM II Lessons Learned* (Ft. Leavenworth, Kans.: Center for Army Lessons Learned, 1996), p. II-10-21.

26. Edmunds, pp. 139-40.

27. Headquarters, US European Command, *Operation Support Hope, 1994 After Action Review* (Headquarters, US European Command, 1995), p. 2.

28. Ibid., p. 34.

29. Ibid., p. 14-4.

30. Ibid., p. 8-4.

31. Ibid., p. 8-5.

32. Ibid., p. 14-9.

33. Ibid., p. 8-2.

34. Department of the Army, US Army Training and Doctrine Command, Center for Army Lessons Learned, *Operation Joint Endeavor Task Force Eagle Initial Operations* (Fort Leavenworth, Kans.: May 1996), p. ix.

35. Ibid., p. 9

36. Ibid., p. 5.

37. Ibid., p. 13.

38. Ibid., pp. 163-64.

39. See the concept for such a system in Stephen P. Ferris and David M. Keithly, "21st-Century Logistics: Joint Ties That Bind," *Parameters*, 27 (Summer 1997), 38-49.

40. Department of Defense, *Defense Total Asset Visibility Implementation Plan* (Washington: Dept. of Defense: November 1995), p. 1-5

41. Ibid., p. 2-3.

42. Ibid., p. 6-4.

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