ARMY LOGISTICIAN

Supporting Just Cause

ARMY LOGISTICIAN

PROFESSIONAL BULLETIN OF UNITED STATES ARMY LOGISTICS

ARTICLES

DEPARTMENTS

COVER – While most media coverage of Operation Just Cause focused on combat operations in Panama, the key roles played by many combat service support units and logistics activities, both in Panama and the United States, assured success. The articles beginning on pages 2 and 6 discuss Just Cause from the logistics perspective. In the cover photo, a Black Hawk helicopter is offloaded from an Air Force C-5 transport in Panama.

ALOG EMPHASIS

DLA WILL MANAGE DOD CONTRACTS Following up on one of last year's Defense Management Review recommendations, the Department of Defense (DOD) is consolidating virtually all DOD contract administration services under a new Defense Contract Management Command. Under the command of Army Major General Charles R. Henry, the command was established as part of the Defense Logistics Agency (DLA) in February. It will operate through 5 districts (headquartered in Boston, Philadelphia, Atlanta, Chicago, and Los Angeles), which will manage 41 area and 90 plant offices. The services and DLA will report by 31 July on their plans to consolidate and streamline contract administration services under the new command.

LOGEX '90 SCHEDULED This year's logistics exercise, LOGEX '90, scheduled for 10 to 22 June, will simulate operations of a U.S. theater army area command and corps support command and supporting units in the Central Army Group (CENTAG) area of West Germany, Turkish Thrace (the portion of Turkey located in Europe), and France. Participants will be located in Kaiserslautern, West Germany, as well as at Forts Lee and Pickett, Virginia, requiring them to use satellites, data facsimiles, and computer modems for information exchange. Representatives from joint, combined, and national commands will attend. Participants will include approximately 3,000 Active Army and Reserve Component personnel of the 4 U.S. services and members of the armed forces of Belgium, Canada, France, Greece, Italy, Japan, Luxembourg, South Korea, Spain, Turkey, the United Kingdom, and West Germany. The next LOGEX is scheduled for 1992.

TACOM AWARDS ASM CONTRACT The Army Tank-Automotive Command (TACOM), Warren, Michigan, awarded a $33.4-million, 5-year contract for systems engineering analysis to support the Army's armored systems modernization (ASM) program. TRW Systems Engineering and Development Division in California, with support from the Planning Research Corporation, McLean, Virginia, will perform planning, analyses, evaluations, and engineering services to support the development of ASM combat vehicles. The ASM program was formerly known as the heavy force modernization plan.

FM 43-12 UPDATED Revised FM 43-12, Division Maintenance Operations, provides guidance for battlefield maintenance operations in heavy, light, airborne, and air assault divisions. The manual is designed for use by division commanders, motor officers, shop officers, and maintenance managers to keep weapon systems and equipment in mission-capable condition.

Supporting Just Cause

Christmas 1989 will remain a memorable one for many people. For Eastern Europeans, it brought newly gained freedom and hope for democracy. For Panamanians, it marked the end of a dictatorship. For nearly 26,000 troops of all military services, it meant service in the largest U.S. military operation since Vietnam.

But there's a story behind the headlines of air and sea assaults, heroic deaths, and the successful conclusion of combat operations. This is the story of the support for Operation Just Cause.

The four-fold mission of Operation Just Cause was to protect American lives in Panama, to ensure the security of the Panama Canal, to restore democracy in Panama, and to capture Manuel Noriega and bring him to justice.

The tactics of the contingency operation have been well publicized. The plan called for the rapid deployment of a balanced mix of forces, nighttime insertion, and round-the-clock operations. The operation began with three night airborne assaults, in the largest airborne operation since World War II, and ended with the arrest of General Noriega. Such a massive operation, with so little warning, required logistics planning and operations of equal scope, both at the wholesale and retail levels.

Hours before combat troops boarded aircraft bound for Panama, combat service support soldiers were preparing to deploy them. Logisticians assigned to arrival-departure airfield control groups (ADACG's) developed load plans for equipment that would be air delivered or dropped. They also processed paratroopers and other deploying soldiers and their equipment. Some ADACG members deployed to Panama to ensure that air-landed supplies and troops were off-loaded correctly and moved to their appropriate destinations.

Only fully mission-capable equipment could be sent to Panama. To verify that users had properly performed preventive maintenance, members of supply and maintenance assistance and review teams inspected vehicles destined for use in Panama. Additional maintenance was performed by unit mechanics if necessary.

Equipment bound for Panama had to be palletized,
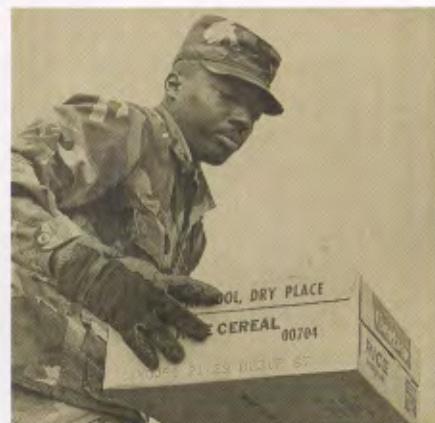
☐ A 1st COSCOM soldier unloads cereal destined for Panama. Processing shipments of food, clothing, and medical supplies was an important role of logisticians on the homefront.

weighed, measured, and inspected. Air Force personnel assisted Army logisticians in safety inspections of cargo at call-forward areas and later ensured that approved cargo was properly loaded aboard C-141 and C-5 aircraft.

To ensure that the deploying soldiers would have the supplies they needed to achieve their mission,

☐ A forklift operator at Defense Depot Memphis, Tennessee (above), moves a pallet of supplies to a truck for transport to Memphis International Airport, where they are loaded aboard an Air Force C-5 aircraft (left) for transport to Panama. Soldiers in Panama would have run out of health and comfort items if it weren't for the 17,500 "care packages" prepared by 1st COSCOM soldiers and Army and Air Force Exchange Service employees at Fort Bragg (below).

supply soldiers and civilian employees at depots across the country worked 24-hour-a-day shifts to fill requisitions. As truck shipments arrived from depots and suppliers, soldiers unloaded, documented, and verified their contents and reloaded the freight for transport to awaiting planes. Supply clerks separated the items, removed the paperwork, and processed the

freight using automated supply systems.

Christmas was an unusually hectic time at Defense depots. (The involvement of Army depots of the Depot System Command is not covered here but is discussed in a related story beginning on page 6.) During Operation Just Cause, the Defense Personnel Support Center (DPSC), in Philadelphia, Pennsylvania, processed about 95 percent of the supply requirements of the Defense Logistics Agency (DLA)— more than $13.3-million worth of food, clothing, and medical supplies to support troops and humanitarian efforts in Panama.

Other DLA centers were just as busy. Across town from DPSC, the Defense Industrial Supply Center processed requests for 27,000 feet of high voltage cable. At Cameron Station, Virginia, the Defense Fuel Supply Center quickly arranged for 1 million extra gallons of JP-4 aircraft fuel to be supplied to Barksdale Air Force Base, Louisiana, and accelerated the delivery of 185,000 barrels of JP-5 aboard a resupply tanker to Defense Fuel Supply Point Rodman. The Defense Construction Supply Center in Columbus, Ohio, processed requisitions for spare parts for Black Hawk helicopters, 5-ton trucks, and high-mobility, multipurpose, wheeled vehicles. The Defense Logistics Services Center (DLSC) in Battle Creek, Michigan, provided the Army Tank-Automotive Command in Warren, Michigan, 24-hour access to

DLSC's logistics remote users system.

The job of filling the orders processed by the DLA centers went to defense depots, where by Christmas Eve hundreds of workers had participated in support efforts nationwide. At Defense Depot Mechanicsburg, Pennsylvania, warehouse workers shipped more than 1,328,500 pounds of materiel to military airbases to be airlifted to Panama for troop support or humanitarian aid. Similarly, workers at Defense Depot Tracy, California, packed ready-to-eat meals and medical supplies and delivered them to Travis Air Force Base for shipment. Defense Depot Columbus, Ohio, provided 10,000 blankets and a variety of other items, including repair parts for commercial vehicles, materials-handling and construction equipment, and weapon systems. Defense Depot Odgen, Utah, shipped items ranging from medical supplies and clothing to repair parts to a military port or directly to units in Panama.

When soldiers from Fort Bragg, North Carolina, deployed to Panama, they left in a hurry, carrying only the most essential equipment. For a prolonged stay, most of them would have run out of personal hygiene and comfort items had it not been for the

☐ At the hot refueling point operated by the 193d Support Battalion, a UH-1 Huey is refueled as a Black Hawk medevac helicopter takes off to resume action.

"care packages" prepared at Fort Bragg. Each of the 17,500 packages contained candy, chewing gum, sewing kits, toothpaste, toothbrushes, dental floss, deodorant, razors, shaving cream, writing paper, pencils, lip balm, sunscreen, hair brushes, and foot powder.

Away from the continental United States supply base, participating in Operation Just Cause in Panama, some of the busiest soldiers were not the combat soldiers but those whose job it was to support them.

A movement control team (MCT) airlanded 12 hours after the initial invasion and immediately took charge of moving and loading equipment. The MCT also ensured that soldiers and equipment that arrived at Howard Air Force Base in Panama were processed and moved to their designated locations promptly.

Using everything from trucks, vans, and buses to standard tactical vehicles, drivers transported materiel and troops where they were needed. Drivers rarely formed organized convoys while delivering supplies, but they usually had a military escort. When the Panamanians who normally drive trucks for the military returned to work after the fighting subsided, Army drivers shifted to riding "shotgun" on the supply trucks.

Ordnance soldiers supplied ammunition to troops fighting in 27 different locations during the first few days of the invasion. One of their primary missions was to conduct aerial resupply – rigging ammunition sling loads for helicopter delivery. On one of the

□ A Black Hawk helicopter of the 7th Infantry Division (Light), Fort Ord, California, is offloaded from an Air Force C-5 aircraft in Panama (left). A 1st COSCOM soldier checks the oil level in his vehicle to ensure it is ready for action (above left). At Torrijos International Airport, soldiers of a 1st COSCOM arrival-departure airfield control group repair cargo pallets (above right).

early days of the invasion, one unit prepared 10 tons of ammunition in 45 minutes in sling loads for three Air Force helicopters.

Other combat service support troops refueled helicopters and operated water supply points, discussed in greater detail in the "Just Cause" article in the May-June 1990 issue of *Army Logistician*.

Even the Army Troop Support Agency's commissaries and troop issue subsistence activities in Panama played important roles in resupplying combat troops and families during Operation Just Cause. Panama Commissary District personnel obtained food that was in short supply, including milk, baby food and formula, and pet food.

No tactical operation is without casualties. The dead and injured were air-evacuated. Two of the three Black Hawk helicopters of the Panama-based 214th Medical Detachment were knocked out of service the first day of the operation, but the 214th's efficient maintenance crew put them back in service the next day. The 57th Medical Detachment arrived in Panama the third day of battle. By that time, much of the fighting had subsided, so the main mission of the 57th was to transport wounded Panamanians.

Operation Just Cause gave medical supply personnel the opportunity to test the theater army medical management information system for medical supply (TAMMIS-MEDSUP). TAMMIS software automates combat patient records, regulates hospital space, tracks blood inventories, and manages other aspects of medical logistics.

In conflicts such as Just Cause, the victor confiscates equipment and ammunition from the conquered. Soldiers in Panama had to sort, classify, catalog, and pack the captured and discovered equipment. Captured equipment included 31 aircraft, 29 armored vehicles, 7 patrol boats, and 20 antiaircraft guns. More than 50,000 weapons were captured.

Combat service support soldiers also inspected, classified, and transported to an ammunition supply point more than 700 tons of ordnance confiscated from militant Panamanian forces. Captured ordnance included multinational mortars, antitank missiles, grenades, mines, and small arms ammunition.

Although the individual units that participated in Operation Just Cause are too numerous to list, it should be apparent from this overview that many people from many different organizations sacrificed time and energy at a very personal time of year to come to the aid of their country. The soldiers who earned the right to wear the Armed Forces Expeditionary Medal made an important contribution to U.S. military history. But let us not forget the others, many of whom were not involved in combat and who did not deploy to Panama, without whom Operation Just Cause would not have succeeded.   **ALOG**

LAO's Role in Just Cause: A

The support provided to the successful operation in Panama led Major General W.A. Roosma, deputy commanding general of the XVIII Airborne Corps, to observe, "Logistics is the strong point of contingency operations." The Army Materiel Command's logistics assistance offices (LAO's) played a significant part in providing that support.

It was the worst possible time of year for the Nation's logistics system to respond to a crisis. An Army materiel management and distribution system dominated by civilians had just entered the Christmas vacation season. "Comp time," "use-or-lose leave," and "liberal leave" policies were being encouraged from the highest command levels for Army civilian employees. Nonetheless, early on the morning of 20 December 1989, the seemingly silent, slumbering giant of the Army Materiel Command (AMC) roared into action. Emergency operating procedures were implemented at AMC headquarters in Alexandria, Virginia, and at national inventory control points and depots from coast to coast. It was the beginning of Operation Just Cause in Panama.

AMC's logistics assistance offices (LAO's) played a significant role in supporting the operation from 20 December 1989 through 12 January 1990. This article explores the support operations at Fort Bragg, North Carolina, and AMC headquarters and, to a limited extent, the operations of other LAO's and AMC's major subordinate commands.

At Fort Bragg, the situation was not encouraging as the operation got underway. Not only were Fort Bragg personnel in the midst of the holiday season, but two training holidays were scheduled during the next 10 days. To compound the difficulties, a major

ice storm and subzero temperatures closed down the Fayetteville area the day before the operation began; only emergency-essential employees (military and civilian) reported to work. The ice was so bad that 321 barrels of deicing fluid were needed on the night of 19 December to prepare planes at neighboring Pope Air Force Base for the flight to Panama.

Once the operation began, the most pressing initial need within the logistics community was for information such as unit troop lists, personnel data, and equipment densities. A zealous, proactive approach in determining who and what needed support set the tone for supporting Just Cause and a standard for supporting future low-intensity operations. There was no time to implement traditional "transition-to-war" plans. Operation Just Cause was planned for short duration (30 days or less) and with precise objectives; AMC's response would have to be just as timely and specific.

Based on the meager information available, LAO-Bragg initiated a limited recall of logistics assistance representatives (LAR's) in the Fayetteville area. LAR's on leave outside the area were called but told not to return to Fort Bragg unless directed. Approximately half of the LAR's at Fort Bragg had leave plans during the period of the operation; however, only two had to change their plans, one of whom had planned out-of-town travel.

AMC's prime source of logistics information was the network of LAO's at those installations hosting units that were committed to Panama. Fort Bragg, which provided the commander and staff for the operation's Joint Task Force from the XVIII Airborne Corps, had the most concentrated and detailed information on logistics status, as well as on such variable conditions as weather and airframe availability that would affect support from the continental United States (CONUS). LAO's at Forts Bragg, Ord (California), Lewis (Washington), Polk (Louisiana), Benning (Georgia), Stewart (Georgia), and Drum (New York) provided information directly to AMC headquarters or through the LAO at Fort Bragg.

Representatives of LAO-Bragg were part of the emergency operations centers (EOC's) of the XVIII Airborne Corps, 82d Airborne Division, 1st Special Operations Command, and 1st Corps Support Command (all headquartered at Fort Bragg). These representatives met at the LAO twice each day to discuss avenues of support. Essential information was passed to AMC headquarters, which in turn passed

CONUS Perspective

by Lieutenant Colonel Joseph A. Malcom

it on to the AMC major subordinate commands and to Department of the Army headquarters. Each EOC representative made recommendations on the direction AMC support should take.

Being the LAO in an EOC can be a frustrating experience. The LAO is the most unusual individual in the room. Everyone else present either is a "regular" member of the staff or represents a unit assigned to the task force. The LAO may be a familiar figure to the G4, but to almost everybody else he is wearing an unknown patch.

Even if the LAO is an accepted member of the staff, he will still face frustrations in receiving requests for logistics support. Those requesting support at the operating level do not distinguish among the sources of that support, whether AMC, the Defense Logistics Agency, the General Services Administration, or Acme Auto Parts. Customers want support and are

☐ A soldier of the 1st Corps Support Command inspects a vehicle at Fort Bragg before it is shipped to Panama.

not concerned with what agencies are responsible for what types of support. General William G. T. Tuttle's comments in the January-February 1990 issue of *Army Logistician* on a "seamless logistics system" are absolutely correct. It is the LAO's job to ensure that commanders are not faced with any wholesale-versus-retail problems; the LAO must work to make the logistics system a "seamless system" of support for those in the field.

When midnight requests for items managed by DLA, GSA, and other components of the national logistics system hit the XVIII Airborne Corps EOC, the question was not who manages the items; the LAO was asked how soon he could get the parts to Fort Bragg or Panama. Fortunately, AMC's EOC was determined to provide support. Kaye Emmons, Bob Porter, Dave Fledderman, Gordon Philippovic, and others manning the logistics assistance desk at AMC took specific requirements, coordinated with other logistics agencies, and had the requested items delivered with great speed. Professional performance prevailed throughout the logistics community and brought numerous positive comments from the field. For example, the deputy G4 of the XVIII Airborne Corps noted that AMC was ". . . responsive 24 hours a day, 7 days a week, and deliveries [were] made in 18 to 24 hours. Not once did the AMC and its LAO's fail to respond."

The major debate at the local LAO level during Operation Just Cause was whether to attempt to "push" parts and maintenance support forward or to wait like the "Maytag repairman" for requests. The solution was a good compromise. "Packages" of parts and ammunition, accompanied by maintenance technicians, were organized and offered, when available, to the task force. This helped streamline the operation and avoided accusations that AMC was a "stovepipe" command. When logistics assets (parts, equipment, *and* people) are known to be available, commanders at all levels are in a position to anticipate problems and respond with precision. Anticipation allows commanders to implement the remaining sustainment imperatives of integration, continuity, responsiveness, and improvisation.

On the first day of Operation Just Cause, the Joint Task Force requested maintenance support from AMC. The Army Aviation Systems Command (AVSCOM) LAR at Fort Bragg, Courtney Fox, was placed on orders to leave for Panama on D+1. Ten

other LAR's at Fort Bragg were also placed on stand-by orders. This began the deployment of more than 25 AMC civilians and contractors from Pope Air Force Base. All but six AMC civilians who deployed to Panama supported Army aircraft. Their accomplishments were reflected in excellent daily readiness reports.

Fox's departure was so early that a centralized procedure for processing civilians for deployment into the hostile environment had not yet been established. Limited availability of passenger seats on military aircraft meant that manifesting individual military and civilian personnel had to be strictly controlled. The manifest system developed by the XVIII Airborne Corps staff proved to be simple and direct. As long as this system was followed, individuals requested or approved by the J4 of the Joint Task Force were manifested as soon as possible. In future contingencies, AMC will need to funnel civilian deployments through a tightly controlled manifest system, probably within the readiness directorates and LAO offices. Anything else will result in delays.

The most interesting case of a civilian passing through Fort Bragg's LAO had to be that of Darryl Bast of the Army Armament, Munitions, and Chemical Command. Bast was on leave en route to Texas when he was stopped by the State Highway Patrol, escorted to Red River Army Depot, Texas, and told to report to Fort Bragg with 500 pounds of test equipment. Civilian aircraft could not accommodate the size and weight of the equipment, so the command plane at Red River flew him to Simmons Army Airfield at Fort Bragg. From there, LAO-Bragg arranged for him to take the next flight to Panama. Local LAR's physically loaded the test equipment on a C-141 transport so that he could make that flight. It was truly a "come as you are" war for Darryl Bast.

Operation Just Cause also broke new ground in supply support. At the request of the LAO, the Logistic Control Activity at the Presidio of San Francisco, California, prepared a daily report on the status of individual requisitions and summary data by Department of Defense activity address code, date, and other categories of information. This report was sent by military network to LAO's, including those in Panama, and provided to materiel management centers directly involved in supporting the operation. Never had there been such detailed information available on a real-time basis.

The logistics system, however, did not function faultlessly. In the area of distribution, there was a tendency to lose visibility of intransit shipments at the ports of debarkation and embarkation. For operations of short duration and low intensity, there has to be a better way of tracking the exact location of individual parts from the initiation of a requisition to receipt of the parts by the using unit. Telling a commander on the ground that a materiel release order has been "cut" or that "we've got good shipping status" is meaningless if the part in question cannot be located at the port.

When the tactical operation was over, the "Fat Lady" refused to sing for the logisticians. Most of the troops came home from Panama, and most of their equipment followed. At that point, logisticians began the work of evaluating damaged equipment and repairing or replacing it. The LAR's at each of the installations that deployed equipment to Panama provided their expertise to logistics personnel at all levels, from the prescribed load list clerk to the national maintenance point manager. Each LAR had gained a renewed respect for his contribution. If the feeling had not been there before, the bonding between LAR's and "their equipment" was solidified by Operation Just Cause.

Lessons Learned

The experiences of Operation Just Cause are still being analyzed and areas needing improvement are being evaluated. The lessons learned will be summarized in a videotape. At the risk of possibly getting ahead of the Army's final recommendations, I believe Just Cause demonstrated that the following areas need attention—

AMC logistics assistance readiness. Classified, close-hold operations will continue to "catch" the Nation, and AMC, by surprise. AMC's participation in major exercises such as Reforger offers excellent training. However, exercises like Reforger, which are scheduled months in advance, do not provide a true test of our readiness posture. To prevent knee-jerk reactions in a crisis, AMC needs to develop emergency deployment readiness exercises (EDRE's) similar

to those used by table of organization and equipment units. The EDRE's will test the ability of AMC and its major subordinate commands to initiate emergency operating procedures in a timely, orderly, and standardized manner.

Such exercises will also ensure that LAO's have their LAR's fully prepared to deploy. The LAO's should adopt checklists like those used by tactical units. These checklists should not only cover alert procedures but also list factors to consider when preparing individual LAR's for deployment, including shots, wills, powers of attorney, clothing, equipment, finances, and physical and medical condition.

Intransit visibility. The distribution system needs a means of providing accurate, timely data on the location of parts and equipment in transit. Aircraft repair parts during Just Cause were particularly sensitive. Unfortunately, there were cases in which parts were known to have been shipped and believed to have arrived in Panama, but no one in Panama knew on which pallets they were shipped, where the pallets were offloaded and stored, or whether the parts were actually picked up by the using unit.

Logistics status reports at the national level. A great deal of logistics information was provided to AMC and to the Department of the Army from the Joint Task Force and LAO's. A composite of this information needs to be provided back down the chain to alert the Task Force and LAO's to the "total picture."

Essential elements of logistics intelligence. AMC headquarters and LAO's need access to intelligence information in order to plan proactively for logistics support rather than react to circumstances. Weather reports, the status of captured enemy weapons, casualty data, and information on the disposition of the Panamanian Defense Force did not seem logistically important on the first day of the operation. However, some of this information proved critical to logistics planning as the operation progressed. For example, adverse weather at four major ports in the United States and in at least two areas within Panama began to have an impact on distribution operations. And the disposition and return of enemy weapons turned out to be a major challenge for AMC. Logisticians need essential elements of intelligence just as critically as the tactical community.

A national logistics decisionmaking tool. The demand for critical parts, equipment, and maintenance support needed in any operation should not come as a surprise to logisticians, nor should support requirements be determined by guesswork. The Army Logistics Center at Fort Lee, Virginia, developed a decisionmaking helper several years ago that used the capabilities of spreadsheet software. Given certain variables (such as climate, troop list, equipment density, and anticipated enemy reaction), the spreadsheet could "predict" how much ammunition, fuel, and other commodities would be needed on a given day of an operation or how many aircraft would be needed to transport a deploying force. The program was extremely friendly for users. Given the experiences AMC has had in Grenada, St. Croix, and Panama, and the other operations undertaken with no notice, we should be able to develop a similar "predictor" for determining AMC support.

By any measure, Operation Just Cause was an overwhelming success. A dictator was removed and a nation was set free. The operation was treated favorably by the local, national, and international media. There were numerous news stories on television, including the tumultuous return of the 82d Airborne Division to Sicily Drop Zone at Fort Bragg in one of the largest jumps since World War II. I listened intently for more than 3 weeks to hear a reporter mention logistics; the word was never spoken. Not once did someone utter the letters "AMC." Logisticians remain the silent partner in success; however, we also remain "the strong point of contingency operations." **ALOG**

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Movement Control: The Quiet Combat Multiplier

by Lieutenant Colonel Walter T. Brown

Nearly every soldier in the Army above the grade of private can talk about the awesome combat power of an Apache attack helicopter or a Bradley fighting vehicle and how they contribute to combat readiness. If you were to ask those soldiers how movement control fits into the total readiness picture, 9 out of 10 times you would probably get some version of what one of my former commanders called the 2,000-meter stare. This lack of understanding of the movement community by maneuver elements has been a source of mistrust and frustration.

Much has been made of the term movement control, and for good reason. First, commanders prefer not to think of themselves and their units being controlled by someone else. Second, any member of the movement community will quickly tell you that he does not control the movement of customers but coordinates or orchestrates their movement. I see those of us in the movement community as the commander's bidding voice for space and time, whether for use on the autobahns in Germany or one of the logistics air missions currently operating in VII Corps, U.S. Army, Europe (USAREUR). Our real challenge is to ensure that we provide the best possible use of available movement assets and their supporting infrastructure. The bottom line is that movement control is a critical link in the total logistics chain.

When requesting transportation movement support, commanders should consider a number of things. Remember, there are not enough military assets to satisfy everyone's movement requirements at the same time, and commercial movement is expensive. The function of a movement manager, or controller, is to balance the needs and priorities of *all* customers. Movement requirements should be identified in clear, concise terms and provided to the supporting movement agency in a timely manner.

Every move supports the training, sustainment, and readiness of our forces, from the retrograde of class IX items to the movement of troops to one of the major training areas. Everything starts with the commander's intent. Based on this, the commander's staff formulates mission requirements and priorities and identifies any special mission support issues. Armed with available guidance and the assistance of the staff transportation logistician, the commander's staff establishes the ground work for a successful move.

Once the unit determines its destination and departure time, what is to be moved, and the means of transportation, the requirements are given to the commander's bidder for space and time, the movement controller, who often must do hand-to-hand combat coordination to get what the commander requires. This statement may seem a bit dramatic, but movement controllers often find themselves in a difficult position as they fight for the use of limited roadways, especially in Germany with its high density of vehicles per highway kilometer. I recognize that the highway is only one element in movement, but it is the element that has caused me the most problems.

The process of planning and conducting unit movement is summed up in what I call the movement pyramid (see chart at right). Developing and coordinating plans for a move start with the commander's intent. The commander and his staff establish requirements, controls, and priorities for the move, while the movement control center (MCC) coordinates the transportation and manages the move.

Functions and responsibilities of MCC's are fairly standard across the Army, although area peculiarities may require some variations. In many respects, the MCC for VII Corps is typical. Functions and responsibilities of the 229th Transportation Center are—

• Coordinate for highway, air, rail, and inland water transportation to support the movement of supplies, equipment, and personnel.
• Develop and monitor the execution of movement programs for VII Corps in peacetime and wartime.
• Adjust the corps distribution pattern.
• Provide effective movement management for programmed and nonprogrammed movement requirements.
• Supervise and provide guidance to all assigned and attached movement control teams.
• Trace, divert, and stage intransit cargo.
• Maintain a liaison with and obtain necessary support from transportation elements of other U.S. Armed Forces in USAREUR, allied forces, and host

Pyramid diagram (bottom to top)

Commander's Intent (base)

Left	Right
Establish mission requirements	Identify desired route

| Start-Stop Time | Identify rest halt requirements | Internal Movement Control |

| Identify logistics support requirements | Establish movement priority |

| Submit standardization agreement | Prepare for move |

— *Commander's Control*

| Verify standardization agreement | Map reconnaissance of route |

| Verify road availability | Alert support base | Cut march credit |

| Issue credit | Activate control and support |

— *Movement Control Center Assistance*

Convoy Start

Convoy Completed

— *Commander's Control*

Objective Reached (apex)

□ **Elements involved in planning and conducting unit movement.**

nation transportation agencies.
• Establish main supply routes and coordinate the use of out-of-sector supply routes.
• Develop and execute the highway regulation plan for VII Corps.
• Manage the VII Corps convoy monitoring program.
• Coordinate the development of corps wartime deployment plans.
• Implement and enforce peacetime highway regulation requirements.
• Conduct a VII Corps "go-to-war" inspection of deployment plans.
• Operate a training program for traffic management coordinators from supported units.
• Manage the use of commercial containers in VII Corps.

Movement controllers can make their job easier by discussing and coordinating issues with the right people and training those who do not understand the difficulties of providing movement support. Com-

manders and staff planners can assist by ensuring that their transportation logisticians participate in all mission, exercise, and training sessions. Their input may prevent backtracking and second-guessing later. Transporters should aggressively participate in these sessions to provide their expertise to commanders requiring unit movement support.

Movement control, if understood and properly applied, will help our forces stay trained and ready in peace and, if necessary, will function as the quiet combat multiplier to assure victory in war. Total teamwork is the answer. **ALOG**

Lieutenant Colonel Walter T. Brown is the commander, 229th Transportation Battalion, Nellingen, West Germany. He is a Vietnam War veteran and has served as an installation transportation officer, a transportation systems analyst, and a director of logistics.

Coordinating Logistics at the Depot

When the Army Training and Doctrine Command studies how best to counter an enemy threat, often there is a choice between two options—develop a weapon system or improve an existing one. To support either choice, the Army Depot System Command (DESCOM) created centers of technical excellence program managers (CTX-PM's). CTX-PM's ensure that, as part of the weapon system acquisition process, logistics support is planned, developed, and acquired.

The CTX-PM program began in 1981 after an integrated logistics support (ILS) study determined there was a need for it. The program makes a single depot the focal point for a total weapon system. The CTX-PM is the individual who coordinates all support for the system. This arrangement not only facilitates development and fielding of new weapon systems but also provides continuing support to the fielded systems.

The CTX-PM coordinates logistics at the depot. He makes sure integrated logistics support is provided for the total weapon system, not just certain components. He coordinates maintenance, supply, transportation, and quality control for the system.

When prototypes are under construction, the CTX-PM helps determine what will be needed to support the system once it is fielded. This reduces the Army's costs of relying on the manufacturer for support. He ensures that depot-level maintenance and repair capabilities are in place and that training, test equipment, and facilities are adequate to meet the system's demands. After the weapon system is fielded, the CTX-PM takes steps to ensure that technology does not get ahead of employee knowledge and that depot personnel are qualified to handle changes.

The CTX-PM is DESCOM's logistics representative, or point of contact, for the weapon system's project manager and materiel developer. He makes

sure that they understand depot capabilities and make effective use of these capabilities.

CTX-PM's have highly technical backgrounds in fields such as engineering and maintenance. They have years of hands-on experience with new weapon systems. Their knowledge of the development process enables them to organize and control production and better manage production surges when they occur.

CTX-PM's represent and report to the DESCOM commanding general. They are commissioned and have a charter outlining their responsibilities. They are fully empowered to solicit the support of other depots.

The Army currently has 30 CTX systems with at least 1 CTX-PM. Letterkenny Army Depot, for example, has three CTX programs including the M109 self-propelled howitzer improvement program and the Hawk and Patriot missile systems. Because each weapon system is in a different phase of production and requires different types of coordination, there is a CTX-PM assigned to each one.

The howitzer improvement program is entering the production stage. A CTX-PM is coordinating that process and ensuring that the depot is prepared to handle maintenance and repairs of the improved howitzer when it is fielded. The Hawk air defense system, which has been part of the Army since 1958, has gone through four modernization programs. Each time a modification is made, the CTX-PM ensures that
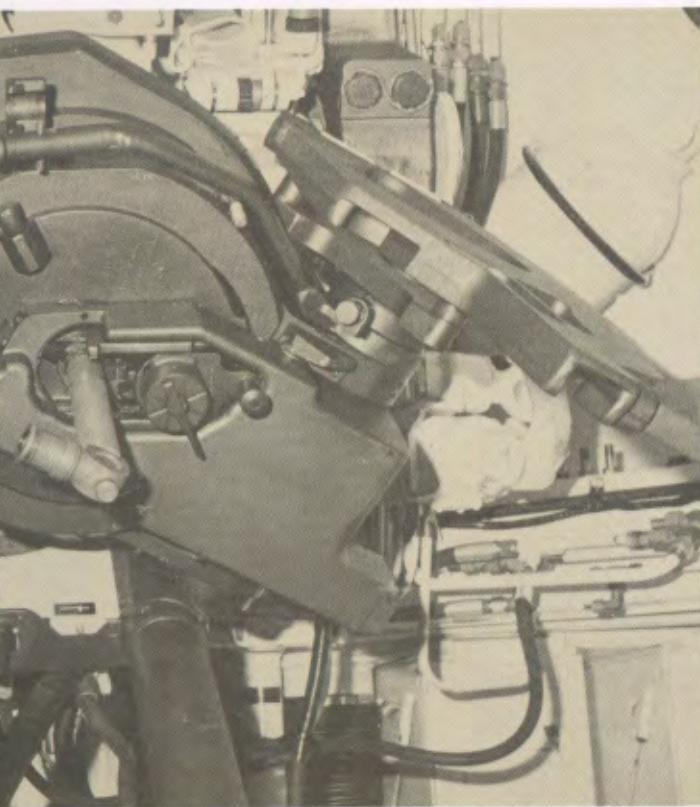
□ The center of technical excellence program manager (CTX-PM) for the Patriot missile system (above) examines the power supply unit attached to a Patriot launcher. The Army has 30 CTX systems (right) with at least 1 CTX-PM.

depot-level maintenance and training are upgraded to keep up with current technology. The Patriot missile system is modified and upgraded as needed. Because Patriot radios are repaired at Tobyhanna, generators are repaired at Tooele, supplies come from New Cumberland, and missiles are certified at Red River, coordination is complex. The Patriot CTX-PM has a steering committee to help coordinate depot support with the contractors, other depots, and support activities involved.

Depot and shop personnel have the technical expertise and years of hands-on experience with weapon systems. It is important to retain that expertise and build on it. The CTX-PM program is one way the Army is doing that.   ALOG

Systems with CTX-PM Support

Depot	Materiel
Anniston	M1/M1A1 Abrams Tank Hellfire Missile System Army Tactical Missile System (ATACMS)
Corpus Christi	AH-64A Apache Helicopter UH-60A Black Hawk Helicopter Light Helicopter (Airframe and Powertrain)
Letterkenny	M109 Howitzer Improvement Program (HIP) Hawk Missile System Patriot Missile System
Red River	M2/M3 Bradley Fighting Vehicle Multiple Launch Rocket System (MLRS) Fire Support Team Vehicle (FISTV)
Sacramento	Firefinder Radar System (AN/TPQ-36/37) Light Helicopter (Electronics and Avionics)
Tobyhanna	Electronic Switching System (AN/TTC-39) Electronic Switching System (AN/TYC-39A) Digital Group Multiplexer (DGM) Single-Channel Ground and Airborne Radio System (SINCGARS) Regency Net Communications System Integrated Family of Test Equipment (IFTE) Single-Channel Objective Tactical Terminal (SCOTT) Surveillance Target Attack Radar Subsystem (Joint Stars) All-Source Analysis System/ Enemy Situation Correlation Element (ASAS/ENSCE) Defense Satellite Communications System (DSCS) Enhanced Position Location Reporting System (EPLRS)
Tooele	Heavy, Expanded-Mobility, Tactical Truck (HEMTT) Armored Combat Earthmover (M9 ACE) High-Mobility, Multipurpose, Wheeled Vehicle (HMMWV) Family of Medium Tactical Vehicles (FMTV) M939 5-Ton Series of Trucks Heavy Equipment Transporter System (HETS)

Inland Waterways—

by Lieutenant Colonel Richard F. Wollenberg and William H. Ferguson

Deploying a brigade task force
to Fort Chaffee led
to the first barge movement
by an Active Army unit
since World War II.

In August and September 1989, the Army's 101st Airborne Division (Air Assault) deployed the equipment of a brigade task force and two UH-60 Black Hawk helicopters from its base at Fort Campbell, Kentucky, to Fort Chaffee, Arkansas. The task force was going to Fort Chaffee to participate in a Joint Readiness Training Center (JRTC) exercise. There was something different about this deployment, however. The division did not move the task force's equipment by the usual means of air, railroad, or highway. Instead, the 101st used barge transportation on the inland waterway system.

Although barge travel had been used successfully by Army National Guard and Army Reserve units from Oklahoma and Texas in making small-scale moves to such destinations as Camp Grayling, Michigan, and Fort Chaffee, not since World War II had an Active Army unit in the continental United States moved by barge. And never had a barge movement the size of the 101st's been attempted.

The Fort Campbell Directorate of Logistics (DOL) already was exploring the feasibility of using barges as an alternate means of transportation when the deployment to Fort Chaffee was scheduled. Two factors had generated the directorate's interest in barges. The DOL staff knew that adequate rail, highway, and air resources might not always be available to support deployment requirements of full mobilization. Experience in moving by barge could prove valuable in future contingencies. Using the inland waterways would provide Fort Campbell with an alternate transportation capability to such recurring exercise destinations as Fort Chaffee and Camp Grayling, as well as access to several major Gulf Coast ports that would be used for an oversea deployment. The staff also knew that increasing commercial transportation costs made it prudent to search for the cheapest means of transportation available.
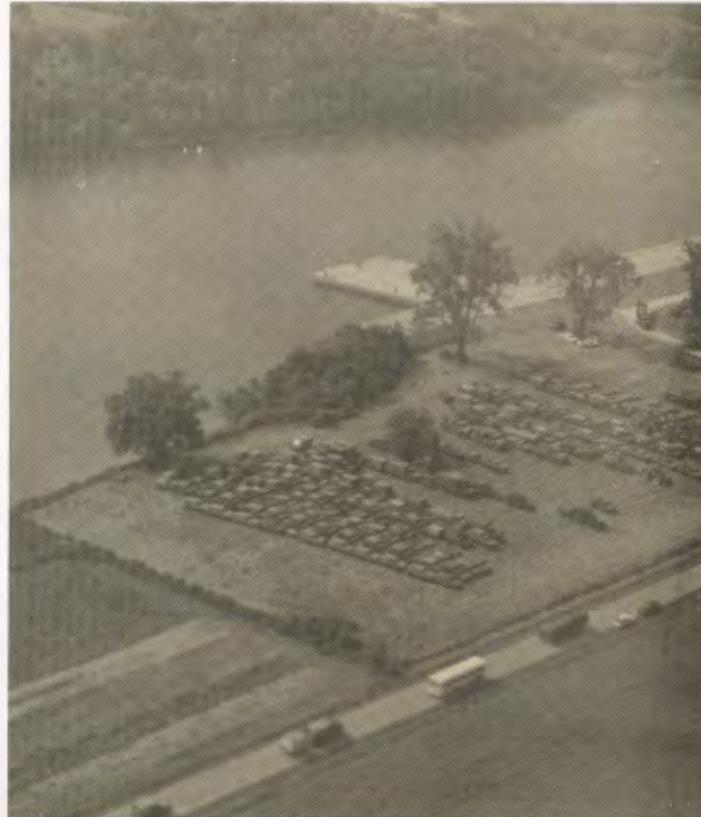
Initial estimates by DOL indicated that barge travel was cost effective and could meet the division's requirements; transit times by barge were competitive with those of other modes of transportation; loading and unloading times would be less for barges than for other modes; and the need for blocking, bracing, and tie-down materials would decrease significantly since only the first and last rows of vehicles on a barge would need to be secured. As a bonus, using barges would improve security (because the barges, once underway, would be inaccessible from land) and greatly reduce intransit damages to the equipment

JULY-AUGUST 1990

A Deployment Alternative

□ **The load site at old Lock "C" on the Cumberland River was a short drive from Fort Campbell. In the inset, a truck towing a water trailer crosses a bridge section onto a barge.**

onboard (because the barges would be constantly in motion, not always stopping and starting).

Once the initial concept for deploying by barge had been developed, we realized that the only true method of determining its feasibility was to conduct an actual barge operation. The scheduled deployment of the 101st Airborne Division's 2d Brigade to Fort Chaffee offered an excellent opportunity to test the concept under actual deployment conditions. The DOL accordingly prepared a staff paper summarizing all available information on barge movement.

An already existing load site was available at Lock "C" on the Cumberland River, an old, dismantled river lock just 10 miles from Fort Campbell's rear gate. The 372d Transportation Company (Terminal Transport) of the Corps Support Brigade's 29th

Transportation Battalion had previously conducted successful barge-loading training exercises at the site. The relatively short distance to Lock "C" helped prevent congestion over the highway as convoys of vehicles traveled to the load site.

Once command approval was obtained to move the 2d Brigade task force over the inland waterways to Fort Chaffee, a series of activities began to ensure that the movement would proceed in an efficient and responsive manner.

The DOL's Installation Transportation Office (ITO), working closely with the Division Transportation Office (DTO), coordinated the units and activities involved in the move. The 2d Brigade provided the transportation offices with equipment density lists that formed the basis for developing barge loading plans. Movement requirements were provided to the Military Traffic Management Command (MTMC), which obtained the necessary equipment and selected a barge operator to handle the move.

The Army Corps of Engineers, already experienced in barge operations as a result of the Army National Guard and Reserve exercises, provided guidance on load requirements and operations and offered assistance in preparing the load site at Lock "C." Fort Campbell's 20th Engineer Battalion developed an access road to the actual load point, constructed a bridge from the ramp to the loading platform, and assembled bridging materials for use as needed. The 372d Transportation Company, as a result of its experience in barge loading exercises, assumed control of the load site and conducted the actual loading operations.

Personnel from the ITO and DTO were sent to Fort Chaffee to survey the area where the barges would discharge and to begin coordination with the Fort Chaffee ITO and the JRTC's receiving activity. After these consultations, all parties agreed that offload operations should be split between two separate points, at the city of Fort Smith, Arkansas, and at Camp Gruber, Oklahoma.

In August, MTMC notified Fort Campbell's ITO that Canal Barge Company, Inc., of New Orleans, Louisiana, had been awarded the contract for the move to Fort Chaffee. Meetings were then held with Fort Campbell activities, the Corps of Engineers, the U.S. Coast Guard, and Canal Barge Company repre-

□ One of the two Black Hawk helicopters is secured on a barge for its journey from Fort Campbell to Fort Chaffee.

sentatives to coordinate the movement. Canal Barge Company had been involved with earlier National Guard and Reserve moves to Fort Chaffee, so its representatives were able to provide information and guidance that improved the conduct of the 101st's move.

As the actual dates for loading the barges approached, plans were finalized and the loading site readied. On 28 and 29 August, deploying vehicles were convoyed from Fort Campbell to the staging area at Lock "C" to prepare for loading. Fort Campbell's law enforcement personnel used the opportunity to practice traffic control procedures under deploy-

ment conditions. Military police traffic control points were established along the entire route of the convoy, from the installation to the load site. Police were also stationed at the load site to control access.

The 801st Maintenance Battalion established a "quick-fix" team at the load site to ensure that any unanticipated maintenance problems were quickly resolved and did not interfere with loading operations. The vehicles were segregated at the staging area by destination and load sequence so they could be called forward and loaded on the barges in a smooth, uninterrupted flow. The 501st Signal Battalion established communications links between the load site and the installation. The 326th Medical Battalion manned an aid station and medical evacuation helicopter to provide emergency medical treatment in the event of injuries.

On Monday, 28 August, Canal Barge Company began positioning the barges to make them accessible for loading. The towboats *Elizabeth Lane* and *Walter Hagestad*, which had brought the empty barges to Lock "C," would be used to transport the vehicles and aircraft to Fort Smith and Camp Gruber. The U.S. Coast Guard District Office in Paducah, Kentucky, dispatched a boat to control river traffic and provide escort service to the final destinations. Army Corps of Engineers personnel were standing by to monitor the departure and to expedite lock operations en route. The Corps of Engineers provided surveillance along the entire route to monitor the progress of the barges and establish their exact location at any given time.

Following preliminary loading and safety instruc-

□ Two towboats moved the 41 barges over 800 miles on the inland waterways to Arkansas and Oklahoma. A total of 688 vehicles and 2 aircraft were moved on the barges.

tions, loading finally began on 29 August. The entire operation proceeded even more smoothly than anticipated. Facing the challenge of a previously untested deployment operation, everyone from planner to stevedore, logistician to infantryman, put forth maximum effort to accomplish the task at hand. Everyone involved displayed a positive, "can-do" attitude as the vehicles rolled forward and were positioned aboard the barges.

On 30 August, loading was completed and the barges prepared for departure. The high point of the day brought applause from the crowd at the site when members of the 6th Battalion, 101st Aviation Regiment, landed two UH-60 Black Hawk helicopters on the barges. The helicopters were then secured for the trip. At 2130 on 30 August, the *Elizabeth Lane* and the *Walter Hagestad* pulled away from Lock "C" and began their 829-mile journey over the Cumberland, Tennessee, Ohio, Mississippi, and Arkansas Rivers to their destinations. The departure was made 1 full day ahead of the scheduled date.

In all, 688 vehicles and 2 aircraft, weighing in excess of 8 million pounds, were moved on 41 barges. The first flotilla of 19 barges arrived at Fort Smith on Wednesday, 6 September, while the remaining 22

barges docked at Boudinot Safety Harbor at Camp Gruber the following day.

The successful completion of this operation demonstrated that barge movement over inland waterways is a viable deployment option. The move also provided invaluable training in inland waterway operations for the soldiers and activities involved. The soldiers of the 101st Airborne Division, together with the supporting Fort Campbell tenant units, showed that they were fully capable of accomplishing their deployment mission by using a new and untried transportation concept. **ALOG**

Lieutenant Colonel Richard F. Wollenberg is the director of logistics at Fort Campbell, Kentucky. He holds a bachelor's degree from North Dakota State University, in Fargo, and a master's degree from Troy State University in Alabama.

William H. "Bill" Ferguson is the installation transportation officer at Fort Campbell. He is a retired Army logistics noncommissioned officer.

Lessons Learned by First Lieutenant Jeffrey W. Ridenour

The 372d Transportation Company (Terminal Transport) played a significant role in supporting the 2d Brigade task force's deployment to Fort Chaffee. Because the barges were bound for two destinations — Fort Smith and Camp Gruber — vehicles had to be loaded correctly to ensure delivery at the proper site. By participating in an exercise of this magnitude, company personnel learned several lessons that will improve inland waterway terminal operations in the future —

• Deploying units must adhere as closely as possible to their scheduled times for arriving at the loading site to avoid both congestion and delays while cargo is inspected and documentation is reviewed.

• Marshaling vehicles by destination and type is the only way to effectively handle large quantities of vehicles at a loading site.

• An adequate supply of flotation devices for personnel is a must, especially if there are many vehicle drivers.

• Upon arriving at the terminal marshaling area, equipment to be moved by barge should be prepared for over-the-road movement according to FM 55-30, Army Motor Transport Units and Operations. Equipment should be inspected before it is accepted for

loading by the terminal operators.

• An onsite maintenance team is invaluable for maintaining an uninterrupted flow while loading vehicles.

• A centralized command post is necessary for effective control, especially if stow plans or loading procedures change. Hand-held radios can provide the communications essential to centralized command and will greatly increase the efficiency of the operation.

• Access to barges must be tightly controlled. If too many people occupy the restricted space on the barges, a safety problem can result.

• Common stevedore equipment is a must.

• Stow plans are valuable guides during loading, but the plans must have correct vehicle dimensions.

First Lieutenant Jeffrey W. Ridenour is a platoon leader in the 372d Transportation Company (Terminal Transport), Fort Campbell, Kentucky. He served as barge site and loading officer-in-charge for the 2d Brigade task force deployment.

Army Logistician acknowledges the assistance of Lieutenant Ridenour in providing the aerial photographs on pages 14 and 16.

Ten Keys to Reforger Success

by Major Jon H. Moilanen

Exercises like Reforger allow leaders to experience and solve myriad problems that occur in operations. The author discusses his experience with some of these problems and identifies 10 ways to correct them.

The 3d Armored Cavalry Regiment (ACR) was one of the major combat forces participating in Reforger '88. Reforger (Return of Forces to Germany) is an exercise that demonstrates our ability to rapidly reinforce the nations of the North Atlantic Treaty Organization and protect the democracies of Europe.

Starting in late August 1988, over 3,600 troopers of the 3d ACR deployed from their home station at Fort Bliss in El Paso, Texas. Air Force and chartered U.S. commercial aircraft transported most of the troopers. The majority of the equipment was transported by rail to gulf seaports and sealifted to a western European port.

By early September, the regiment had massed in West Germany. Third ACR soldiers linked with equipment stored as pre-positioned materiel configured to unit sets (POMCUS). Squadrons, troops, and companies of the regiment readied the POMCUS equipment, as well as equipment the unit brought from the United States, and moved by road, rail, and air from marshaling areas to a tactical assembly area in the corps area of operations.

Logistical deployment, redeployment, and tactical operations of the 3d ACR demonstrated the usefulness of the regimental mission-essential task list. As a reinforcing major subordinate command to V Corps, the 3d ACR accomplished assigned offensive and defensive missions while initially under the operational control of the West German 10th Panzer Division, and subsequently the U.S. 8th Mechanized Infantry and 3d Armored Divisions.

Reforger '88 was an essential training and readiness challenge for the 3d ACR that focused attention on deployment issues and the importance of their early resolution. Several events stressed the ACR's ability to execute its plans effectively and resulted in significant lessons learned. These lessons provide keys for success in future Reforgers (see chart on page 20).

Mission Statement

Timely receipt of the mission statement from the gaining command in U.S. Army, Europe (USAREUR), is essential. Units require the mission statement early in the planning process. A clear mission statement allows unit planners to identify requirements. Training programs at the home station focus on stated or implied tasks from the mission statement. Additionally, task organization is tailored to enhance mission success. These fundamentals are eventually balanced with troop strength and equipment allowances.

In Reforger '88, the gaining corps was late in sending a specific mission statement to the 3d ACR. The lateness forced regimental planners initially to use assumptions that were developed from previous Reforger notes and experiences. During reconnaissance, conducted about 6 months before Reforger, 3d ACR planners became aware of the tendency of action officers outside the continental United States (OCONUS) to focus on current command post or field training exercises. This may have been due to the narrow attention paid by the corps
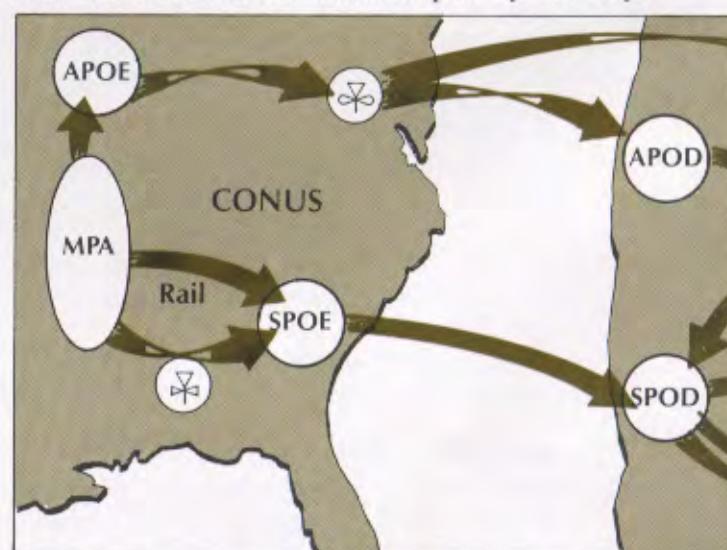
☐ The 3d ACR deployment model for Reforger '88.

to some reception and redeployment actions.

POMCUS Equipment

The type and quantity of weapon systems and equipment that will be available for issue from Combat Equipment Group, Europe (CEGE), POMCUS sites must be identified early in the Reforger planning process.

In Reforger '88, conflicting guidance to reinforcing units on the availability of POMCUS equipment hampered a building-block approach to assess combat capability and task organization.

Automated Unit Equipment List

Once the available POMCUS is confirmed, units must establish how much equipment can be deployed from the United States to compensate for POMCUS shortfall. This shortfall is identified on the automated unit equipment list (AUEL), which is used to program the surface transportation of required materiel from the CONUS station to its European seaport destination. The type and quantity of available POMCUS equipment listed on the CEGE hand receipt must be accurate and stable before a final AUEL commitment is made.

During Reforger '88, a final AUEL was decided about 60 days before strategic deployment started. The POMCUS equipment on the CEGE hand receipt continued to change after the final AUEL was decided. This resulted in late changes to shipping manifests and theater movement requests for equipment from the continental United States (CONUS).

Some units minimized the significance of projecting who would operate vehicles based on available troop strength for deployment. Some units attempted to change equipment densities for less than critical

reasons. In addition to these struggles, there were the peacetime restrictions due to strategic sealift and airlift costs.

Authorized Personnel Strength

Authorized personnel strength for deployment, often referred to as ramp strength, must be confirmed early in the planning cycle.

In Reforger '88, current manning shortages and projected regimental requirements for fielding the M3 cavalry fighting vehicle denied planners the ability to easily confirm the regimental ramp. Ramp fluctuated from an initial planning low of 3,000 to a directed high of 3,800. Eventually the regiment was granted a ramp of 3,650. When projected replacements failed to provide the required manning strength for Reforger, Reserve components were superb in fielding essential combat arms, combat support, and combat service support skills for the regiment.

Communications Upload Plan

The communications upload plan (CUP) for POMCUS must be a well-coordinated effort between CEGE and supported units. Early acknowledgment of capabilities by both commands will facilitate the CEGE installation and operational readiness of communications systems.

Reinforcing units should make the CUP a major topic at the initial Forces Command (FORSCOM) action agent conference. Understanding the requirements and capabilities can ensure accurate AUEL densities of vehicles and communications equipment. The CUP should be reviewed in minute detail with CEGE action officers during an OCONUS reconnaissance, and a physical inspection at the POMCUS site should confirm the upload status of communications

Legend

MPA	Movement Preparation Area	**TAA** Tactical Assembly Area
APOE	Aerial Port of Embarkation	fixed-wing refuel
SPOE	Seaport of Embarkation	rotary-wing refuel
APOD	Aerial Port of Debarkation	maintenance halt
SPOD	Seaport of Debarkation	bridge
DHA	Driver Holding Area	ferry
VHA	Vehicle Holding Area	
CEC	Combat Equipment POMCUS	fixed-wing axis
MA	Marshaling Area	rotary-wing axis

systems.

In Reforger '88, several discrepancies in unit requests caused CEGE to take unilateral actions late in the planning process. POMCUS site companies were directed by CEGE to determine communications requirements without the coordinated input from the regiment. This caused the regiment to consume excessive time in the marshaling area reconfiguring equipment to requirements for regimental command and control.

Property Accountability

Accurate property accountability is a mandate that requires active support at every level of command. Initial property accountability for 3d ACR was conducted with various degrees of success. The type and quantity of POMCUS equipment listed on the CEGE hand receipt changed often before deployment. This turbulence adversely affected the type and quantity of equipment that was actually issued during the POMCUS deployment.

The POMCUS inventory plan had problems. Some of the last ACR units to receive POMCUS did not have sufficient time to properly inventory property in the marshaling area due to delayed strategic airflow, whereas some units did minimal inventory in the marshaling area due to muddy and rainy conditions. CEGE hand receipts had some posting errors that were further complicated by unit representatives making untimely changes to their hand receipt.

Some accountability had to revert to manual inventory measures when the logistics applications of automated marking and reading symbols (LOGMARS) techniques would not function correctly for the property book officer at the POMCUS site. Although LOGMARS is a proven time-saving system, the regiment experienced bar code labels that would not cling to equipment and bar code readers that would not register the laser-read identification.

The authorized stockage list (ASL) and prescribed load lists (PLL's) for repair parts in POMCUS were a significant issue. The POMCUS PLL's for some of the units had incorrect parts for the type of equipment to be supported. Many loads were at a very low onhand quantity until late in the planning process for deployment. Low confidence in CEGE stocks caused the regiment to deploy the required ASL and PLL's from CONUS.

Additionally, uncertainty on CEGE final turn-in standards encouraged more reports of survey for clearance processing than would be expected normally.

In the future, the initial FORSCOM action agent conference should identify uniform standards on equipment availability, preventive maintenance schedules, and POMCUS turn-in criteria. This will ensure more credible property accountability.

COSCOM and ASG Coordination

The reinforcing unit and the supporting corps support command (COSCOM) agencies must verify that logistics accounts and supporting automated data processing are established and functioning properly. In Reforger '88, 3d ACR accomplished proper coordination with the COSCOM; nevertheless, human and system errors within the regiment and the COSCOM, as well as failure to effectively troubleshoot support problems in a timely manner, created a crisis management situation. Procedures for requisitioning repair parts were unacceptable and materiel readiness suffered.

Units must conduct logistics reconnaissance with supporting agencies, understand and support the required automation interface, and develop a contingency plan to use when the primary systems fail. The most important factor in programming these support mechanisms is face-to-face coordination between area action officers before, during, and after the training exercise. During Reforger '88, logistics intelligence updates could have minimized several significant sup-

Ten Keys to Reforger Success

• Receive the mission statement early in the planning stage.

• Identify POMCUS equipment early.

• Confirm the availability of POMCUS equipment before the final automated unit equipment list is committed.

• Confirm the authorized personnel strength early in the planning cycle.

• Coordinate unit communications equipment requirements in detail with the CEGE.

• Ensure that accurate property accountability procedures are followed in all phases of equipment issue and turn-in.

• Coordinate among the corps support command and area support group action officers before, during, and after the exercise.

• Monitor for force modernization differences in unit equipment requirements and POMCUS availability.

• Ensure deployment by unit-line-number sequence.

• Identify movement requirements in exacting detail.

port issues with the COSCOM and its area support groups (ASG's).

Thorough coordination with the ASG's of the theater army area command (TAACOM) is essential for effective theater deployment actions. During Reforger '88, ASG's changed published plans for seaport operations, overnight and maintenance sites along convoy routes, and redeployment assembly areas. In some cases, excellent support plans existed for reinforcing units; however, units had great difficulty in gaining this intelligence in a timely manner.

Each node in the reception plan should be briefed in detail during the USAREUR planning conferences by the person in charge of that operation. Reinforcing units must visit each site and exchange plans and concerns with the supporting units. Issues can be surfaced early in the preparation phase for mutual resolution.

Force Modernization

Force modernization must be considered when assessing combined arms configuration and the ability to sustain. Careful monitoring of force modernization fielding in POMCUS is key to effective systems employment for POMCUS equipment shortfalls.

Differences in 3d ACR fielding schedules in the United States for combat systems and support systems affected task organization for Reforger. The 3d ACR is authorized the M3 cavalry fighting vehicle and the high-mobility, multipurpose, wheeled vehicle (HMMWV) but had not fielded the systems in CONUS. During Reforger, a misunderstanding of POMCUS hand receipts and site inventories by the regiment resulted in the issue of armored personnel carriers without M220 TOW missile systems in lieu of the M3. Furthermore, substitutions of the 1/4-ton utility truck for the HMMWV caused materiel readiness problems, since there was a low density of repair parts in the unit ASL and PLL.

Unit-Line-Number Management

The unit line number must be followed once the strategic airflow confirms a deployment sequence by unit identification code. The unit line number is a unique code assigned to each unit in the strategic deployment. Reinforcement priorities of the gaining theater commander in chief are managed by use of the unit line number. A clear understanding of the unit line number in relation to strategic and intratheater force tracking improves accurate reinforcement to a forward deployed corps.

Rather than deploy troopers strictly from units identified by unit line number, several deployment groups of the 3d ACR were shifted in the deployment timetable with little regard to unit designation. This internal displacing was not coordinated with stateside or European movement agencies and caused a major problem in force tracking. For example, USAREUR and the deployment agencies lost temporary visibility of a 3d ACR POMCUS unit. Thinking the unit was still in CONUS, USAREUR initiated crisis management to deploy the unit onward. In fact, the unit was already in the theater and in the process of efficiently drawing POMCUS equipment.

Intratheater Rail Movement

Early confirmation of POMCUS and AUEL densities is necessary for quality programming of European rail movement. In Reforger '88, numerous changes throughout the planning process caused several untimely requests as the 3d ACR repeatedly adjusted rail requirements. Some changes were necessary due to conflicting guidance on rail loading from movement and railway officials or lack of railcars at a designated site. Some planning changes were due to lack of timely decisions by the regiment and subordinate units on what equipment they could deploy onward from either seaport of debarkation or the marshaling area.

A progressive deployment matrix must identify the movement requirements in exacting detail for every weapon system and piece of equipment through each phase of reinforcement. Planning rail movement for POMCUS in a unit marshaling area or for equipment from a U.S. seaport requires accurate requests in a timely manner to ensure reception and delivery of combat power at the required location and time. The confirmed AUEL and the POMCUS hand receipt are the basic documents required for movement planning.

After conclusion of tactical and logistical exercises with U.S. and other NATO forces by late September, the 3d ACR redeployed from West Germany. Prepositioned equipment was turned in to the POMCUS sites while equipment from the United States was shipped to Fort Bliss. The last troopers of the 3d ACR were airlifted to El Paso in late October. A small element of ACR troopers accompanied unit equipment back through east coast or gulf ports and inland railway to their home station in Texas. All soldiers and equipment of the "Brave Rifles" were massed at Fort Bliss by mid-November.

Plans properly developed using the 10 keys to Reforger success can prevent many problems in future Reforger exercises.   ALOG

Major Jon H. Moilanen, who is currently attending the Logistics Executive Development Course at the Army Logistics Management College, Fort Lee, Virginia, was the regimental S4 of the 3d Armored Cavalry Regiment when he wrote this article. He is a graduate of the University of Wisconsin at Oshkosh and the Army Command and General Staff College.

Fielding Improved Chinooks

The momentum and glamour was at its highest as the new CH-47D helicopter—better known by its family name, Chinook—passed the milestone III decision review before full production. A distribution plan was developed to assure the finest equipment, along with the highest level of logistics support possible, would be in the hands of the "early deployers." The 101st Airborne Division (Air Assault), Fort Campbell, Kentucky, became the first unit equipped with the pride of the Army's cargo aircraft fleet, followed by the XVIII, III, and I Corps.

The spirit of cooperation was high. U.S. Forces Command (FORSCOM) aircrews delivered "new" CH-47D aircraft to gaining units all over the continental United States (CONUS). The "D" models actually were not "new" but totally rebuilt "A-," "B-," and "C-" model aircraft. New engines, drivetrains, rotor systems, and state-of-the-art electronic flight controls were installed in the "old" airframes. Sheet metal was inspected, hydraulic lines and components were replaced, and new paint was applied.

When the time came to field C-47D's in U.S. Army, Europe (USAREUR), the Chinook community reached an unforeseen roadblock. Army Materiel Command depot assets were fully employed, and FORSCOM units were involved in operations and deployments just about everywhere. It didn't seem wise to send USAREUR crews back to CONUS to prepare new aircraft for oversea shipment, since they were getting ready for their own transition.

Simultaneously, the "C"-model aircraft being displaced in USAREUR were scheduled to be fielded to Reserve component units in CONUS, under the same force modernization rules as the newer "D" models. Somebody had to prepare the "C" models for shipment to CONUS and then deliver them and all their support items to Reserve units across the country. The displaced aircraft would also need to be brought up to CONUS transfer standards before delivery.

During the next CH-47 users' conference, action officers talking in the hallway came up with an idea. Since Reserve component units were getting the "C" models, why not send them to Europe to inspect the aircraft before shipment, letting them take care of the tool and repair part inventories at the losing units? Gaining and losing maintenance personnel could work out individual problem areas face to face. Reservists

by Don L. Hamblin

also could meet the displaced "C" models at CONUS ports and deliver them to gaining units throughout CONUS. While Active Army units continued their training, reserve units would get the best possible deployment training. Action officers took the idea back to their respective major commands and worked out the details.

Later Korea came up on the distribution schedule. The original plan called for shipment preparation to be contracted so that soldier training would not be interrupted. But since fielding improved Chinooks in USAREUR had been so successful, it was again proposed that the reserves provide all the shipment preparation, delivery, and retrograde services for the Korea fielding. This involved a little more effort, but when the bottom line was computed, it revealed that the Army would save over $300,000 by using reserve personnel to do the work!

Nobody could pass up a savings like that, so the CH-47D new equipment training team was diverted to Olathe, Kansas, to train Reserve component personnel on the new equipment 2 years ahead of schedule. Now the Army had a CH-47D-trained unit in the Reserve components.

☐ At the Industrial Airport in Olathe, Kansas, members of the 89th Aviation Support Facility, U.S. Army Reserve, load a CH-47D helicopter into an Air Force C-5 transport for delivery to an Active Army unit.

Reservists proved what a valuable asset they are and that the Total Army concept will always pay dividends. The CH-47 modernization office plans to use Reserve component personnel for the Alaska, Hawaii, and Panama fieldings.

This fielding experience shows that the Army is a good steward of taxpayers' dollars. It also demonstrates that even within the confines of published guidance on materiel fielding, there is still room for innovation at all levels of logistics.   ALOG

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Using Maintenance Data at t

The Materiel Readiness Support Activity compiles a data base on

As it is fielded to many Active Army and Reserve component units, the standard army maintenance system (SAMS) is proving to be a success in improving retail-level maintenance management. SAMS automates many procedures that were previously performed manually and gives shop managers the ability to generate shop reports and other management tools. Because SAMS can perform many management functions, managers can devote less time to recordkeeping and administration and more time to keeping equipment up and running.

The advantages offered by SAMS are quite visible to those at the retail level who use the system on a daily basis. However, SAMS has also produced improvements in data analysis at the wholesale level that are not so readily apparent. Many SAMS users do not realize that the maintenance data they input into their tactical army combat service support computer system (TACCS) computers are forwarded to the wholesale level and used extensively to perform equipment analyses and compile management reports.

The data input into SAMS level 1 at direct support (DS) and general support (GS) activities are forwarded to activities that use SAMS level 2. From the SAMS level 2 sites, the data are forwarded each week on floppy disks to the wholesale level at the Army Materiel Command's Materiel Readiness Support Activity (MRSA) in Lexington, Kentucky. Through SAMS, MRSA receives both data on completed maintenance actions and such associated information as numbers and types of parts consumed and descriptions of malfunctions.

After arriving at MRSA, data on a number of significant items are loaded into a wholesale-level SAMS data base called the work order logistic file (WOLF). Located at MRSA, the WOLF currently contains data on approximately 300 end items (primarily pacing items). These data, which are maintained for the most recent 36 months, are available for performing analyses. Data on other items maintained by SAMS units are kept on tape at MRSA and can be loaded into a temporary data base for prompt analysis when requested.

The WOLF provides SAMS data for all items reported to the wholesale level through an online data base. This is a great advantage for SAMS users, because the data for all SAMS items are available at one central location.
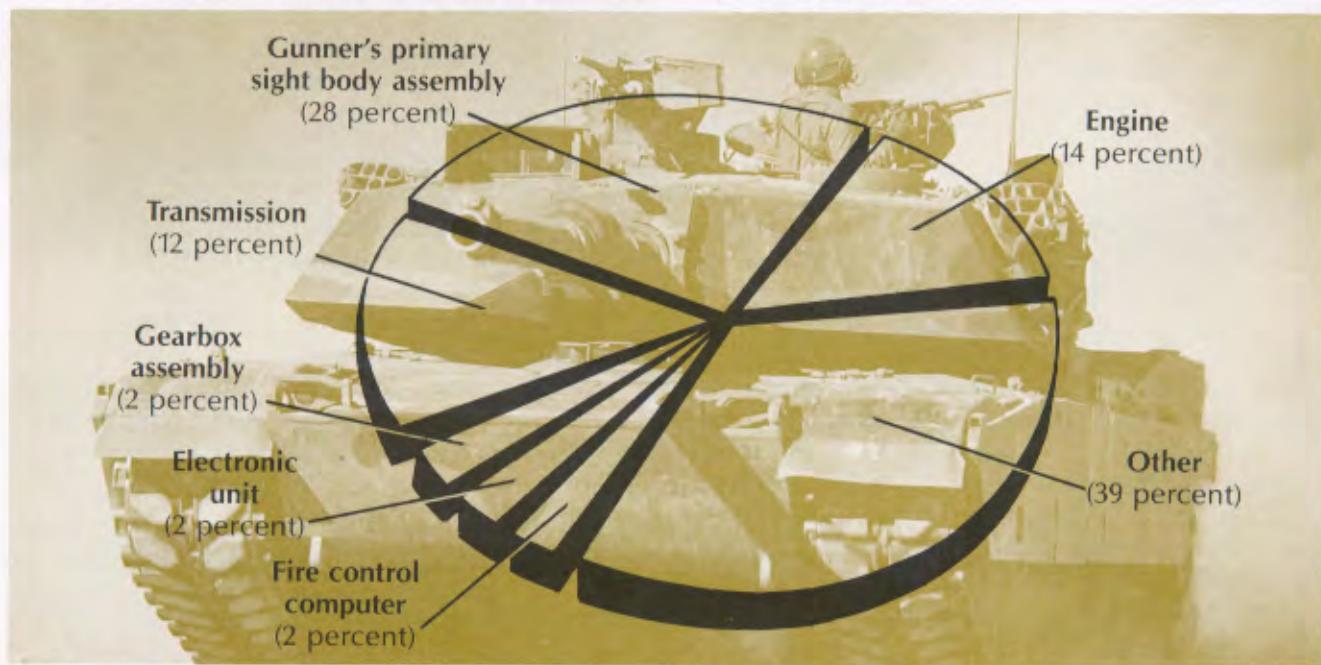
☐ **Components on the M1A1 tank requiring maintenance.**

- Gunner's primary sight body assembly (28 percent)
- Transmission (12 percent)
- Gearbox assembly (2 percent)
- Electronic unit (2 percent)
- Fire control computer (2 percent)
- Engine (14 percent)
- Other (39 percent)

he Wholesale Level by Thomas V. Ress

major end item maintenance.

The WOLF provides a significant capability for data analysis and equipment support for both the wholesale and retail levels. To understand what the WOLF can do, it is important to know what kind of data MRSA receives from the field. SAMS operates only in table of organization and equipment (TOE) DS and GS units. At present, there are no data in WOLF from table of distribution and allowances (TDA) units. A SAMS TDA system is currently being developed and TDA data will be available at MRSA once that system is fielded to TDA organizations. Most WOLF data also come from Active Army units. However, as SAMS is extended to Army National Guard and Army Reserve units, data from these units are also being included in separate National Guard and Reserve WOLF data bases.

The type of data available from the WOLF is end-item oriented. This means that all of the data apply to end items that were repaired in TOE DS and GS shops. All data in the WOLF are linked to the national stock number of an item, so all WOLF queries are driven by national stock numbers. If an analysis is performed on the M1 tank, for example, the national stock number for the M1 is the data element used to request all pertinent data. Using this input key, the WOLF can provide such maintenance data as man-hours required to maintain or repair an item; number of days the item remained in shop; the reason the item was in the shop (such as awaiting parts or awaiting inspection); listings of repair parts consumed in maintenance and repair; and costs of repair parts. In many cases, MRSA can also use the data to tell why an item failed.

Maintenance information can be provided for all units worldwide or can be limited to specific major commands, corps, divisions, or company-level units, based on unit identification codes. In fact, data can often be analyzed and provided down to the level of equipment serial numbers. An example of the type of information the WOLF can provide, using representative data, is shown in the chart at the left.

The data MRSA receives from SAMS are much more accurate and complete than the data received from the system SAMS replaced, the maintenance reporting and management (MRM) system. One major reason for SAMS' greater accuracy is that the data entry procedures for SAMS are automated, while MRM data were entered manually. SAMS software also features edit procedures that require accurate data entry. SAMS has additional data elements, such as a malfunction description, which contribute to equipment analysis efforts at the wholesale level. All of these factors have improved the quality of the data reported from the field.

The benefits of the WOLF are many. MRSA is providing WOLF data to Army, contractor, other service, and allied customers almost daily. The data are used by managers at all levels within the Army community to assist in equipment support efforts. In recent months, MRSA has performed analyses for the corps commanders conference; general officer visits to South Korea; Fort Carson, Colorado; and numerous other installations and locations. MRSA has also analyzed paint problems on the high-mobility, multipurpose, wheeled vehicle and M1A1 tank data for the Department of the Army serial number tracking program. Current plans call for distributing monthly WOLF analyses on two pertinent equipment items to each Army corps commander.

Eventually, passwords will be issued to selected users so they can dial up the WOLF data base. In the interim, MRSA is accepting requests for information and performing analyses. The results are then provided to customers in a hard-copy format. The turn-around time for such analyses is normally 3 to 5 days.

Activities interested in obtaining further information on the WOLF or requesting an analysis may write to—Commander, USAMC Materiel Readiness Support Activity, ATTN: AMXMD-MS, Lexington, KY 40511-5101, or call AUTOVON 745-3690 or -4100 or commercial (606) 293-3690 or -4100. Oversea customers can easily initiate requests by using electronic mail (tress.mrsa1@redstone-emh2) or by calling MRSA's customer assistance line (available 24 hours a day, 7 days a week) at AUTOVON 745-3082.

Thomas V. Ress is a maintenance system specialist in the standard army maintenance systems (SAMS) section of the USAMC Materiel Readiness Support Activity in Lexington, Kentucky. He holds a bachelor's degree from the University of Evansville in Indiana.

# Fixing Forward— Toward a New Maintenance System

by Captain Michael P. Gilroy

The brigade crossed the line of departure at 0530. By 1300 spectacular gains of 20 to 30 kilometers had been registered across the brigade front. Seeking to exploit his advantage, the commander orders the brigade to continue the attack. The forward support battalion (FSB) commander, already far from the logistics tail in the division support area, informs the brigade commander that the supply lines are long and beginning to stretch the capabilities of the FSB. Due to the distance between the brigade and the FSB, supply trucks take longer to move forward and vehicles requiring direct support maintenance are out of service for longer periods of time. The FSB, still trying to recover all of its own assets from a recent move, is being stretched to the breaking point.

Improbable? Hardly. Scenes like this are being played out in local field training exercises as well as at the National Training Center, Fort Irwin, California. During local exercises, the logistics system often is not overtaxed for fear of slowing, or even stopping, valuable training for maneuver units. Although the logistics system is put through its paces at the National Training Center, critical breakdowns often are noticed too late. The result is a game of "catch up." Given the speed with which modern combat units can cover ground, they may find themselves outracing their logistics tails at speeds they had not anticipated. Army doctrine states that units must fix forward in order to keep the combat power forward, but we need a new system for implementing that doctrine. There are two options that could provide the system we need—an intermediate maintenance collection point (IMCP) and a brigade maintenance collection point (BMCP).

The IMCP would comprise those maintenance assets of a battalion which, under current doctrine, are located in the battalion field trains. The IMCP, led by the battalion motor sergeant, would be positioned midway between the unit combat trains and the brigade support area (BSA)—possibly closer to the front—as shown in the chart below. During the offensive, the IMCP would jump forward with the task force, occupying sites previously vacated by the com-

Brigade Support Area

Intermediate Maintenance Collection Point

Unit Maintenance Collection Point

Line Units

25 kilometers   10 kilometers   5 kilometers
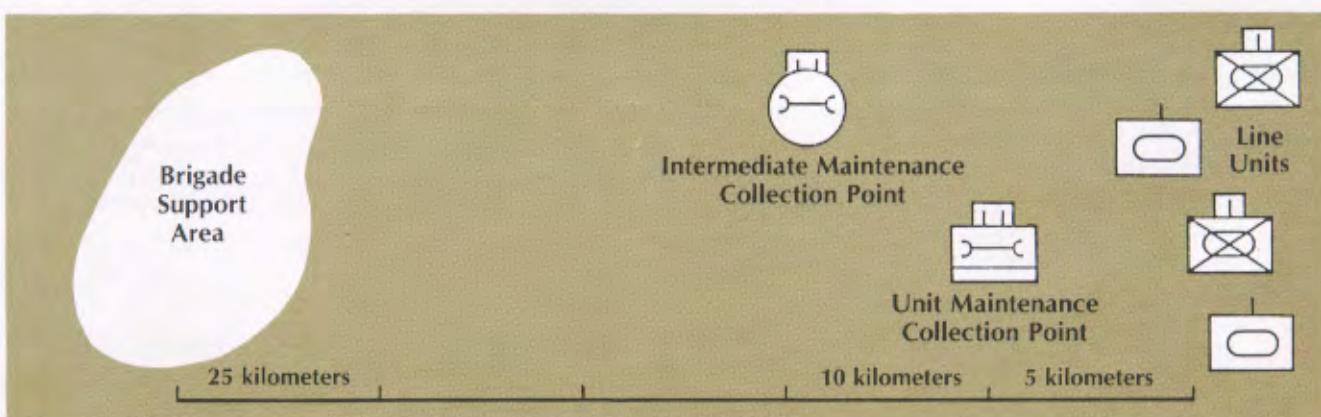
☐ The intermediate maintenance collection point would be located between the unit combat trains and the brigade support area.

AN/VRC-V5

1 SFC (63E40) M1 tank maintenance supervisor
1 SP4 (63B10) Light-wheel vehicle mechanic

1 PFC (77F10) Petroleum heavy vehicle operator

1 SSG (63E30) M1 tank system mechanic
1 SP4 (63T10) Bradley fighting vehicle system automotive mechanic
1 PFC (63E10) M1 tank automotive mechanic

AN/VRC-V2

1 SGT (76C20) Company PLL clerk/driver

1 SSG (63E30) M1 tank system mechanic
1 SGT (63E20) M1 tank automotive mechanic
3 SP4 (63E10) M1 tank automotive mechanic

1 SP4 (63B10) Recovery vehicle operator
1 PFC (44B10) Welder

AN/VRC-V2

1 SGT (63E20) Recovery vehicle operator
1 PFC (63E10) Recovery vehicle operator/driver

AN/PRC-V1

1 SP4 (88M10) Heavy vehicle driver

1 SGT (63S20) Heavy-wheel vehicle mechanic
2 PFC (63S10) Heavy-wheel vehicle mechanic
2 PFC (63B10) Light-wheel vehicle mechanic

2 SGT (63B20) Light-wheel vehicle mechanic
1 SP4 (52D10) Power generation equipment repairer
1 SP4 (63B10) Light-wheel vehicle mechanic
1 PFC (52D10) Power generation equipment repairer

1 SGT (31V20) Unit-level communications maintainer
1 SP4 (31V10) Unit-level communications maintainer
1 SP4 (45E10) M1 Abrams tank turret mechanic

☐ Maintenance personnel and equipment would be consolidated at an intermediate maintenance collection point.

bat trains and unit maintenance collection point. Once a workload accumulated, the IMCP would stop, set up shop, and begin repairs. With the IMCP moving forward, all of the battalion's maintenance assets would stay in touch with the line units. Proposed resourcing for the IMCP is shown in the chart above. Note that the word "intermediate" in the acronym IMCP refers to the distance between the BSA and the combat trains, not necessarily the level of maintenance performed there.

What would the IMCP require in order to be effective? First, it would need a reinforced maintenance support team from the FSB. This means the FSB must task-organize all of its assets across the brigade, leaving only a small part of its strength in the BSA. Increased transportation support would be needed from the battalion support platoon and the FSB to keep the flow of major assemblies and other parts moving forward. Recovery and heavy-lift assets from the battalion recovery section would be assigned to the IMCP. Finally, the IMCP would require a prescribed load list (PLL) that would include critical M1 tank

parts that are not stocked in line company PLL's. The IMCP PLL also would stock more of the high-demand items than a line company would normally carry.

What does the IMCP have to offer? First, because the IMCP is located closer to the line units, travel time is reduced for those vehicles that would normally be evacuated to the BSA. Once a not-mission-capable vehicle begins its trek to the rear, it seems the time required to return it to the line increases exponentially. Keeping the not-mission-capable vehicle forward not only cuts travel time, but increases vehicle visibility to the battalion commander. The importance of this visibility is not to be underestimated. The IMCP would provide a location for consolidating all not-mission-capable vehicles forward on the battlefield. This would allow the battalion maintenance officer to keep his unit maintenance collection point (UMCP) forward and intact, instead of splitting operations when the flow of not-mission-capable vehicles is too heavy. Keeping the UMCP forward and on the move in the offensive helps return combat systems to battle quickly.

Function	IMCP Assets	BMCP Assets
Class I	Dedicated	Ad hoc
Class III	Dedicated	Ad hoc
Class V	Dedicated	None
Class IX	None (except prescribed load list)	Dedicated
Transportation	Limited assets from support platoon	Dedicated
Recovery or lift	Dedicated	With unit IMCP assets
Security	Battalion/Task force	Brigade
Command and control	Battalion combat trains command post and battalion maintenance officer	Forward support battalion support operations section and maintenance company commander
Communications	Dedicated	Dedicated, but requires augmentation to be more effective

☐ **Comparison of brigade maintenance collection point and intermediate maintenance collection point assets.**

If it is understood that all maintenance assets should be forward on the battlefield, then the second advantage of the IMCP is that it has a dedicated support apparatus—the battalion support platoon. The support platoon would run logistics packages to the IMCP just as it would to a line company. Supplies of classes I, III (packaged and bulk), and V would be available through the support platoon. Since the goal of the IMCP is to return a mission-capable combat system to the fight without delay, the ability to refuel and rearm at the IMCP is a definite plus. This would not always be the case if a vehicle came forward from direct support maintenance or even from the unit's own field trains. The key principle of the IMCP would be to keep the not-mission-capable vehicle forward and let all required support come to it rather than vice versa. This sounds harder than it actually is.

A concept tested by brigades of the 1st Infantry Division (Mechanized) at the National Training Center is the brigade maintenance collection point. The BMCP operates under the same principles as the IMCP. The advantage of a consolidated collection point in the brigade sector becomes apparent during a defensive situation. Parts and available manpower are pushed to the BMCP from the FSB. Units give their IMCP assets to the BMCP when the brigade assumes a defense posture. Not only are FSB assets pushed forward, but units assist each other in expediting repairs on those vehicles that need to be repaired first. The FSB shop officer should be forward, controlling the work flow based on the priorities set through the brigade S4.

This requires a change of mindset in the support community. If forward is good, then farther forward is even better. Given current Soviet doctrine, there is no possibility of a secure rear. The most secure location for the FSB maintenance company is forward, tucked into the combat elements of the brigade.

The major weakness of the BMCP is supply support (except for class IX), which is why the BMCP functions better in a static situation when there is more time to resupply. There are no dedicated assets for refueling repaired vehicles and resupplying the BMCP. If the BMCP concept becomes doctrine, resource changes must be made in the tables of organization and equipment. Meanwhile, the solution is to task the brigade's reserve battalion to provide class I, III, and V support to the BMCP.

Both the IMCP and the BMCP are concepts that fit in with current Army doctrine. Although not fully resourced, they can be made to work. The key here is flexibility and imaginative thinking. Task organizing the FSB maintenance company may be an anathema to the support community; but to a maneuver battalion commander with critical systems out of the fight, whatever works is what he will support.

The IMCP works. Cutting the distance a vehicle must travel to be repaired is the first step in cutting the time the vehicle will be out of the fight. The next step is putting the right people and equipment in the right spot at the right time. Both the IMCP and the BMCP concepts do this. The bottom line with both the IMCP and the BMCP is more combat power forward—faster than before. **ALOG**

Captain Michael P. Gilroy currently is attending the Quartermaster Officer Advanced Course at the Army Quartermaster School, Fort Lee, Virginia. Previously, he was battalion S4, 2-34 Armor, Fort Riley, Kansas. He is a distinguished military graduate of the ROTC program at Providence College, Rhode Island, where he received a bachelor's degree in history.

Cobra Gold '89

by Major Charles R. Floyd

The author describes logistics support for joint U.S. and Thai military exercises conducted in Thailand.

Cobra Gold '89, the eighth annual Joint Chiefs of Staff (JCS) military exercise conducted in Thailand, provided U.S. forces an opportunity to train in jungle warfare and to test the interoperability of U.S. and Thai Armies and their ability to defend Thailand. While the training and field maneuvers were important parts of the exercise, the logistics operation was one of Cobra Gold's most significant elements.

The exercise was conducted from 3 January 1989 to 20 July 1989 and consisted of five phases—exercise preparation; reception, staging, and deployment; field training and command post exercises and functional training; joint field training exercise (JFTX) and fire power demonstration; and redeployment and recovery.

The exercise plan showed the invading forces pushing the Thai defense forces from the northeast to Sukhothai in the central plains. The situation called for U.S. forces to assist in driving the invading army from Thai territory. Participating in the exercise were approximately 6,000 soldiers from the Thai 3d Army Division and 3,200 U.S. military personnel—2,000 from the 3d Infantry Brigade task force of the 25th Infantry Division (Light) in Hawaii, 500 from the 5th,

☐ **Soldiers supporting Exercise Cobra Gold '89 unload class I supplies from a CH-47 Chinook for issue at the class I break point in the brigade support area.**

7th, and 13th Pacific Air Forces, and 700 from the Special Forces. The 3d Infantry Brigade task force consisted of two infantry battalions, combat service units, and combat service support (CSS) units.

Two thousand soldiers of the 25th Infantry Division were flown 7,000 miles on contracted L-1011's and Air Force C-141's from Hickam Air Force Base, Hawaii, to Thailand. They were deployed to U Taphao, Ta Khli, and the task force base camp at Phitsanulok (see map on next page).

Cobra Gold '89 was a combat service support challenge. Since there were no U.S. support bases in Thailand, the task force had to coordinate all requirements with the Royal Thai Army and the Joint U.S. Military Advisory Group. We in the task force transported troops, supplies, and equipment to three Thai airfields and the Thai port at Sattahip. The joint deployment system was used to coordinate all airlift and sealift requirements. Customs clearance procedures were coordinated to ensure that all regulations

□ **The map (above) shows the truck convoy route through Thailand. Soldiers retrieve MRE's packaged in an airdropped container delivery system from a rice paddy (above right).**

were met in transporting hazardous materials. Thai contractors provided rail transportation, police escorts, port support facilities, billets, fuel, kitchen police support, commercial telephones, cranes, forklifts, vehicles, and many other services.

The 25th deployed over 350 trucks, 150 trailers, 18 military-owned demountable containers (MILVAN's) of ammunition, and 12 MILVAN's of class I. Supplies and equipment were transported on the USNS *Cape Horn* from Honolulu, Hawaii, to the port of Sattahip. The MILVAN's were later sent by rail to the task force base camp at Phitsanulok.

Truck convoys were used to transport equipment 700 kilometers from the port at Sattahip to the base camp at Phitsanulok. Each convoy took 2 days with an overnight rest stop at Sara Buri, where the 3d Forward Area Support Team provided maintenance, medical assistance, fuel, bottled water, and meals, ready-to-eat (MRE's). It took 5 days to deploy all of the equipment from the port to the base camp. Convoy operations required detailed planning to ensure that

each march unit had a Thai police escort and that required support was provided throughout the convoy route. At each designated rest stop there were fuel, medical assistance, and a maintenance collection point.

During bilateral cross-training, CSS units conducted classes with Thai counterparts. C Company of the 725th Maintenance Battalion provided training in organizational, electronics, and missile maintenance; armament; technical supply; and recovery operations. D Company of the 25th Medical Battalion trained personnel in the proper methods for treating head injuries and wounds of the abdomen and chest, applying pressure dressings and tourniquets, and evacuating casualties. C Company of the 25th Supply and Transport (S&T) Battalion conducted training in supply and transportation operations.

CSS units deployed approximately 100 kilometers from base camp for the JFTX. A brigade support area (BSA) was established to support the 2,000 soldiers of the 3d Infantry Brigade task force. Air Force C-130 aircraft and Army CH-47 Chinook helicopters were used for aerial resupply. MRE's were airdropped using the container delivery system. Daily resupply of class I and ice and emergency resupply of class VIII and IX items were provided by CH-47 Chinooks.

Sling loads of water, MRE's, and ice were airlifted to the infantry battalions.

During the JFTX, C Company of the 25th S&T Battalion issued 47,469 MRE's and T rations at the class I break point in the BSA. The company also issued approximately 28,000 gallons of water and 20,000 pounds of ice at the break point. About 36,500 gallons of diesel fuel and 1,000 gallons of motor gasoline were issued at the class III fuel points, and 108 short tons of class V were issued at the ammunition supply and ammunition transfer points. Twenty-two 5-ton trucks and 2 stake and platform tractor trailers were used to distribute supplies for 161 requests. The trucks were driven 54,260 miles to transport over 5,700 passengers and 125 short tons of supplies.

D Company of the 25th Medical Battalion provided division-level medical, dental, and preventive medicine support. The Air Force provided a 20-bed tactical field hospital for corps-level medical support. D Company treated 715 patients, returned 713 patients to duty, and evacuated 2 patients to Hawaii.

C Company of the 725th Maintenance Battalion deployed with 361 lines of authorized stockage list items, 32 lines of major assemblies, and 20 lines of prescription items. The company received 250 job orders, most of them in the communications and elec-

tronics area, and 264 requisitions with priority designator 03 that were either filled onsite or passed to Hawaii. Maintenance of the task force equipment proved to be a challenge due to the high miles driven and heavy use of all deployed equipment.

Cobra Gold '89 was a logistician's dream come true. Planning and executing the CSS requirements presented challenges, but as a result of 9 months of planning and coordinating with Royal Thai Army and other U.S. military organizations, the exercise was a success. The 25th Infantry Division (Light) deployed on a major JCS exercise, conducted military training with a Pacific ally, and demonstrated the U.S. commitment to the security and stability in the Pacific region.   ALOG

Major Charles R. Floyd is deputy G4, 25th Infantry Division (Light). He is a graduate of the University of Richmond, the Army Command and General Staff College, and the Logistics Executive Development Course. He holds master's degrees from Webster College, St. Louis, Missouri, and the Florida Institute of Technology. Major Floyd was the forward area support coordinating officer of the 3d Infantry Brigade when he wrote this article.

Masters of the Game

by Lieutenant Colonel Mark N. Erskine

I recently observed some of this country's premier warfighters conducting a major command post exercise and analyzed what warfighting is all about. The battle command training program (BCTP) has been called many things, some good and some bad, depending on where one sits. Whatever one thinks of it, the training program provides a unique insight into how a commander sizes up a battle and relays his intent to his subordinates.

The commander's staff does the stubby-pencil work of a plan and produces the myriad pieces of paper and other communications that set the commander's idea in motion.

The logistics plan that puts a mobile armored corps into action in an oversea theater is so immense that it could fill a book. Over the last 8 years, our equipment has improved and our people are the best we have ever recruited; however, our active duty tail (logistics capability) has paid a large end-strength bill to keep the tooth (tactical) ratio high. At least 70 percent of our logistics warfighters are in the Reserves and much of their equipment is old.

A movement and fighting plan for a mobile corps requires innovative, aggressive, and responsive logistics support. Sealift and airlift shortfalls make our ability to sustain the fighters difficult. Our ability to refuel on the move, reconstitute critical battlefield resources, and move vast amounts of equipment and ammunition over long distances is diminished when the key players don't get to exercise routinely with the warfighters. Division logistics soldiers and a limited number of corps logistics units get this level of training, but most combat service support units simply do not.

Realistic training with "go-to-war counterparts" and an increase in the tail, in both people and modern sustainment equipment, are the keys to making logistics planning a reality. The sage old "Yoda" of BCTP said in one of his sessions, "The thing that always messed up my movements were the artillery and the ambulances." Movements, patient evacuation, maintenance, supply, and all the other mundane wartime "merchant business" are the things that staff officers must plan in order to earn their pay. If BCTP does nothing more than make us think about how to do our jobs better, it is a sure winner.

It's not often that one is able to observe the likes of General Cavozos, USA (Ret.), Lieutenant General Grange, USA (Ret.), Lieutenant General Graves, four division commanders, a host of other warfighters, and the BCTP staff gather to train, think, and learn about this business we call war. I was grateful for that opportunity to learn from the masters of the game.

Lieutenant Colonel Mark N. Erskine is the assistant chief of staff for materiel, 13th Corps Support Command, III Corps and Fort Hood, Texas.

Reading Beyond the CSS Battlefield

by Lieutenant Colonel George J. Gliaudys, Jr., USAR

Lieutenant Colonel Richard D. Hill's article, "Reading the CSS Battlefield," in the May-June 1989 issue of the *Army Logistician* brought some thoughts to mind which I hope will enlarge on his insightful essay.

My command has participated in a variety of exercises, such as LOGEX, Borderstar, Cascade Peak, and Team Spirit, in which logistics play was a prominent part. Among the lessons learned from such exercise participation is that the combat service support (CSS) battlefield will not be a tidy push-through of bullets, blankets, and beans to the front line troops. In fact, combat service support commanders at all levels will need to balance their logistics missions with competing collateral military concerns. Commanders will have to anticipate, plan, and resource for such collateral concerns to minimize any deleterious impact on their main logistics mission.

The probable CSS battlefield scenarios have a commonality of collateral events; for example—

• Clogged roads as the local population moves from the main battle areas.

• Local contracting needs to supplement U.S. efforts.

• Humanitarian aid requests to commanders for care of displaced persons.

• Battle damage claims by local nationals.

• Solatia payments to civilians.

• War atrocity claims and investigations.

• Requests from U.S. journalists for access to troops and areas for reporting purposes.

• U.S. and host nation agreement applications to

specific incidents involving U.S. troops and civilians.
- Red Cross protection violations.
- War booty and trophy incidents.
- POW treatment and confinement concerns.

The list goes on, but this sample is illustrative of what a combat service support commander will have to endure as part of his charter. Of course, there is military discipline to be administered under the Uniform Code of Military Justice as well as ongoing problems of soldiers that may require chaplain, legal, or medical resources.

All of these events are to be anticipated. Their cumulative impact will influence, to some degree, the course of battle. They represent an inevitable drain on the commander's time and attention. In these matters, the commander can be assisted by his special staff.

From my viewpoint as an Army lawyer, the combat service support commander should use the special staff in preparing the logistics battlefield. The integrated skills of lawyers, civil affairs officers, and chaplains can alleviate the impacts of some of the collateral events on the battlefield. The Grenada incursion was a watershed in the development of what is called operational law. Operational law provides to commanders an adeptness in the legal, political, cultural, and civil affairs needed in the modern-day environment. For example, a legal review of command operational plans is one type of mandated legal assistance provided to the commander that helps purge operational plans of questionable actions inconsistent with the law of war standards.

The complexity of the milieu in which commanders must accomplish their missions was recognized by the Secretary of the Army. In December 1988, Secretary John O. Marsh, Jr., directed the Judge Advocate General to establish a center for law and military operations. He indicated that the purpose of such a center will be the ongoing examination of legal issues associated with the preparation for, deployment to, and conduct of military operations.

Accordingly, in reading the CSS battlefield a commander must see the collateral events that must be resolved even as he pursues his logistics mission. To do anything less is to jeopardize the success required to win.

Lieutenant Colonel George J. Gliaudys, Jr., USAR, is Staff Judge Advocate, 311th Corps Support Command, Los Angeles, California. He holds a J.D. degree from Loyola Marymount University Law School in Los Angeles. His civilian position is that of Deputy District Attorney for the County of Los Angeles.

Combating Innumeracy

by Captain John M. Tomkovich, Jr.

In his book, *Innumeracy*, John Allen Paulos states—

> In an increasingly complex world full of senseless coincidence, what's required in many situations is not more facts—we're inundated already—but a better command of known facts, and for this a course in probability is invaluable.

This book is about the problems that result from the lack of mathematical ability in America. Paulos points out that we are constantly told about the hazards of illiteracy and how to overcome it through programs such as Project Literacy, U.S. (PLUS), and Reading is FUNdamental. Yet, "innumeracy," the lack of familiarity with numbers and mathematics, also plagues this Nation but goes relatively unnoticed.

The "better command of known facts [through] a course in probability" suggested by Paulos could be beneficial to all Americans and to Army logisticians in particular. Understanding probabilistic events leads to better decisionmaking. Logisticians should take the lead in eliminating innumeracy in America.

The Army Logistics Management College, Fort Lee, Virginia, offers the Decision Risk Analysis for Logisticians course. This 2-week course provides logisticians, numerate and innumerate alike, with the basics of probability theory, statistical analysis, and decisionmaking. Most public learning institutions offer courses in logic, mathematics, and decisionmaking. These courses could be very effective in overcoming "innumeracy."

So, join the fight to eliminate innumeracy. Read the book, *Innumeracy*; attend the Decision Risk Analysis for Logisticians course; or enroll in other appropriate classes. You could make a difference.

Captain John M. Tomkovich, Jr., is a former operations research-systems analysis instructor and analyst for the Army Logistics Management College, Fort Lee, Virginia.

Putting Ethics

Last year, I was fortunate enough to be recipient of the Nick Hoge Award for Professional Development. The Department of the Army established the award to promote excellence in civilian personnel administration and management. Selection is based on writing an essay that addresses a subject that contributes to that purpose. I chose "ethics" as the subject of my essay.

Personnel administration and management may seem a far cry from the complex field of logistics management; but in thinking about ethics in the workplace, it occurred to me that ethical principles extend to all occupational areas and must be exercised by each of us who hold positions of public trust. Logisticians in recent years have been subjected to almost microscopic scrutiny for ethical conduct.

So important are ethics in Government that President Bush's first Executive Order, 12688, created the President's Commission on Federal Ethics Law Reform. Why was this necessary? Are we, as Federal employees, less ethical than our fellow citizens in the private sector? I don't believe so, but I do believe that our responsibilities demand that we exercise our public trust in an exemplary manner. We may be held to higher standards of ethical behavior, and I believe that this is appropriate.

The President's commission evaluated existing ethics rules with two objectives: to obtain the best public servants, and to obtain the best from those public servants. It also charged that public officials have an obligation to be sure their actions not only appear ethical, but *are* ethical; and that we have a duty to conduct our offices not only with honor but with *perceived* honor, for the appearance of unethical behavior can be as harmful as an actual breach of ethics.

President Bush, at his meeting with members of the senior executive service, spoke of his respect for those in the public service. He recognized the need to rely on career civil servants if he and his administration were to achieve their objectives. The President's message was a strong indication of his admiration for the Federal employees with whom he has worked and of his concern with improving the image of all public servants. That image is a reflection of the public's perception of our ethical values and is dependent on how we demonstrate those values on a daily basis.

Most of us consider ourselves "ethical" people. But as we have often seen in the last few years, the

Discussions and debates on ethics in Government continue to make headlines. Ethics in logistics management has been as closely scrutinized as any function in Government.

to Work by Kathleen L. Kenna

distinction between what constitutes ethical or unethical behavior is not always evident. Honest and honorable people sometimes slip into unethical conduct because they do not evaluate their actions objectively. At times it becomes necessary to clarify exactly what is considered ethical conduct. The provisions of the Procurement Integrity Act not only clarify but also expand the definition of ethical conduct in the procurement arena. Their implications are so extensive that they have caused a mass exodus of those who fear their future employability may be jeopardized by the provisions of the Act. While interpretation of some of the vague terminology in the Act will take years, the passage of this Act has certainly caught our attention. It has raised the ethical consciousness of logisticians and others involved in procurement actions.

Ethics are concerned with what is right and what is wrong in human behavior. They describe a societal norm and the conduct that adheres to that norm. Ethics are not neutral. They address the question of what ought to be. To communicate the ideals of ethical behavior for a specific group, organization, or profession, leaders publish codes of ethics and rules for enforcing those codes.

The problem with making rules is that we can never make enough rules to cover every contingency. Even if that were possible, we could never make rules specific enough to ensure that the code is usable. Also, as soon as rules or laws are made, the inclination of many people is to find ways to circumvent or find exceptions to them. The number of tax attorneys and financial advisors who spend their professional lives probing the intricacies of the Internal Revenue Code demonstrates that.

As the commission stated, "Ethical government means much more than laws. It is a spirit, an imbued code of conduct, an ethos. It is a climate in which, from the highest to the lowest ranks of policy and decisionmaking officials, some conduct is instinctively sensed as correct and other conduct as being beyond acceptance."

How do we develop a personal code of what is right and wrong? We develop that code from history, from our personal experiences, and from our observations of society. We are taught moral principles primarily based on religion and politics. Our principles are also molded by the values and norms of the society in which we live. These values change over time. For example, until the 1930's child labor in industry was widely accepted in the United States. Today it is not only illegal but anachronistic. Until the mid-1960's many occupations were effectively closed to women and blacks. Today not only is equal employment opportunity the law but affirmative action policies also ensure that all people of our society are equitably represented in the work force.

If values change from generation to generation, how then can we know what is right and wrong? All of us know most of the time but none of us knows all of the time. Dr. Albert Schweitzer described ethics as ". . . the name we give to our concern for good behavior . . . an obligation to consider not only our own personal well-being, but also that of others and of human society as a whole."

Behavior becomes unethical when it favors a special interest out of proportion to and without consideration for the interests of society as a whole. It is not always easy, however, to distinguish between what benefits the individual and what benefits society. Sometimes both may benefit from a given action and at other times a choice must be made from among a variety of alternatives and conflicting priorities.

When confronted with such a choice, we public servants—whether we be military or civilian—must choose the alternative that best promotes the common interest. It is our responsibility to not only examine what can be done according to law or regulation but also to conduct ourselves with an acute awareness of right and wrong. We must step back and judge not only the results of our actions but also the processes leading to those results. At times it is possible to become so focused on achieving a goal that we lose sight of the principle that no goal, no matter how beneficial, validates the means used to achieve it. The integrity of the goal is dependent upon the integrity of the means by which it is achieved.

Logisticians daily make decisions that affect the welfare and the lives of our soldiers as well as our fellow citizens. Many of these decisions are not easy. Many pose ethical dilemmas. It is only through sound judgment and careful consideration of all alternatives that we can make the right decisions.

Most of us have dealt with situations that make us uneasy, where the correct choice is ambiguous and where we are confronted with conflicting priorities. There are no easy answers. Each situation requires an ethical choice. As Federal employees we're ac-

customed to using laws and regulations in making our decisions, but do we sometimes take the easy way out and use regulations as an *excuse* for the decisions we make? Regulations are an attempt to codify principles, but regulations are also subject to interpretation. They certainly are not meant to cover every contingency.

At some point we must rely on conscience to form our principles and guide our actions. Conscience has been described as a "still, small voice" that lets us know whether we have done right or wrong. Each individual's conscience plays an indispensable role in keeping an organization ethical, but we cannot rely solely on each individual's sense of right and wrong to keep the organization ethical. A standard must be established, promulgated, and enforced.

In the Winter 1989 issue of *Sloan Management Review*, Saul Gellerman wrote, "Management is responsible for creating and sustaining conditions in which people are likely to behave themselves, and for minimizing conditions in which they may be tempted to misbehave." To create conditions conducive to good behavior, he suggests publishing a code of ethics, setting the example for ethical conduct at the highest levels, and reducing inducements to misbehave. He describes three conditions that can induce unethical behavior—

- Unusually high rewards for good performance.
- Unusually severe punishments for poor performance.
- Implicit sanctioning of explicitly forbidden acts.

In the last 2 or 3 years we have seen individuals seduced by exorbitant rewards on Wall Street. When people are exposed to vast amounts of money, it is understandable why their judgment may become clouded and their principles undermined. The opposite extreme, unusually severe punishment, may have just as disastrous an effect on an individual's principles. When a person's job is at stake, that person may be tempted to do almost anything or make almost any compromise to safeguard his or her security and reputation. An individual who feels backed into a corner may understandably be concerned primarily with survival and secondarily, if at all, with ethics.

No matter how well conceived and well written a code of ethics may be, it will mean nothing if those for whom it was written ignore it with impunity. If management pays only lipservice to ethical standards those standards do not really exist. If a mixed message is conveyed to employees, then the code of ethics is only a wall-hanging; it is worthless. Employees must realize that the code will be enforced and that those violating the code will be punished.

Ethics require that we instinctively do what is right because we have formed the habit of being ethical. How is this habit formed? It is formed from principles and values learned in childhood from our parents, teachers, and peers. Our ethical foundations are laid in our youth. As adults we build on those foundations, not just from what we have been told but from the examples of others. In our business and professional lives, our leaders and supervisors set our most important examples. If supervisors tolerate unethical conduct or give tacit approval to unethical actions, their examples undermine the strongest code of ethics. Ethics can be "caught" far more easily than they can be "taught."

The first principle of total quality management is its total reliance on commitment at the top. The same is true of ethics. As the Commission on Federal Ethics Law Reform pointed out, an atmosphere must be created by top leadership and at each subordinate level, "in which ethical standards will flourish and violations will be clearly seen as exceptional and intolerable conduct."

That atmosphere, however, does not develop spontaneously. It must be fostered and nurtured carefully. This cannot be done in a "training session" of an hour or two. It must be a continuous process. We must be willing to program time to examine and discuss ethics in the workplace. We must be willing to take a risk; to ask ourselves what we normally would do in a given situation and then ask if that is what we *should* do. It is only when ethics become an everyday concern that they cease to be a problem.

Ethics cannot be legislated. An ethos cannot be forced. Violations of ethics can be punished, but punishing violators should never be the goal. The goal should be an awareness that we must judge ourselves, not wait for someone else to judge us. We must concentrate on doing what is right, not on avoiding being "caught." It is only when we are truly "guided by integrity and a conscious regard for the common interest" that we create an atmosphere in which "ethical standards will flourish and violations will be clearly seen as exceptional and intolerable conduct."

Ethics are critical to management because we have accepted a trust. On a daily basis we deal with critical aspects of the Nation's business. We have accepted a stewardship in managing our Nation's security and a substantial part of its resources. With that stewardship comes the responsibility of conducting that business irreproachably.   ALOG

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Artificial Intelligence Aids Logisticians

by Brigadier General Malcolm R. O'Neill and Som Karamchetty, Ph.D.

Modern technology presents Army logisticians with both opportunities and challenges. In the past, when battles were fought with less sophisticated weapons, distinct lines separated the opposing forces. For the logistician, the battlefield offered a fairly well defined "rear" where combat service support could be performed. However, technological improvements are revolutionizing every phase of battlefield operations. The Army's AirLand Battle doctrine hypothesizes that, in the future, highly mobile forces will operate in an extremely hostile environment. These forces will use, and logisticians will be called on to support, weapons of unprecedented complexity and lethality. The emerging battlefield situation will require, as Army Chief of Staff General Carl Vuono has suggested, "anticipation, integration, continuity, responsiveness, and improvisation."

The impact of the technological innovations of the last two decades on logisticians has been enormous, and in many respects it has been positive. For example, "smart weapons" and "brilliant munitions," by improving kill probability, have actually helped logisticians by reducing the amount of ammunition that must be transported. At the same time, however, the technical sophistication of new weapon systems has compounded the logistician's burden in operating, maintaining, and supplying those systems and in training support personnel. Logisticians today must contend not only with the complex demands historically associated with supporting armies in the field, but also with new complexities created by advanced technology.

Fortunately, the emerging technology of machine intelligence, or artificial intelligence, as it is more often called, promises to help logisticians overcome the challenges generated by the new weapons. Some of the machine intelligence applications the Army is developing have great potential for solving logistics problems.

Machine Intelligence Technologies

Constant anticipation and continual adaptation are essential ingredients for winning in dynamic battlefield situations. The use of machine intelligence technology will allow the soldier to exploit appropriate knowledge in a timely way.

Machine intelligence differs from traditional computer programming. Traditional programming is strictly procedural—the systems programmer and developer try to anticipate all problems that the user might face and then incorporate solutions into the program. Machine intelligence, by contrast, is computer software that mimics human methods of solving problems, including searching, representing knowledge, reasoning, deducing, learning, and understanding. The power of a specific system is a function of the methods it can use.

Machine intelligence systems can be broadly classified into several types: expert, natural-language interface, speech recognition, intelligent pattern-recognition, intelligent tutoring, and automatic programming systems. Of these, expert systems are the most highly developed and the most commonly used by the Army at present. Expert systems have many viable commercial and military applications. While the other machine intelligence technologies hold great promise for the future, expert systems are ready to benefit the Army now.

An expert system is computer software that codifies the knowledge of human experts in a particular area. An expert system greatly enhances the capabilities of the layman by permitting him to apply expert knowledge in solving problems. Simple expert systems, known as rule-based systems, represent expert knowledge and "tricks of the trade" as rules. Given a set of rules and a set of facts, the average person can derive other facts and conclusions. Expert systems are designed to equip a computer with this reasoning capability.

Machine Intelligence in Army Logistics

As they have matured, expert systems have found ready applications in Army logistics. Of the scores of Army expert systems, we have selected a small number to discuss in the logistics functional areas of manning, arming, fixing, and moving.

Manning the force. AirLand Battle Management (ALBM) is a joint showcase project of the Army and the Defense Advanced Research Projects Agency under development at the Army Laboratory Com-

mand (LABCOM) and the Army Communications and Electronics Command. ALBM is being programmed with expert knowledge of battlefield tactics, doctrine, and likely enemy actions and reactions and with a planning capability. It will assist the battlefield commander in periodically assessing his tactical situation and will present him with alternative courses of action. With the help of ALBM, commanders can analyze their options and the enemy's likely plans in a very short time, thereby deriving a tremendous advantage. The combat support service module of ALBM will help logisticians to plan support services so that logistics considerations constrain the battlefield commander as little as possible.

Another highly effective expert system is the battlefield reconstitution expert system now being developed at LABCOM. By incorporating the expertise of seasoned commanders, it assists users in reconstituting units that have suffered attrition during the course of a battle. The system reconfigures such units into effective fighting units and thus multiplies the force available to the commander.

Soldiers constantly face the threat of unexploded munitions on the battlefield. However, explosive ordnance disposal requires extensive knowledge of both munitions and delicate defusing procedures. The explosive ordnance disposal expert system developed by LABCOM overcomes this problem by providing expert ordnance information to soldiers and technicians who are novices in working with munitions. This interactive support improves safety on the battlefield.

Arming the force. To create a conventional expert system, knowledge in a particular subject is gathered from experts and then tediously customized for input to the computer system. A type of machine intelligence called machine learning offers an alternative that actually enhances a computer system's performance by facilitating "on-the-job learning." Starting with a limited input of knowledge, machine learning

systems improve their performance because they *learn* automatically as they face new situations.

Forecasting ammunition use is an ideal candidate for machine learning. System developers have been vexed by lack of knowledge about ammunition consumption. Using a new machine intelligence technique called genetic algorithms, LABCOM is designing a machine learning system that can predict ammunition use. The ammunition predictor may be integrated into the standard army ammunition system-division ammunition officer software to become an integral component of ammunition supply logistics.

As mentioned previously, smart munitions can reduce the need for ammunition supplies by increasing kill probability. Conventional weapon systems require human intervention to guide munitions to a kill once a target is sensed. However, smart missiles and artillery rounds incorporate current computer and electronic technology, which give them the intelligence to home in on targets. LABCOM has undertaken a cooperative smart weapons demonstration program that uses the resources of several Army laboratories.

Fixing the force. Machine intelligence offers the greatest promise—both in the military and civilian sectors—in equipment diagnostics and maintenance. Significant savings in life-cycle costs will result from increased application of expert systems at various stages of a product's life cycle. Diagnosing problems in weapon systems and maintaining complex equipment are knowledge-intensive tasks ideally suited to the use of expert systems. Expert systems can greatly improve readiness by enabling novice users to perform diagnostic and repair tasks in the field.

The Aviation Applied Technology Directorate of the Army Aviation Systems Command has taken the lead in applying expert systems technology in diagnosing problems in helicopter subsystems. The

☐ **An expert system will enable chip designers to lay out very high speed integrated circuits that can be tested.**
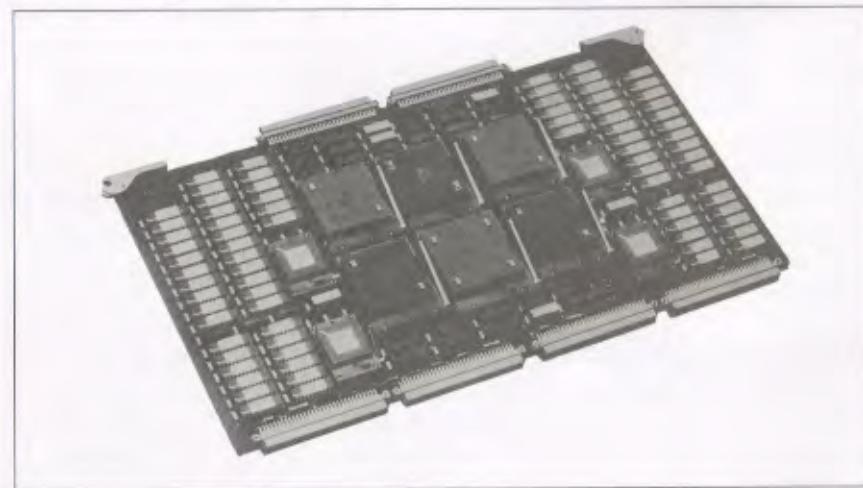
☐ **The automated airload planning system will make planning cargo loads for air shipment a faster and simpler process.**

results so far have been very impressive. The time needed to diagnose problems in AH-64 Apache attack helicopters has been reduced 48 percent at Fort Hood, Texas, and unnecessary removal of TOW missile subsystems has been cut 50 percent at Fort Lewis, Washington. Because of the sophisticated diagnostic capability of the expert system, multiple faults and adjustments can be identified on a single test flight; under the previous procedure, a separate flight was required to discover each fault. By using the expert system, maintenance test flights of CH-47 Chinook helicopters have been reduced 75 percent at Fort Campbell, Kentucky.

Following on these developments, the Army Tank-Automotive Command (TACOM) has embarked on programs to convert all diagnostics for the M1 Abrams tank to expert systems methodologies. Expert systems and electronic manuals will ultimately become an integral part of electronic system standards in the new family of vehicles planned under the armored systems modernization program.

TACOM's Research and Development Center is working on voice-interactive systems that will allow vehicle maintenance personnel to work with computers by talking to them. Voice interaction offers the special advantage of allowing operators to keep their eyes and hands on their work while the computer accepts human-voice commands. TACOM is also developing a robust expert maintenance system (REMS), which will replace bulky manuals with a knowledge-based system that works with a voice-interactive system.

The Army Missile Command has developed a personal-computer-based expert system that helps meet the very complex diagnostic and maintenance requirements of the pulse-acquisition radar for the Hawk missile system. The pulse radar intelligent diagnostic environment (PRIDE) provides on-screen instructional assistance to users. It also offers a high payoff through faster repairs and increased reliability, availability, and maintainability of the pulse radar system.

Prognostic systems ensure mission success and help reduce costs by predicting possible failures. LABCOM is developing systems with built-in sensors that will monitor the stress caused by such phenomena as electromagnetic pulses and high-power microwaves. A prognostic system will calculate the cumulative effects of stresses to predict a weapon system's remaining life expectancy or probability of failure during a mission. Such a system can protect against unforeseen risks by warning the operator of impending problems before a mission is undertaken.

Electronic systems that are easy to test can be diagnosed and maintained quickly and economically. However, current chip designs lack testability. LABCOM's Electronic Technology and Devices Laboratory is developing a testability expert system, the Test Engineer's Assistant (TEA), to assist the designers of very high speed integrated circuits. TEA will provide chip designers with the expert knowledge they need to design and lay out circuits that are testable.

The backplane of a Firefinder radar system typically has a "rat's nest" of 10,000 wires, which makes diagnostics and maintenance tasks nightmarish for technicians. The complexity of this system is too great for a simple expert system. The Project Manager for Test, Measurement, and Diagnostic Equipment has developed a model-based expert system that reduces the time needed to resolve problems from weeks to 1 1/2 hours.

Moving the force. Troop movements require significant planning and coordination. The Military Traffic Management Command is developing a number of ex-

pert systems that will ease the burden on persons responsible for planning and executing movements. Some significant efforts in this area are the traffic engineering problem analyzer, tender review assistant, strategic deployment system, and overseas cargo automated booking.

A splendid example of an expert system for movements is the automated airload planning system (AALPS), which captures a loadmaster's expertise in loading cargo planes. Using AALPS cuts a 22,000-man-hour planning effort to less than 1 hour. This accelerated planning capability is provided by AALPS through a large number of "canned" data modules and permits changes in loading plans until late in the loading process.

Logistics information systems. Army planners have undertaken a number of expert systems projects to improve the performance of logistics information systems. These projects include a Competition in Contracting Act compliance system, individual contracting action report, planning assistant for logistic systems, and Sacramento Army Depot manufacturing and methods system.

Capping these systems is the logistics planning and requirements simplification (LOGPARS) system, developed by the Army Materiel Readiness Support Activity. LOGPARS supports the management of integrated logistics support functions. Development of the LOGPARS expert system is being coordinated with the Department of Defense's computer-aided acquisition and logistics support (CALS) program.

Future Prospects

In the future, Army logistics will benefit from the maturing of other machine intelligence technologies, such as natural language interfaces, speech recognition, intelligent tutoring, and automatic programming. Machine intelligence has been designated one of the 13 emerging technologies in the Army Technology Base program. (Twenty-five percent of Technology Base funds have been committed to these 13 technologies.) LABCOM has set up centers of excellence and a High-Performance Computing Research Center to ensure that machine intelligence technologies are developed in a timely fashion and that Army personnel are trained in using them.

Natural language interfaces will eventually allow logisticians without specific training in data-base languages to query data bases. Such capabilities will be especially useful in expediting supply management. Despite their promise, natural language systems have a long way to go before robust applications become a reality.

Speech recognition technology will overcome some of the constraints that current computer systems impose on users. By permitting users to communicate with computers through spoken commands rather than by pressing keyboard or console buttons, speech systems will free computer operators to concentrate fully on their work.

Intelligent tutoring systems can provide students with intensive and remedial coaching, just as human teachers do. These systems develop models of student comprehension of a given subject and diagnose a student's strengths and weaknesses. Intelligent tutors will help meet the intensive training requirements of increasingly complex weapon systems in a time of tight finances.

As the complexity of future weapon systems increases, the complexity of software will also grow. Automatic programming—the use of machine intelligence in software engineering—should be an exciting development early in the next century. Automatic programming should reduce the life-cycle costs of software systems, which have been increasing at a greater rate than the costs of other systems.

The Army has undertaken many significant programs to develop expert systems technology, particularly in applying expert systems to logistics. However, because of the complexity and breadth of Army logistics, we have a long way to go to effectively apply the full spectrum of machine intelligence technologies and realize their full potential. The other emerging components of machine intelligence (natural language interfaces, speech recognition, intelligent tutoring, and automatic programming) will be needed. Fortunately, mechanisms are in place to put these technologies to work in support of Army logisticians. **ALOG**

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LEADERS DESCRIBE
ARMY'S LOGISTICS POSTURE

In the posture of the Army statement for fiscal year 1991, the Honorable Michael P. W. Stone, Secretary of the Army, and General Carl E. Vuono, Army Chief of Staff, described a broad array of logistics issues that will play major roles in the planned transition to a "versatile, deployable, and lethal Army of 1995." The posture statement was delivered to the second session of the 101st Congress earlier this year.

Citing the success of Operation Just Cause in Panama, Stone and Vuono stressed the Army's readiness to deter aggression and protect U.S. and alliance security interests worldwide. They declared that, "Of necessity, this Army will be smaller, but it will be a capable force of the highest possible quality."

Six fundamental imperatives have guided the development of today's Army and will continue to guide the transition to a smaller, capable force for 1995 and beyond—

• Quality soldiers and civilians.
• Dynamic doctrine.
• A balanced force mix of heavy, light, and special operations forces.
• Tough, realistic training.
• Assured future modernization.
• Competent, confident leaders.

Reductions in force structure will be based on careful analysis to ensure that the future Army will retain those characteristics. Army plans for the 1990's call for a reduction from 5 corps with 28 divisions to 4 corps with 23 divisions.

The Army's sustainment programs will ensure readiness in the areas of materiel, personnel, and warfighting capability. The leaders cautioned, however, that current funding will accommodate only the highest priority logistics programs. Materiel readiness will continue to be ensured through—

• Depot supply systems, such as the air line of communications (ALOC), which rapidly moves repair parts to units overseas, and the combat authorized stockage list (ASL)/prescribed load list (PLL) program, which provides repair parts during the initial phases of combat.

• Depot maintenance programs, including repair and overhaul of major items and depot-level reparables, with near-term readiness as a funding priority.

• Stock funding and customer replacement of depot-level reparables, which will begin this fiscal year.

• Transportation, though it was noted that additional funds would be needed to fully fund oversea programs should withdrawal of troops or redistribution of equipment become necessary.

• Strategic airlift and sealift capabilities, which are currently inadequate, and acquisition of additional sealift ships, which the Army supports.

Warfighting readiness will be sustained through theater reserves and industrial-base programs, including—

• Stockage of preferred munitions, which are now at minimally acceptable levels. Planned procurement programs in the next 3 years should improve the Army's munitions posture.

• Pre-positioning of materiel configured to unit sets (POMCUS), which enables personnel to quickly deploy to Europe with a minimum of equipment.

• Increased manufacturing capability by private industry to provide ammunition, equipment, and materiel in wartime.

Personnel readiness will be ensured through improved medical support and modernized organizational clothing and individual equipment.

Stone and Vuono said that "Trained and ready Army units, both globally deployable contingency forces and forward-deployed forces, backed by rapid reinforcement from the United States, will remain the centerpiece of the Nation's military strategy for the forseeable future."

DOD ORDERS CONSOLIDATED
DEPOT SUPPLY OPERATIONS

Consolidated management of Department of Defense (DOD) supply depots under the Defense Logistics Agency (DLA) will be tested in northern California under a recent decision by the Deputy Secretary of Defense. The consolidation will serve as a prototype for merging management of materiel distribution functions at the 35 major supply depots operated by the services and DLA in the continental United States (CONUS). Consolidating DOD depot management is one of the recommendations of last year's Defense Management Review.

The facilities involved in the prototype test include Defense Depot Tracy, Sacramento Army Depot, Sharpe Army Depot, Naval Supply Center Oakland, and Sacramento Air Logistics Center. The consolida-

tion will standardize software systems, implement common procedures, merge common inventory items, centralize packing, and increase shipment consolidation. The resulting reductions in overhead and transportation costs should save $127 million during fiscal years 1990 through 1995.

DLA and the services currently operate separate depot supply systems. Each has its own management structure and uses its own procedures and software systems. The 35 CONUS supply depots operate 3,400 warehouses, covering over 30 million gross square feet, to store general supplies valued at $95 billion.

The Deputy Secretary is scheduled to receive an interim report on the progress of the prototype test by 15 October. Planning to consolidate the remaining 30 DOD supply depots in CONUS is underway.

ACQUISITION REPORTS DEVELOPED

The Army Materiel Readiness Support Activity, Lexington, Kentucky, has developed three reports to help materiel system managers analyze and maintain acquisition plans and schedules. The reports are generated from the acquisition management milestone system (AMMS), the central data base used to plan and track the development and fielding of new and improved materiel. The reports identify schedule or milestone problems, cite regulatory requirements, and recommend corrective action. The reports will reduce the time required for research, program analysis, and schedule review and update.

The three reports are the developer system analysis report (DSAR), for program managers and support personnel; the Army Training and Doctrine Command (TRADOC) system analysis report (TSAR), for TRADOC combat developers, trainers, and force modernization managers; and the major Army command system analysis report (MASAR), for managers in the gaining major commands. Routine use of these reports will simplify system schedule management and improve the accuracy of AMMS data.

For more information about AMMS, write to— Commander, USAMC Materiel Readiness Support Activity, ATTN: AMXMD-EI, Lexington, KY 40511-5101, or call AUTOVON 745-3925 or commercial (606) 293-3925.

ALPC MEETS

Lieutenant General Jimmy D. Ross, Deputy Chief of Staff for Logistics, chaired the 25th meeting of the Army Logistics Policy Committee (ALPC) on 8 and 9 March. Attendees included the Honorable Susan Livingstone, Assistant Secretary of the Army for Installations, Logistics, and Environment; Lieutenant General Leon E. Salomon, Commander, Army Logistics Center, Fort Lee, Virginia; Mr. Richard Heinbach, Assistant Deputy for Materiel Readiness, Headquarters, Army Materiel Command; deputy chiefs of staff for logistics of the major Army commands; and other senior Army logisticians. Under Secretary of the Army John W. Shannon was a guest speaker. Topics of discussion included Operation Just Cause, AirLand Battle-Future doctrine, strategic logistics program, logistics force structure changes, issues from the annual division support command and support group commanders' conference, and logistics automation.

The next meeting, tentatively scheduled for 11 and 12 October at the Defense Logistics Agency, Cameron Station, Alexandria, Virginia, will address major changes taking place in army combat service support force structure and related issues.

□ Members of B Company, 48th Support Battalion, 2d Armored Division, Fort Hood, Texas, pull the engine of an M3 Bradley fighting vehicle during the annual Return of Forces to Germany (Reforger) exercise. This year's scaled-down Reforger, Centurion Shield '90, involved fewer soldiers but demonstrated the Army's readiness to execute logistics missions in support of deployment and tactical operations.

AMC REQUESTS RIF AUTHORITY

General William G. T. Tuttle, Jr., commanding general, Army Materiel Command (AMC), requested on 15 May authority from the Army Staff to conduct a substantial reduction in force (RIF). The action was required because of the serious shortage of payroll dollars programmed by Department of the Army for the command's operating and maintenance account (OMA) P7S for fiscal year 1991 (FY 91). Department of the Army is to provide a decision on the request

by 15 June.

General Tuttle notified the Vice Chief of Staff, Army, and the AMC work force in April that the command faced a RIF unless Department of the Army provides additional payroll dollars for FY 91. The command will have to reduce its work force by about 6,000 people to stay within the FY 91 OMA P7S funding guidance. In his April memorandum to the AMC work force, General Tuttle wrote, "I have made Department of the Army aware of our problem, but there is no apparent relief in sight. Therefore, we must begin worst case planning for a substantial reduction in force. . . ."

The planning figures used in calculating the required reductions are based on the President's budget getting congressional approval, unscathed, and the Army Stock Fund reimbursements materializing as projected. If Department of the Army grants the RIF authority, the command expects to receive by 12 July guidance from the Office of Personnel Management on voluntary early retirement options employees may exercise. Based on the outcome of that action, RIF notices are to be issued to the remaining affected members of the work force by 6 August.

General Tuttle emphasized to the AMC work force that every effort will be made to lessen the adverse impact. "This will not be business as usual," he wrote. "I am concerned about this situation, and your welfare has my full attention."

NEW DESIGNS DEVELOPED
FOR DINING FACILITIES, TISA's

At the request of General Robert W. RisCassi, then Army Vice Chief of Staff, the Army Troop Support Agency (TSA) and the Army Corps of Engineers collaborated in developing three new standard designs for dining facilities and three for troop issue subsistence activities (TISA's). Both sets of plans incorporate features that reflect the Army's goals for automation, human engineering, and safety.

One dining facility design is for feeding companies of 150 to 250 personnel and 2 are for battalions—1 for feeding 400 to 800 and the other for feeding 801 to 1,300 soldiers. Rather than using a straight-through, cafeteria-style configuration, the new designs adopt a "scatter system" that includes two fitness bars, two hot food stations, two beverage stands, and two condiment lines. To further reduce congestion and waiting time, there are two headcount stations. Diners will also appreciate the contemporary decor. The dining areas can be subdivided for classes, luncheons, and seminars.

The three designs for the TISA's are based on barracks capacity—5,000, 15,000, and 25,000. The designs allow for modifications based on units' specific mission requirements. All three TISA designs include computerized inventory systems, emergency generators, modular construction, improved materials-handling equipment, better insulation, and a more effective heating system.

Construction of dining facilities and TISA's based on the new designs is contingent upon Corps of Engineers scheduling and Congressional funding. TSA anticipates that the first dining facility to be built based on the new design concepts will open at Fort Ord, California, during fiscal year 1991.

CHEMICAL WEAPONS IN GERMANY
TO BE INCINERATED

The Army plans to destroy chemical munitions stored at a site near Clausen, West Germany. The Army has proposed moving the more than 100,000 artillery rounds to Johnston Atoll in the South Pacific for disposal in the Johnston Atoll Chemical Agent Disposal System. A task force under the 59th Ordnance Brigade is responsible for the removal operations.

Teams of 20 specially trained personnel will pack munitions in vapor-proof steel containers and stack and seal them in MILVAN shipping containers. The loaded MILVAN's will be transported by truck convoy to Miesau, and then by rail to the port of Nordenham. There, the rounds will be loaded on a ship for transport.

For safety, three types of air monitors will be used for gas detection during the removal process, and an emergency response team will be on hand. The German police will provide escorts for the truck convoy.

The Army plans to build eight domestic facilities that will be used to destroy chemical weapons stored in the United States.

FORT POLK UNIT OFFERS
BATTALION MAINTENANCE GUIDE

The 705th Support Battalion (Maintenance) at Fort Polk, Louisiana, has developed a battalion maintenance pamphlet for use at the operator and organizational levels. The pamphlet summarizes the battalion's approach to maintenance and is intended to reinforce but not duplicate a maintenance standing operating procedure. Since the document is generic, it could be applicable to most battalion-sized units.

The pamphlet outlines the battalion commander's maintenance philosophy and includes segments on inspections; external maintenance assistance; safety; motor officer selection; preventive maintenance checks and services; prescribed load list (PLL)/the

Army maintenance management system (TAMMS) clerk operations; reconcilations; excess management; controlled exchange; publications; the Army oil analysis program; calibration; petroleum, oils, and lubricants management; unscheduled maintenance; tool room operations; spot painting; vehicle recovery; basic issue items and components of end items; operator selection, licensing, and training; return from the field procedures; motor park appearance; and physical security.

For more information or a copy of the pamphlet, call Major Larry Harman at AUTOVON 863-7915 or -6101 or commercial (318) 535-7915 or -6101.

MEDICAL CONTRACTS SAVE MONEY

The Army Health Services Command (HSC) reduced Army health care expenses last year by increasing the availability of on-post medical services. HSC contracted with 828 full-time-equivalent private providers to practice at Army facilities that had a shortage of military staff members. More than 516,450 primary-medical-care-for-uniformed-services (PRIMUS) clinic visits were scheduled at an average of $44.09 a visit, which is $22 less than the average $66.67 visit under the civilian health and medical program of the uniformed services (CHAMPUS).

One reason that Army CHAMPUS expenditures have risen sharply in the last few years is because military families seek off-post medical care when Army facilities are short-staffed or unavailable. Many Army clinics have experienced military staff shortages due to losses, transfers, and reduced recruitment.

HMMWV's TAKE TO THE DESERT

The Army Tank-Automotive Command (TACOM), Warren, Michigan, is modifying 63 high-mobility, multipurpose, wheeled vehicles (HMMWV's) and providing modification kits for 12 others to prepare them for special forces missions in arid environments. A modified HMMWV, a high-mobility trailer, and a motorcycle will be the three components of the Army's desert mobility vehicle system (DMVS). The DMVS crew will include a driver, navigator, and gunner. The DMVS is expected to be fielded late this year.

In addition to painting the vehicles a sand color, the HMMWV modifications include—

• Providing the capability for the crew to inflate and repair tires.

• Replacing the front seats with bucket seats, modifying the seat belts, and installing hand-holds for improved comfort and support.

• Making space in the cargo area for twelve 5-gallon cans of fuel or water.

• Installing a lighted, magnetic compass and two boxes to hold ammunition.

• Wrapping protective wire mesh around the lower radiator hoses.

□ One of 63 HMMWV's at the Army Tank-Automotive Command's research, development, and engineering center receives a coat of sand-colored paint in preparation for use as a desert mobility vehicle.

MAM COURSE REQUIREMENTS REVISED

The Army Logistics Management College (ALMC), Fort Lee, Virginia, has revised the prerequisites for its materiel acquisition management (MAM) course. The MAM course, which is a requirement for the Army Acquisition Corps, lasts 9 weeks, not 1 week as reported in the May-June issue of Army Logistician.

Commissioned officers seeking to attend the MAM course should be captains or majors with at least 6 years of active Federal commissioned service. They should also have completed their branch advanced course and hold functional area code 51 (research, development, and acquisition) or have been selected for participation in the Army Acquisition Corps. Civilians should be in grades GS-11 through GS-13 and selected for participation in the Army Acquisition Corps.

All attendees at the MAM course should have a bachelor's degree or higher. Officers, warrant officers, noncommissioned officers, and civilians who do not meet the prerequisites but are assigned to an Army acquisition management position will be considered for admission to the MAM course on a case-by-case basis.

ALOG › EMPHASIS

(Continued from page 1)

**COMMISSARIES
TO CONSOLIDATE**
Secretary of Defense Dick Cheney announced that the Army commissary system, now managed centrally by the Army Troop Support Agency at Fort Lee, Virginia, will merge with commissary systems of the Navy, Marine Corps, and Air Force. The decision follows reports from a Department of Defense (DOD) study, the Jones Commission Baseline Reassessment of the Military Commissary Program, that consolidation will save about $90 million a year and improve service to military personnel and their families. At presstime, the Army was awaiting a decision as to whether the unified commissary organization will be a new defense agency or a component of an existing agency. No date has been set for consolidation.

**SERVICES SHARE
TECHNOLOGY**
Tobyhanna Army Depot, Pennsylvania, and Warner Robins Air Logistics Center, Georgia, plan to develop automated technology for repairing damaged circuit board components. By applying automated technology to the repair process, technicians can cut repair times from 28 to 5 minutes. This time savings will be increasingly significant as Tobyhanna personnel expect a six-fold increase in circuit board repairs by the year 2000. The 3-year, joint-services project, scheduled to begin this fall, is one of the first manufacturing technology research projects shared by an Army depot and the Air Force.

**29TH AORS
IN OCTOBER**
The 29th annual Army Operations Research Symposium (AORS) will be held 10 and 11 October 1990 at the Army Logistics Management College, Fort Lee, Virginia. Papers are being solicited to support the symposium theme, "Analysis—Meeting Changing Requirements and New Challenges." Inquiries concerning the symposium should be addressed to—Director, U.S. Army Materiel Systems Analysis Activity, ATTN: AMXSY-DA, Aberdeen Proving Ground, MD 21005-5071, or call AUTOVON 298-6576 or commercial (301) 278-6576.

**DEPLOYMENT
STUDIES LISTED**
A bibliography of studies and models on deployment is available to authorized persons. Write to—DLSIE, ALMC, Fort Lee, VA 23801-6043, or call AUTOVON 687-4655 or commercial (804) 734-4655.

**SUPPORT
MANUAL REVISED**
Revised FM 63-20, Forward Support Battalion, describes the functions and operations of each section in a forward support battalion, including logistics and medical missions and tactical responsibilities. It also describes the direct support services provided to brigade and division units operating in the brigade area.

Coming in Future Issues—

- Workhorse of the Arctic
- Anniston Keeps M1's Running
- Airdrop Resupply Business
- Reducing Engine Failures
- Why Not a High Tooth-to-Tail Ratio?
- Defending LCU's
- Logistics for Deep Operations
- Parallel Planning in the 10th Mountain Division
- Modernizing the Western Supply Center
- Using Containerships for Deployment
- Why Can't I Get Parts?
- CSS Equipment in Rear Battle
- Aviation Support of the AirLand Battle
- Subsistence Support for Caravan Guard
- Low-Intensity Logistics in the 'Outback'
- Depot Support for AirLand Battle