ARMY LOGISTICIAN

ALOG

May-June 1986

Logistics in the Falklands

VOLUME 18, NUMBER 3
MAY-JUNE 1986

ALOG ARMY LOGISTICIAN

THE OFFICIAL MAGAZINE OF UNITED STATES ARMY LOGISTICS

ARTICLES

DEPARTMENTS

COVER—The hard logistics lessons of the Falklands War between Great Britain and Argentina are described in the story beginning on page 2. The article explores the difficulty of supporting troops in a bare-base environment and the difficulty of providing that support from over 8,000 miles away. The cover painting depicts British logistics-over-the-shore operations used to support their Falkland forces.

Army Logistician magazine (ISSN 0004-2528) is an official Army periodical published bimonthly by the Editor at the U.S. Army Logistics Management Center, Fort Lee, VA 23801-6044, under the sponsorship of the Assistant Secretary of the Army (Installations and Logistics), the Deputy Chief of Staff for Logistics, and the Commander, U.S. Army Materiel Command. Second class official mail postage paid at Petersburg, VA, and additional mailing offices. Postmaster: Send address changes to Editor, *ALOG* Magazine, ALMC, Fort Lee, VA 23801-6044.

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ALOG EMPHASIS

WEAPONS TO GET BAR CODES

Weapons now on hand or entering the Department of Defense inventory will soon receive laser-etched bar codes. While laser-etching the bar codes has proven feasible and useful, a joint-service study group has yet to decide whether contractors or the Government should mark the weapons. The group is also developing specifications for permanently marking various materials pending the time when major end items or repair parts made of those materials are selected for permanent marking.

DX OUT, RX IN

The term "reparable exchange (RX)" replaced "direct exchange (DX)" in Army Pamphlet 710-2-2, Unit Supply UPDATE, Issue Number 8. The "reparable exchange" is an over-the-counter exchange of items that now occurs, with few exceptions, only at the direct support unit. The new term more accurately reflects the current automation-based exchange procedures.

FUEL TANKERS TO BE BOUGHT

By fiscal year 1989, the Army plans to buy 720 7,500-gallon tank semitrailers and M915 trucks to line-haul bulk fuels in the communications zone and corps areas. Procurement of the first 180 tankers is expected in fiscal year 1987. The tankers will increase by 50 percent the single-lift capacity of 12 medium truck companies (petroleum) in the Active Army and Reserve components without increasing personnel requirements.

DIAGNOSTICIAN PLAN TESTED

Fifteen noncommissioned officers recently completed a 5-month test of the master diagnostician concept at Fort Hood, Texas. Under this concept, selected systems mechanics are trained in battle damage assessment and repair and are placed at the unit and intermediate direct support levels to diagnose problems with disabled equipment. The 15 soldiers—the first graduates of the Ordnance School's master diagnostician course—practiced their skills on Abrams tanks and Bradley fighting vehicles of the 2d Armored Division. Test results are being staffed.

UNITS VIE FOR SUPPLY AWARDS

Army supply experts are evaluating the units and organizations nominated for the Chief of Staff, Army, Unit and Organization Award for Supply Excellence. The nominees represent a cross section of the total Army, not just supply units. Awards will be presented at an American Defense Preparedness Association conference in Washington, D.C., later this year.

(Continued on page 44)

Logistics of the Falklands

Logistics problems of Argentina and Great Britain during the to U.S. logisticians in supporting remote operations.

It was, as the Duke of Wellington said of Waterloo, "a damned close-run thing." The 1982 conflict in the South Atlantic between Great Britain and Argentina—the Falklands War—posed logistics challenges and called for improvised solutions on both sides that made the line between tactical success and failure a fine one.

It is indeed fortunate for hundreds of British and Argentine infantrymen that the war ended as quickly as it did. The British were desperately short of artillery ammunition, combat rations, and helicopter transport. Spare parts problems had degraded land-based air defenses, and troops were suffering more and more from the cold, wet environment. Had the Argentines still been deployed and inclined to further resist, there probably would have been large-scale, savage infantry battles; the British would have been forced, for both tactical and domestic political reasons, to press for victory before their logistics problems forced them to settle for a stalemate.

The most significant logistics problems were lack of mobility, ammunition, and rations. These shortcomings not only affected tactical operations; they also impeded the conduct of other support activities. In contrast to the "high-tech" war in the skies, with its Exocet and Sea Skua missiles, a more primitive war was waged ashore, where the logistics shortages had their greatest impact. For example, Argentine soldiers in the Falklands capital, Port Stanley (or Puerto Argentino, as they called it), had to unload supply aircraft by passing cargo along a human chain. And lack of transport forced many British infantrymen to walk the 85 miles from their landing site at San Carlos to Port Stanley.

The Falklands War began during the predawn hours of 2 April 1982, when 475 Marines of the 2d Battalion, Bujo Tacito, Armada Republican Argentina, landed at and around Port Stanley on East Falkland Island. They were ferried ashore from the landing ship, dock, *Candido de Lasala* and the landing ship, tank, *Cabo San Antonio*, by 4 (mechanized landing craft) LCM-6's, 14 (tracked personnel landing vehicles) LVTP-7's, and 15 (amphibious resupply cargo lighters) LARC-V's. Under strict orders to keep all civilian casualties and property damage to a minimum, the Argentines secured their objectives within hours and suffered only minor casualties. Whatever else the armed forces of Argentina did or failed to do during the Falklands War, the 2d Marine Battal-

□A Harrier jet is shown about to land on the container British most of their heavy-lift helicopter capability.

War

by Bruce P. Schoch

Falklands War provide lessons

ion's actions during Operation ROSARIO were quite successful, as was the performance of their American-made logistics watercraft.

Following their seizure of the Falklands, the Argentines relied primarily on airlift to increase the size and strength of their occupying garrison. The 4,100-foot, hardsurfaced runway at Port Stanley was lengthened another 200 feet with steel plating and illuminated by the army's 9th Engineer Company. During April, military and civilian aircraft transported 9,000 personnel and 5,000 tons of equipment and supplies to the Falklands. The runway was quickly repaired after the 1 May British airstrike, and the Argentine airlift continued to the end of the war. Averaging two flights in and out daily (often at night, in bad weather, and flying low to avoid intercept by the British Harrier jets), Argentine aircraft brought in an additional 470 tons of equipment, including four 155-millimeter howitzers and two Exocet missiles and launch equipment, and ferried out 604 wounded personnel.

ship *Atlantic Conveyor*. The sinking of this ship cost the

The British land campaign to recapture the Falklands was essentially a light infantry action, with an ad hoc, multibranch, and multiservice composition that in effect formed a "light infantry division." The British force consisted of the 3d Royal Marine Commando Brigade; two parachute battalions (used as heliborne and foot infantry); two dismounted mechanized infantry battalions; one Gurkha battalion of soldiers from Nepal; five batteries of towed 105-millimeter howitzers; one section of light armor; two brigade headquarters and service detachments; and elements of three squadrons (each equivalent to a U.S. battalion) of the army's port regiment. This composition reflected the availability of both units and transport. Logistics played a leading role in force structuring for the campaign.

The primary British logistics unit in the Falklands War was the 17th Port Regiment, Royal Corps of Transport. The only unit of its kind in the British Army, the 17th Port Regiment is based at Matchwood Military Port, near Southhampton, England. The regiment is composed of three active squadrons and one reserve squadron, each with its own mission—

- The 51st Squadron consists of the British Army's sailors, who wear blue uniforms. They man and operate vessels and lighters for logistics-over-the-shore operations. Forty percent of this unit is detached to oversea postings in Belize,

Hong Kong, Cyprus, and, more recently, the Falkland Islands. The 51st Squadron supplements the civilian crews on the 7 Royal Fleet Auxiliary Service logistics landing ships, each of which has a capacity of 1,400 tons and is armed with two 40-millimeter automatic cannons.

- The 52d Squadron consists of stevedores who use European-designed materials-handling equipment to support the 51st Squadron's mission.
- The 53d Squadron provides administrative supply and subsistence support to the regiment.
- The 265th Squadron, a reserve unit, augments the regiment in all three functional squadron areas and participated in the British buildup in the Falklands after the Argentine surrender.

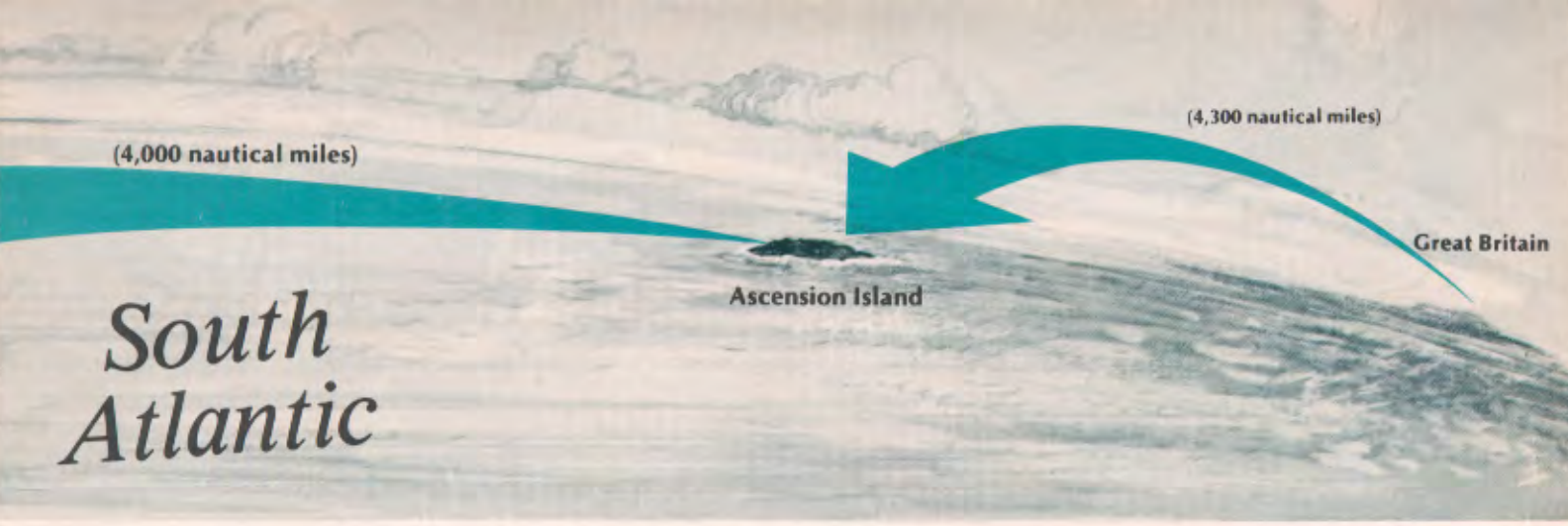
British Army engineer, supply, postal, and medical companies and detachments formed the service core for both the 3d Commando Brigade (Marines) and the 5th Infantry Brigade (Army). An engineer company installed a metal-plate landing pad for Harrier jets at Goose Green in less than a week, allowing up to four Harriers to refuel there at one time. Both Royal Marines and Scots Guard bandsmen were pressed into service as stretcher-bearers. The Royal Marines used army service, transport, and catering (food service) units. At the time of the Falklands War, the Marines were a "barebones" service lacking an organic logistics "tail"; this is now being changed.

Because the Falklands are located in the South Atlantic, much closer to Argentina than to Great Britain, mobility presented a serious challenge to the British. The Royal Navy chartered or requisitioned 59 merchant ships for the Falklands War, including 6 from Swedish, Norwegian, and Canadian firms. Ten of those were not needed and were returned to their owners before hostilities were over. Of the number actually used, 12 arrived after the Argentine surrender. They included the only pure containership used in the campaign, the *MV Astronomer*, which served as a helicopter ferry and repair platform, and the *SS Rangatira*, which brought the bulk of the engineers, equipment, and materiel. The *Rangatira* carried materiel for lengthening the Port Stanley runway and was eventually used to provide temporary housing for the occupation forces.

The 37 merchantmen actually used during the war included 9 tankers, with a total capacity of 700,000 tons of fuel; 4 troopships, including a hospital ship; 11 fleet support ships, including 5 minesweepers and 6 "despatch" and repair vessels; and 13 logistics ships (including 1 water tanker), with a total capacity of 100,000 tons.

Two of the logistics merchantmen deserve special mention. The *MV Elk*, with two 40-millimeter guns, was the only armed merchantman in the Falklands during hostilities. Although it brought 2,000 tons of ammunition to the Falklands, hasty loading plans caused it to leave 300 pallets of Royal Marine ammunition behind in England. The *SS Atlantic Conveyor* was a combination roll-on-roll-off and containership that was sunk by Argentine Exocet missiles. It carried 14 Sea Harrier jets; 4 CH-47C Chinook helicopters, 3 of which were lost in the sinking; 1 Lynx-II antisubmarine warfare helicopter, which was lost; 6 Wessex Mark V utility helicopters, all lost; 4,000 tents, all lost; the bulk of the invading force's helicopter cargo slings, all lost; and the bulk of aluminum plating for the Harrier landing strip, most of which was lost.

The sinking of the *Atlantic Conveyor* was critical in several respects. The loss of heavy-lift and utility helicopters severely limited troop mobility and crippled the amphibious landing of the 1st Battalion, Welsh Guards, at Bluff Cove on 8 June. The sole surviving CH-47C was forced to perform



herculean service for the remainder of the campaign. The loss of cargo nets hampered resupply of forces ashore by aerial slingloads, forcing greater reliance on smaller, slower-to-handle loads aboard helicopters. Finally, the loss of tents probably prompted the very rapid return of Argentine prisoners of war at the conclusion of hostilities, since there were not enough shelters for 9,000 British and 11,000 Argentine soldiers with Winter beginning.

The loss of the *Elk*, with its ammunition cargo, would have been disastrous. As it was, ammunition was barely adequate for the five 105-millimeter howitzer batteries; some units were down to six ready rounds per tube on 14 June, the day of the Argentine surrender. By the end of the campaign, 30 guns had fired 16,000 shells from positions around Port Stanley. However, this concentration of fire was only possible once Port Stanley was hemmed in after nearly 2 weeks of British build-up. The required supply rate for the field artillery was 400 rounds per tube per day, but this was not met until near the end of the war.

An Argentine airstrike on the San Carlos beachhead as the 5th Infantry Brigade was completing its landing destroyed its entire stock of Milan antitank missiles, a weapon the 3d Marine Commando Brigade had already found useful in busting sangers (built-up entrenchments) and bunkers. The Gurkha battalion landed with only the small arms ammunition in each trooper's pouch.

The British improvised a gargantuan air line of communication (ALOC) operation to deliver men and materiel to the Falklands. This ALOC ran from Great Britain to Ascension Island in the South Atlantic (4,300 nautical miles), and from Ascension to the task force around the Falklands (4,000 nautical miles). British Overseas Airline Company VC-10 airliners and Royal Air Force C-130 transports (modified for in-flight refueling) flew 600 sorties to Ascension, delivering 5,000 troops and 6,000 tons of supplies. Up to 400 fixed-wing and helicopter flights were recorded daily to and from Ascension. As the British Fleet sailed to Ascension, most of the personnel and supplies were transferred to the warships and auxiliary ships for transport to the Falklands. An additional 44 C-130 sorties were flown to the Fleet in the Falklands area, their loads parachuted for sea recovery. The ALOC resupply effort was necessary, although supplies for a 3-month campaign were being shipped, because merchantmen from Great Britain needed 3 to 4 weeks to reach the Falklands.

Fortunately for the British, there were no tanks opposing their landing at San Carlos (the 12 Argentine Panhard AFV tanks being 85 miles away at Port Stanley). Indeed, the British were opposed by nothing more than a corporal's guard of infantry that quickly withdrew. However, there were real problems with establishing and sustaining a base and moving inland to close with the Argentines.

The 3d Marine Commando Brigade landed on 21 May at San Carlos and needed 5 days to build up the base area. During that time, 12,000 tons of equipment and supplies and 5 battalions of men were landed by helicopter, by 5 (later 6) logistics landing ships, by Mexeflote barges, and by a handful of landing craft from the landing ships, dock (*HMS Fearless* and *HMS Intrepid*). These landing craft, eight (utility landing craft) LCU-9's, and eight smaller personnel and vehicle landing craft were designed for unit landings rather than for sustained logistics-over-the-shore operations. Since Port Stanley, the only port in the Falklands, remained in Argentine hands throughout the war, the entire British supply effort was over-the-shore. Ultimately, 30,000 tons of supplies and equipment were unloaded, mainly at San Carlos.

Discharge of supplies was effectively limited to 6 hours daily because of Argentine airstrikes, rough seas, and Antarctic Winter darkness. Many British helicopters, and most Argentine ones, could not operate over the barren, mountainous islands at night. The crew of the sole British CH-47C helicopter on two occasions suffered "white-out" disorientation during snow showers, as did the crews of Wessex helicopters used during the British recapture of nearby South Georgia Island. Helicopters and crews equipped with and trained in the use of passive night-vision goggles were used in tactical maneuvers at night, by the British in their raid on Peeble Island and the capture of Mount Kent and Fitzroy and by the Argentines in their reinforcement and subsequent evacuation of Goose Green.

The loss of critical helicopters, especially three of the four available CH-47C's when the *Atlantic Conveyor* was sunk, led to a ripple effect on British tactics and logistics. Helicopter shortages and operational shortfalls led the British to land the Welsh Guards at Bluff Cove as the only way to outflank the Argentines and move troops forward rapidly. This effort turned into a disaster because of lack of air cover and basic violations of the principles of amphibious landings.

Inland transport was a serious problem for both sides. There were only 12 miles of paved roads in the Falklands, all in the Port Stanley area; the rest of the "routes" were literally trails across the moors and through mountains. The British sent only 300 vehicles to the Falklands, very few of which were all-terrain-capable. The Royal Marines had 24 Volvo BV-202 tracked vehicles, and the single British armored unit (B Troop, Blues and Royal) had only 9 armored vehicles, including 4 Scorpions, 4 Scimitars, and 1 Sampson recovery vehicle. While the BV-202's proved quite useful for towing artillery and ferrying small loads forward, their speed did not exceed that of infantry soldiers on foot. Land-Rovers, long a British workhorse utility vehicle, did not have sufficient ground clearance for the often rocky terrain of the Falklands. Nor were the 5th Brigade's Sno-Cats particularly effective.

The lack of suitable off-road vehicles, coupled with the overstressed helicopter fleet, meant long marches on foot for most of the British troops. Facing cold weather, sustained only by combat rations, and burdened with heavy loads, troops could make only slow, methodical progress. While preserving the force, the slow advance also strained the supply reserves. Problems for the Argentine forces were similar, and they had even fewer helicopters than the British.

Despite press reports to the contrary, Argentine troops in the Falklands were not starving (though some isolated malnutrition cases were later evacuated from outposts). The Argentine forces had been in possession of the Falklands for 6 weeks before serious British opposition began, and they were able to fly supplies in and fly wounded soldiers out up to the day of their surrender.

The Argentine diet must have been monotonous, because the Argentine command sent purchasing agents and droving parties into the interior of East Falkland Island to purchase some of the 700,000 sheep raised by the locals. The Argentine command tried to maintain a correct relationship with the 2,000 British inhabitants of the Falklands and, while there were lapses, property generally was not seized. Most of the inhabitants did not cooperate with the Argentines, but on at least one occasion an Argentine purchasing officer did buy 300 sheep at Fitzroy. Most of the sheep, however, were lost by inexperienced drovers during the 15-mile drive back to Port Stanley.

At the end of the campaign, Argentine rations from the supply dumps around Port Stanley were sufficient to feed both British troops and Argentine prisoners of war. Distribution of rations to its forces outside the Port Stanley and Darwin base areas appears to have been the biggest Argentine subsistence problem.

The British, however, had problems with the quantity and quality of food from the beginning. While troops ate well aboard the troopships, it was another matter ashore. The British had shipped to the South Atlantic several months' worth of refrigerated and institutional rations (12 million meals in all), but only 38 days' worth (1 million meals) of operational, or combat, rations. Ammunition resupply, troop movements, displacement of field artillery, and evacuation of the sick and wounded took priority for precious helicopter lift. Field kitchens would have to wait until surrender; meanwhile, troops ashore subsisted on combat rations. From the landings at San Carlos on 21 May to the surrender at Port Stanley on 14 June, 5 battalions consumed 24 days' worth of rations and 3 others consumed 14 days' worth; there were barely 2 weeks of combat rations left on 14 June. While much has been said of the high degree of physical conditioning of the British troops, the ration issue had at least one deleterious effect: company physical training cadres, no longer able to maintain their customary high-protein diets, began to fall out, while slightly overweight troops "drew upon their reserves" and kept going.

British ammunition storage sites lacked adequate cover and hardstands.

The speed of the British deployment caused problems in addition to the lack of mobility, ammunition, and food. While the 3d Marine Commando Brigade was on "spearhead" status when the war began and had its initial 30-day load of supplies and equipment already placed on pallets for rapid deployment, the 5th Infantry Brigade did not. One unit, the 2d Battalion, Scots Guards, had just come off duty at Buckingham Palace and did not have cold-weather clothing (the Royal Marines had such clothing from their annual training in Scandinavia). Several officers who were members of the peerage literally had to "pull rank" with family members in the House of Lords to receive Winter clothing before deployment.

Despite much evidence that the British forces had better physical conditioning and unit training and cohesion than the Argentine forces, the British still experienced up to 20 cases of trenchfoot per day after they landed. Argentine troops, in their largely static and prepared postions, were not badly clothed for the climate. British Broadcasting Corporation newsreels of Argentine prisoners awaiting evacuation or undergoing strip searches revealed adequate Winter uniforms.

Logisticians can learn several lessons from the Falklands War. For example, units that are going to be resupplied by air must be fully trained in both external slingloading and internal loading of cargo and utility helicopters. Specially trained support personnel may not be available to do the job.

Physical conditioning is critical, though it can be misapplied. The intent is not to develop professional athletes, weightlifters, or human porters. The goals of unit and individual physical training should be to develop stamina for long marches, to learn personal health and hygiene (including looking out for fellow soldiers), and to learn to fend for oneself in the wild.

Units should critically evaluate their equipment needs. Are field kitchens necessary? British troops brewed their tea on folding stoves. How much is needed in weaponry? At least two Argentine aircraft were destroyed, in flight, by handheld antitank rockets, which were also useful for reducing sangers and bunkers. Must troops have shelters, or can they sleep in the open? There are no easy answers—all requirements must be carefully evaluated.

Air defense of logistics facilities, even with small arms, is obligatory. Twenty-five percent of the British vessels attacked in the Falklands were logistics or support vessels; all but two of the Argentine ships sunk were logistics vessels, and the Argentine submarine *Santa Fe* was on a logistics mission when it was sunk. Argentine air attacks on the San Carlos beachhead destroyed an ammunition point, damaged two helicopters, and in general disrupted the orderly flow of the British deployment. Defense against small but elite ground raiders also deserves training attention.

Any means that is not criminal should be considered to move men, equipment, and supplies. Horses, mules, carts, dogs, civilian vehicles, and civilian porters all can be possibilities at some time. The options were fewer in the Falklands, but not absent: the Argentines briefly impressed the Governor's plane into service (it was destroyed by a cluster bomb), and the British availed themselves of a small, abandoned Argentine coaster, the *Monsunen*.

The Falklands War was a laboratory war in the mold of the Spanish Civil War of 1936 to 1939. It was also a nearly perfect "barebones" theater into which both sides had to import almost everything required to prosecute the war. Most news reports focused on the new technology used in the war, such as the Exocet missile; but the Falklands War also offers a valuable case study in logistics, particularly for supporting operations in a small, remote theater. ALOG

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Proactive Maintenance Management

by Captain Ralph H. Stutzman, USAR

Maintenance management remains a prime concern of commanders, from company- to Department of the Army-level. Let's face it, without equipment in operating order, a unit cannot respond to its mission requirements. On the battlefield, equipment failure can have catastrophic results. The commander who doesn't pay attention to equipment maintenance, both in garrison and in combat, is doomed to fail.

The old adage "The squeaking wheel gets the grease" doesn't apply to modern maintenance management. When the maintenance wheel squeaks it is already too late, for a breakdown has already occurred. Command attention is still the key to any successful maintenance program, and the unit commander must continually check and inspect his equipment to ensure that it is ready to perform its mission.

The Army's 7-year-old maintenance management improvement program (MMIP) is still the tool to help the commander do this critical job. The program's five objectives (described in DA Circular 750-83-3) are still valid—command knowledge and attention; maintenance operations; maintenance training; management of personnel; and publications, tools, and repair parts. Additionally, Field Manuals (FM's) 29-1 and 43-1 identify six factors that influence maintenance effectiveness—command emphasis, management, supervision, motivation, skill, and resources. Notice that if you were to combine supervision and motivation, the six factors would closely equate to the five MMIP objectives—

- Command knowledge and attention = command emphasis.
- Maintenance operations = management.
- Maintenance training = skill.
- Management of personnel = supervision and motivation.
- Publications, tools, and repair parts support = resources.

Yet another management tool was subsequently introduced to help the commander meet his maintenance management responsibilities. It is called the unit maintenance management system (UMMS). It was advanced as a way to identify maintenance responsibilities at each management level, from squad leader to battalion commander. This system was long needed to establish what each level of management would be responsible for in managing and supervising the overall maintenance program.

Still, the UMMS, like the MMIP, merely identifies functions, management methods, and maintenance factors. Neither suggests how the program or the system is to be implemented.

To assist maintenance managers in implementing the MMIP, I would suggest using the proactive management method. Proactive management—as opposed to reactive management, which simply reacts to problems as they arise—aggressively takes the initiative in anticipating problems and devising possible solutions. Essential to proactive management is planning, using key indicators. Key indicators are nothing new; effective maintenance managers have used them for years. The unique difference in the proactive method is that the key indicators are used in a *systematic* way.

The proactive management method's four-step cycle (shown in the chart on the right) is dynamic and adaptable to changing situations. Step 1 concerns identifying the problem. This is where the key indicators come into play. (Lists of indicators can be found in DA Pamphlet 750-1 and FM's 43-1 and 43-1-1.) Remember that no one list will identify all maintenance problems but will serve only as a tool for the maintenance manager's identification of the problem.

Step 2 concerns diagnosing the problem. Determining why something happened and what caused it to happen is the idea behind step 2. Sometimes the diagnosis is obvious, but sometimes the problem is hard to diagnose and requires considerable study. This can be because more than one factor is contributing to the problem. The key point is, one must not jump to a quick conclusion that may address only a portion of the problem. Once the general cause of a problem is determined, then the specific cause must be found. This determination depends upon the expert judgment of the maintenance manager and his expertise in maintenance operations.

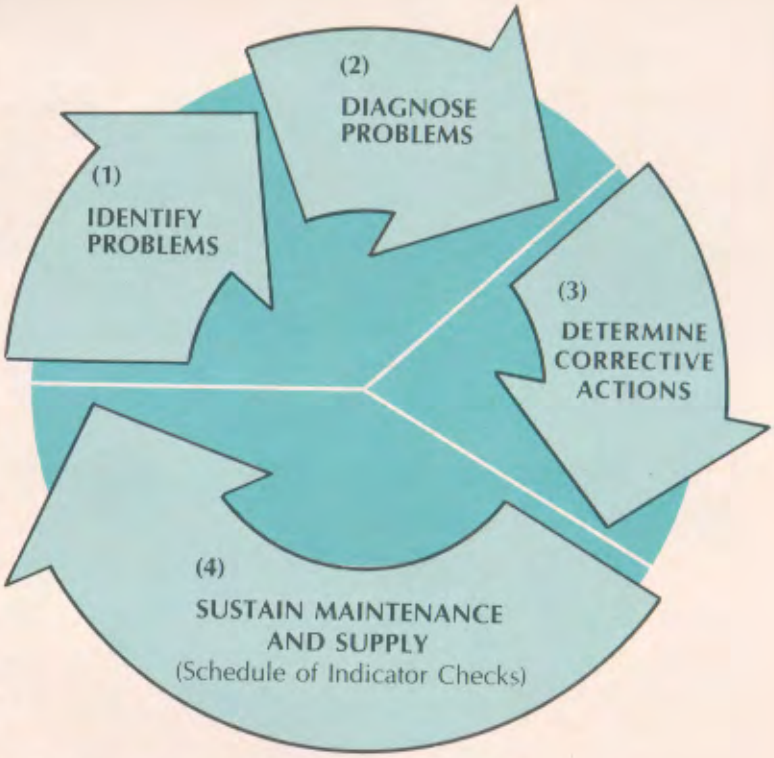
Step 3 concerns corrective actions, wherein the proactive management method differs from most other methods. Managers may choose either of two approaches to problem-solving: obvious solutions or research solutions.

The obvious solution usually is apparent once a problem is identified. This may be the reasonable solution or it may not, because one moves directly from the general cause of a problem to the solution. Sometimes it will work, sometimes not.

The second approach, the research solution, may provide the best course. It is a follow-through on each step of the management cycle. The research solution requires close scrutiny of all the general causes that may be involved in the problem as well as the specific causes. The maintenance manager must judge which of the methods of solving the problem best fits the particular situation. If in doubt, use the research solution. It takes longer, but it is less error prone.

Step 4 concerns sustaining the maintenance program, wherein the proactive management method's cyclic steps 1, 2, and 3 are repeated. If the steps have been followed carefully the first time, they will not have to be repeated in as much detail in subsequent cycles.

Maintenance managers need to establish check-schedules and then set timetables in which to perform the checks. There should be daily, weekly, and monthly checks as well as additional periodic and seasonal checks of maintenance tasks. The maintenance manager must actively examine the equipment in performing these established checks. The checks do not have to be overly time-consuming, but they do need to be well thought-out and regularly performed. The manager should vary his visitation schedule to prevent a "white-wash" by maintenance personnel. In fact, there are days in which he should make more than one visit. Each maintenance manager must establish his own schedule according to the specific needs of his operation.



☐ **Steps of the proactive management method.**

To implement the MMIP using the proactive management method, maintenance managers need use only FM's 43-1 and 43-1-1. These manuals are written in such a way that one may use proactive management to examine potential maintenance problems in light of the six maintenance effectiveness factors.

Effective maintenance operations are critical to the operation of the Army, and the MMIP has been identified as the program to improve current maintenance operations. As with many broad-based programs, the MMIP establishes what maintenance managers are responsible for but gives little guidance on how to implement individual improvement programs. Using the proactive management method and the cited manuals, maintenance managers at all levels can establish efficient, workable MMIP's. ALOG

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Making Tech Manuals

by Stephen T. Larsen

Sergeant Vandegriff scratches his head as he reads the following paragraph from an operator's and organizational maintenance (-12) technical manual (TM)—

> Adding and deleting messages during a live scenario recording session differs from the method used in other modes. Due to the inexact reporting times of targets, it is not practical to pre-program time-tagged edit instructions in the EDIT buffer.

"Hey, lieutenant," Vandegriff calls to his maintenance shop supervisor, "read this and see if you can make heads or tails of it!"

As the lieutenant reads the paragraph, his brow wrinkles. "I've got absolutely *no* idea what they're talking about. You'd better send in a 2028 on it." (The lieutenant's other comments are unprintable.)

"What's the use?" Vandegriff asks. "I sent five of 'em last year on the AN/TPS-25 radar set TM and nobody's done anything about them."

Sound familiar? Making technical manuals better serve the user has been an ongoing concern of the Army ever since there's been a potentiometer to "tweak" or voltage to check. There are few other elements, if any, in the integrated logistics support area that are more complex, sophisticated, high-risk, potentially costly over the equipment's life-cycle, or more visible than the technical manual. When instructors at the Army Logistics Management Center, Fort Lee, Virginia, ask students where they find trouble with their acquisition programs, they shout in reply, "With the TM's!"

Regardless of the type of TM—be it an operator's -10, an organizational -20, a direct support -30, a general support-40, the depot work requirements document, or any combination (-12, -24, -34) of these, the world of TM development and production is fraught with hundreds of logistics pitfalls that could cost the Army hundreds of thousands of dollars and adversely affect readiness.

Each acquisition program has to be carefully examined for its unique requirements, keeping in mind that a TM will be around throughout the equipment item's life-cycle. The logistician-technical writer had better get his requirements into the acquisition process *early*, preferably in the concept-development phase. During the logistics support analysis process, systematic analysis is performed to define the scope and level of logistics support required. The logistics support analysis record (LSAR)—a hard copy of the analysis—includes detailed descriptions on how each maintenance task is to be done (the "D" sheets), which form the bases for developing maintenance procedures in the TM's. But this is just a start: the technical writer-logistician must develop this raw data to ensure the TM's will serve the needs of the user.

There are some basic guidelines the tech writer can follow to develop and produce tech manuals that will better serve the user. Roy Post, chief of technical publications division at the Communications-Electronics Command, Fort Monmouth, New Jersey, says two things are paramount in TM's—*technical accuracy* and *usability*.

User-Friendly

Technical accuracy means the TM provides correct and verifiable data, dimensions, tolerances, specifications, and operating and maintenance procedures. "Inaccurate technical information and procedures cause wasted man-hours and excessive downtime and could result in injury or death," Post says.

Usability goes hand-in-hand with technical accuracy. The most accurate technical data are valueless if the manual is written in jargon, doubletalk, or "officialese" that no one can understand. Keeping in mind that technical accuracy and usability are the basic requirements, consider some of the problems that currently plague developers and producers of TM's.

Problem: Users can't understand what the TM says. Think back to the paragraph that Sergeant Vandegriff read. The paragraph was *technically accurate*, but it was written in such technical doubletalk that it couldn't be deciphered without the engineering equivalent of the Rosetta Stone. The result: the information was absolutely useless to the user.

Solution: Be sure that a user-representative actively participates in the TM verification. Verification is the process whereby the technical accuracy and usability of the TM are ensured by performing 100 percent of the TM's operational and maintenance procedures. This is usually done at the hardware contractor's plant, using test, measurement, and diagnostic equipment that the soldier in the field will have under the maintenance concept for the item. As the user-representative goes through the procedures, the tech writer will be looking over his shoulder taking notes, ensuring that the users' needs are met and also plugging any "holes" found in the LSAR.

In national emergencies when fielding of hardware is accelerated to meet the threat, the verification process sometimes fails to have the soldier-user involvement. These instances have dramatically underscored the essentiality of that involvement. Given the realities of today's acquisition process—such as nonavailability of hardware and compressed delivery schedules—events conspire to prevent the soldier-presence in TM verification. This doesn't mean that the user is shut out of the TM development, for the Army Training and Doctrine Command provides user profiles early in the concept development phase and the tech manual producers keep close contact with the combat developer until after the hardware is fielded.

By the way, the paragraph that Vandegriff struggled with in the beginning of this article actually appeared in a draft equipment TM, but fortunately a soldier was present at the verification and cried bloody murder! Even the contractor's tech writer who wrote the paragraph couldn't figure out what it meant. After consulting the contractor's engineering staff, an Army tech writer rewrote, to the satisfaction of the user, the following—

> It is impractical to attempt to edit during recording of real-time events. This is because the exact times that events occur are random and unknown to the operator.

Clear, simple, to-the-point language conveys the technically accurate and usable information the user needs.

Problem: Some TM's have so many illustrations that they're more like picture books than TM's.

Solution: There needs to be a better understanding of how to interpret and implement the Army's "new look" concept in TM development. Basically, the concept calls for integrating illustrations with simplified text to better explain highly technical material. What has resulted, however, is that some TM's illustrate such mundane maintenance tasks as using a screwdriver—sometimes with repetitive illustrations! Still other TM's inappropriately use caricatures of soldiers performing operational and maintenance tasks.

Since the inception of the "new look" concept, the AMC Materiel Readiness Support Activity, in Lexington, Kentucky, has identified ways to improve TM effectiveness and reduce production costs—

- Reduce the quantity of illustrations.
- Use human figures, not caricatures, in illustrations.
- Eliminate "overkill" of instructions.
- Reduce textual explanations of simple procedures.

Lessons have been learned in better using the "new look" TM concept over its 10-year history. Even private industry is now following the Army's lead in producing operators' manuals for their products that integrate text and illustrations in readable, understandable language.

Problem: Too many "chiefs" can spoil the TM.

Solution: Indeed, TM's are written by "committee." They require input from the combat developer, logistics manager, logistics engineer, production engineer, safety officer, maintenance engineer—in fact, just about everybody associated with a piece of equipment. Frequently, input from all these sources is fed directly to the contractor's tech writer, wherein the problem is created.

It's the Government's tech writer who wants the comments and input from all of these sources. The comments must be filtered through this process; otherwise, the "approval" process can spoil the TM. In an organization as large as the Army, different groups have different axes to grind and all can bring some pretty heavy "artillery" to bear on a contractor's tech writer. With "suggestions" being fired at him from all directions, he runs for cover with the result being an inconsistent, poorly written TM.

The rule *must* be that the Government's tech writer is the only voice that supplies the comments to the contractor's tech writer.

A case in point: After reviewing a draft TM, a combat developer wrote comments directly to the contractor's tech writer, telling how to measure radiation in an "attenuated environment." The contractor inserted the comment verbatim into the TM. Well, an "environment" cannot be attenuated; only something with a measurable level of intensity—such as voltage, power, or radiation—can be attenuated.

What the combat developer wanted to say was, when measuring radiation inside a shelter, the operator must use a compensation factor for being inside the shelter, because *radiation* is *attenuated* when it passes through the shelter walls. Besides giving the contractor's tech writer a technically inaccurate statement, the combat developer directed the passage to be inserted in the wrong chapter of the TM.

Problem: There's no response to DA Forms 2028, Reporting Errors and Recommending Improvements, in tech manuals.

Solution: The UPDATE publications program holds promise as a solution to this problem. UPDATE publications (printed somewhat like telephone books) are periodically distributed to users. When the new "updated" publication arrives, the old one is simply discarded. This approach is being tried with the operator's manual for the UH1H/V helicopter, and users' responses to it are being carefully considered.

Admittedly, there are problems with the current TM system—errors do occur in spite of all the efforts to prevent them and sometimes it can literally take years before valid suggestions and corrections can be incorporated into them. It is also understandable when users despair of sending in DA Forms 2028. But, consider this: There are about 24,000 equipment publications in the Army inventory—a figure that rises 2 to 4 percent a year—and the tech-writer work force does not increase proportionately.

Another possible solution to the TM problem may be in emerging communications technology. The Office of The Adjutant General is exploring an Army integrated publishing and printing service (AIPPS) that includes an electronic data base for TM's. One day, tech writers may be able to key in changes and revisions to TM's directly from a computer console at their desks, which would feed into the AIPPS through a centralized electronic publishing system.

Laser technology could be used to print hard copies of the TM changes and revisions at the users' locations. This would vastly shorten the time now required to change and revise TM's and eliminate the backlog of changes waiting to be done.

The future promises an increasing amount of electronic equipment and a better use of technology. Hopefully we can apply this technology to better provide technical logistics data. After all, getting the *right* things to the *right* place at the *right* time is what logistics is all about, isn't it?

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A computerized course provides—
AMP MOD Training

by Donita S. Schmidt

The Army Materiel Command (AMC) has developed a new system to increase productivity and efficiency in materiel management. To ensure that the system, called the Army materiel plan modernization (AMP MOD), begins yielding benefits as quickly as possible, AMP MOD users must be trained rapidly. To accomplish this, the Army Logistics Management Center (ALMC), Fort Lee, Virginia, has developed a training program as advanced as the AMP MOD itself.

The System

The AMP MOD is a user-friendly, state-of-the-art computer system. It is an interactive major item data base that supports the Army budgeting and procurement process in a secure operating environment. The system is actually a network linking the commodity-oriented data bases at each AMC major subordinate command. In turn, these data bases are linked by high-speed communication lines to a consolidated data base at the Army Depot System Command (DESCOM) at Chambersburg, Pennsylvania. Information in the AMP MOD is obtained by using terminals satellited onto a host computer. Input to AMP MOD is accomplished through interactive computer terminals, batch cards, or interfaces with existing logistics systems such as the continuing balance system-expanded, the total Army equipment distribution program, and the commodity command standard system.

The AMP MOD's online updates and inquiries and realtime exchanges of information eliminate manual manipulation of data. Changes can be made with formatted screens, then verified and posted throughout the system, greatly enhancing the accuracy and standardization of major item data. Its speed gives the manager better control over all phases of major item management.

The Training

The success of the AMP MOD depends largely upon the training its 2,000 users receive. The training program is designed for users at all AMC locations and all levels of management. Like the AMP MOD, the training is also interactive.

The AMP MOD course is available in two different computer-based education modes. The first mode uses a "hands-on mission terminal" approach. The student receives an overview of the system and its processes in a classroom environment. The student then works through a series of practical exercises on a mission terminal, the student's actual workstation. A reference text shows step-by-step procedures for performing each function.

In the second mode, primarily for follow-on training, all instruction is presented on a computer terminal. The student receives a system orientation and then works through a series of exercises simulating the actual AMP MOD operation. The only difference between the training and the real thing is that the simulation gives hints on any incorrect entries.

There are several benefits to using computer-based education in support of a system as diverse as AMP MOD. It allows for individualized instruction; the student can concentrate on the areas that are most important in his job. It also reduces the burden on instructors; the instructor helps with problems a student may have but is not the primary source of instruction. The interactive approach, wherein the student receives immediate feedback on his actions, reduces learning time.

Representatives from 13 of the activities that will be using the system have already been trained and certified as instructors of AMP MOD. They will conduct classes at their respective activities to accelerate the education process. As a result, more people in more locations will be trained in less time, making the AMP MOD a more effective and immediately useful system. ALOG

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Developing Performance Work Statements

by Raymond K. Linden

Ever since the Department of Defense adopted the policy of contracting with private industry for services and support activities, logisticians have been confronted with new dimensions in providing logistics support. Suddenly we had to analyze support functions and tasks, define and categorize them, and determine if they could be performed as adequately and economically by industry as in house. Once the determination was made that the service or support *could* be provided by contract with private industry, then the re-

quired service or support had to be meticulously described in writing. As Hamlet observed, ". . . ay, there's the rub."

While the Government publishes an abundance of regulatory and guidance material, no subject has generated less material than how to organize and write descriptions of work to be done by a contractor. In service contracts, work to be done by a contractor is referred to by a variety of names, such as statement of work, work statement, specifications, technical requirements, purchase descriptions, or scope of work. The performance work statement (PWS)—the term that I will use—is the heart of a service contract.

While there is little guidance on preparing a PWS, there is an abundance of information on developing contract specifications for materiel, supplies, and equipment. Much of this guidance can be used in preparing PWS's for service contracts. The PWS is our means of communicating to the contractor what we want him to do for us and how well we want him to do it.

Government policy requires us to state only the minimum needs; describe supplies and services in a manner that will encourage maximum competition; and eliminate, insofar as possible, restrictive features that might limit acceptable offers to one supplier's product or products of relatively few suppliers. While this policy is primarily hardware-oriented, services also come under it. "Goldplating" in service contracts, as in all Government contracts, is to be avoided.

Unlike hardware specifications, most PWS's for services describe unique requirements of the service to be performed and cannot be standardized. However, there are some situations in which a basic PWS can be tailored to subsequent contracts for similar services. The PWS must be clear, complete, and definite in expressing the minimum needs of the Government. The PWS must be written in a way that ensures that all contractors are competing on an equal basis. Features in the PWS that are unduly restrictive should be avoided. The requirements written in the PWS will reflect the technical judgments of those writing them. If the PWS is written well, it should pave the way for a smooth contracting process.

Many contracting problems result from ambiguities. Often our PWS's are not clear and accurate. Ambiguities cause the greatest number of disagreements between the Government and the contractor. When requirements are inadequately or poorly stated and additional work is required of the contractor to fill our actual needs, an argument ensues. In order to settle the argument, the Government in all probability will have to compensate the contractor for the additional work. It is, therefore, the responsibility of those who write the PWS to ensure that requirements are clear, accurate, complete, and definite. A good PWS means a good contract.

A good PWS tells the contractor explicitly what the Government needs rather than how to provide it. It is up to the contractor to tell us how he will fill the need, and he will be responsible for the results attained. The Government should place maximum responsibility for performance on the contractor, since he is awarded the contract based upon his expertise and ability to perform. We in Government are more concerned with the product than with how it is produced. A good PWS will allow the contractor the flexibility to devise the best way of accomplishing the work. Nonetheless, the PWS must be descriptive and definitive enough to protect the Government's interest and promote competition.

Only straightforward, meaningful phrases should be used in a PWS. Ambiguous words, like "very clean," "acceptable manner," "minimum time," and "maximum efficiency," should be avoided. They are subjective and cannot be measured. Formulating PWS's for service contracts is difficult because the description of the service to be performed often involves intangible, subjective elements. For instance, in housekeeping services one deals with cleanliness, polish, and neatness. These characteristics are subjective, associated with the senses of sight and feel, which are difficult to describe. What constitutes a *clean* window, a *waxed* floor, or a *polished* desk? Statements like "all glass surfaces shall leave no streaks, swirl marks, dust, or fingerprints" should be used. These subjective requirements also are difficult to define unless they can somehow be quantified. Sometimes they can be quantified by referencing a Government or industry standard or by devising an examination or test for the quality of service performed.

The method for writing quality measures into a PWS is called performance values. In writing performance values for contracts, we must identify three things—the performance indicator, the standard, and the acceptance quality level. Performance values are systematized elements by which the Government can evaluate contractor performance and compliance with the terms and conditions of the contract.

A performance indicator is a characteristic of output that can be measured. Let's take for an example providing taxi service. Performance indica-

tors for taxi service could be response time, accidents per mile, and operational cost per mile.

We then must review each job task to see what characteristics can be measured. In many cases, agency directives specify the performance indicators to be used in evaluating output. If indicators are not prescribed, then we must work out with management a set of indicators that quantitatively measures satisfactory output.

A standard is a constant against which something can be measured. Performance standards for a contract must be based upon how well the service was performed in house, since it is DOD policy to demand no more of the contractor than we demanded when the Government was providing the service. Again using the taxi service example, the standard for response time could be 4 minutes, the standard for accidents per mile could be 0, and the standard for operational costs per mile could be 14 cents.

The acceptable level of quality tells what variation from the standard is allowed. It is used to measure the reliability of the output. An acceptable level of quality is expressed in percentages of allowable error in a specified period of time. For the taxi service example, an acceptable level of quality for response time could be plus or minus 5 percent, for accidents per mile 0 percent, and for operational costs 20 percent.

Using the performance indicator with its associated standard, we determine what error rate should be allowed. The acceptable level of quality thus established must be equal to but not exceed the acceptable quality standard applied when the Government provided the service in house. Quality levels are difficult to define since quality is primarily judgmental.

After the performance values are established they are incorporated into the PWS as a performance requirements summary. The summary, in columnar form, lists all the tasks the contractor must perform, the standards, the acceptable levels of quality for those tasks, the method that Government inspectors will use to judge performance, and the amounts of money to be deducted if the tasks are not performed or if performance is substandard. Ideally, the columnar list will include the way each task that is given to the contractor will be measured.

The deduct column of the summary is perhaps the most controversial. Standard inspection clauses contained in our contracts give the Government the right to deduct from the contractor's payment an amount *equal* to the *reduced value* of the performed services that are substandard. To support this clause, we must perform a deduct analysis and include it in the PWS. The Federal Acquisition Regulation allows us to take the deductions only in instances where the contractor cannot perform the services again.

The difficult part of the deduct formulation is in determining how much to deduct. One way is to base the deduct calculations on labor costs alone, since it is almost impossible to calculate value before the output is produced. Also, we must avoid penalizing the contractor. He must be paid for substantial performance of any work he does from which the Government derives benefits. The total of all deducts should never add up to more than 100 percent of the contract payments, since this would constitute penalizing the contractor.

Deduct analyses have little value in contracts that contain performance incentives. Poor performance will result in a reduction in the incentive amount the contractor earns; and if we were to also impose a deduct, then that would constitute a penalty, which regulation does not permit.

To summarize, the PWS should be definitive enough to protect the Government's interest yet flexible enough to encourage competitive bidding on the contract by industry. The contractor should be able to perform the required work, taking his direction from the PWS alone. A PWS will be interpreted by what it says, not by what the writer intended it to say. The PWS must be written so that it can be uniformly interpreted by the Government and the contractor. The established legal principle, "Rule of ambiguitus," will be applied when different interpretations of the PWS arise. If the contender's interpretation is reasonable, the Armed Services Board of Contract Appeals and the U.S. Claims Court will rule against the party who drafted the document. This becomes a very important point because the Government, as the drafter of the PWS, must bear responsibility for ambiguously described requirements.

The PWS, being the heart of a contract, will determine what the contractor will do, what we will receive, and how much we will pay. The criticality of this document demands that our maximum capability be employed in its development. ALOG

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Using Lithium Batteries Safely

The lithium-sulfur dioxide (Li/SO2) battery is well on its way toward becoming the Army's standard battery. The Li/SO2 is a lightweight, powerful battery that operates in temperatures down to minus 20 degrees Fahrenheit. So what's the problem? There is concern over hazards posed by the chemical composition of these batteries. *Education* and *training* are the solutions to the *safe* stockage, storage, transportation, issue, and use of the lithium battery. Those who procure, stock, and store them and those who transport and use them in equipment operation must become familiar with the characteristics of the battery and with the *safe* way to handle, transport, and use them.

What makes the Li/SO2 different from other batteries? The battery cell uses lithium (Li) as the anode and sulfur dioxide (SO2) as the cathode. What makes the Li/SO2 battery potentially hazardous is "venting," which means a leaking of the highly toxic SO2 gas; but there are major safety features built into the batteries.

Venting does not happen often; in fact, from the 1.1 million batteries procured and issued over the past 3 1/2 years, only 40 venting incidents have been reported. Venting may occur rapidly or slowly. Rapid venting can occur with sufficient force to damage the battery box, but the box is currently being redesigned to prevent this. The batteries also have thermal and hard-wired fuses and diode protection to preclude venting caused by electrical conditions.

Here are some practical safety do's and don'ts.

Do—

- Inspect batteries for damage or defects (swelling, bulged plastic wrap, brown liquid in the wrap, physical case damage) before using.
- Report any battery venting to your local safety office within 24 hours and to the Communications-Electronics Command Safety Office (AUTOVON 995-3112).
- Store batteries in cool, well-ventilated areas, separated from flammable liquids, oxidizers, or other hazardous materials; preferably in a sprinkler-protected facility or in noncombustible warehouses.
- Notify your local fire department of battery storage areas.
- Use an approved class-D fire extinguisher in the event of a lithium metal fire.
- Limit stacking of batteries to provide clearance on all sides.
- Prohibit smoking in storage areas.
- Restrict use of open flames in or around storage areas.
- Adhere meticulously to all regulations governing shipping of batteries.

Don't—

- Use batteries that show signs of damage or defects.
- Use equipment if the battery compartment becomes hot. Allow the gear to cool to the touch (at least 60 minutes) before changing the battery.
- Charge the battery.
- Use batteries in parallel circuits unless the batteries or the equipment is protected by diode.
- Short circuit batteries.
- Replace battery fusing with fusing of a different value.
- Test battery for capacity.
- Use a battery that is not authorized for the equipment in which it is to operate.
- Physically damage the battery case.
- Use a Halon fire extinguisher on a lithium metal fire because it produces toxic products.
- Leave batteries in unused equipment for long periods (in excess of 30 days).
- Dispose of used batteries as refuse. Special handling and disposition through the Defense Reutilization and Marketing Office are required.

Lithium-sulfur dioxide batteries are a useful, high-energy, portable power source and are safe when properly handled and not abused. Transportation and disposal of these batteries are regulated, so these functions must be coordinated with the responsible agencies. Regulations, technical bulletins, and manuals providing guidance on the safe handling and use of these batteries are available. More detailed and specific information can be obtained by writing to—Commander, U.S. Army Communications-Electronics Command, ATTN: AMSEL-SF-ME, Fort Monmouth, NJ 07703-5024. ALOG

ALOG magazine gratefully acknowledges the assistance of Louis F. Soffer, Ph.D., of the Army Communications-Electronics Command, for providing the information on which this article is based.

IMA's in Logistics Assistance

by Hardie Leuquire

Individual mobilization augmentees (IMA's) play an important role in AMC's logistics assistance program.

The Army Materiel Command (AMC) operates a worldwide network of logistics assistance offices (LAO's) to help Army activities, both Active and Reserve component, achieve and sustain materiel readiness. The program also assists commanders in identifying and solving logistics problems.

The LAO's represent the AMC commodity areas of armament, communications and electronics, tank-automotive, missile, aviation, and troop support. Organizationally, LAO personnel report directly to AMC's Deputy Chief of Staff for Readiness, with unilateral authority to interface at any level to solve problems that impact on the readiness of unit equipment. The LAO's are collocated with the using commands at all major posts, camps, and stations around the world. In areas where equipment and troop density do not justify a full-time LAO, support is provided on a geographical basis. This approach ensures that each Army component will receive LAO support regardless of its location.

The Logistic Assistance Program (LAP) helps commanders solve materiel and logistics systems problems that are beyond their capability or responsibility. Civilian employees who enter the program must agree to remain with an oversea unit or deploy with a continental United States activity during hostilities. This ensures the Army commander will have logistics expertise in all environments.

The 1,000-member military and civilian LAP workforce meets the requirements of the Army during peacetime operations. Mobilization plans, however, identify an almost 100-percent increase in the logistics assistance requirements of a mobilized force. To meet the increased personnel requirements, the program turned to the Reserve components.

The Army Reserve Personnel Center assigns officers and noncommissioned officers (NCO's) to individual mobilization augmentee (IMA) positions on the LAP mobilization table of distribution and allowances. The IMA is selected after a thorough screening to ensure that he is fully qualified and has an extensive background in logistics. Whenever possible, the individual is selected based on the geographical location of his home in relation to his mobilization station. After being selected, the IMA is assigned to a training station as close to his home as possible.

The IMA training is accomplished in three intensive phases. The objective is to ensure the reservist is fully capable of assuming the duties of the LAO chief or senior logistics NCO during mobilization. The training also prepares the IMA to provide logistics assistance to other Army Reserve activities on a year-round basis. In addition to the three-phased annual training program, the IMA is included in LAO workshops and training sessions and provided with literature dealing with logistics and Army readiness as it is published.

Before beginning the first phase, the IMA is given a copy of all applicable standing operating procedures and Army regulations in addition to an outline of the training requirements and areas that require review before annual training.

The first phase of training actually begins during an initial LAP-oriented annual training period, which is designed to familiarize the IMA with all aspects of the logistics assistance program. Activities the trainee engages in include operating an LAO, interfacing with the retail-wholesale logistics system, reviewing unit readiness, participating in command briefings, evaluating and establishing milestones for solving maintenance and supply backlogs, accompanying the LAO chief on readiness visits to reserve units, and participating in other working issues that will prepare the reservist for his role in logistics assistance.

Next, the newly trained IMA is attached to an active LAO in the geographical area near his home for additional, on-the-job training—usually at the same Active Army LAO where he received his phase-one annual training. This entitles the individual to Servicemen's Group Life Insurance and additional retirement points and gives him an opportunity to become totally involved in the logistics assistance process.

The second training phase occurs during the next year's annual training. The IMA spends half of his 2 weeks of active duty at the assigned mobilization station. He reviews the mobilization plans of the station, identifies and secures office space and telephone services, establishes servicing agreements, and resolves all administrative issues. This gives the IMA a complete understanding of the mobilization station and ensures that adequate facilities will be available for LAP operation upon mobilization. Experience has shown that many IMA's are fully capable of operating on their own at the end of the second phase of training.

The IMA is then ready to provide logistics assistance on a year-round basis to Reserve components within his region. This gives the Active Army LAO additional resources with which to meet his requirement to assist the Reserves. For example, when the chief of the LAO at Fort Knox, Kentucky, receives a request for assistance from the Ohio National Guard, he coordinates a logistics assistance visit to the requesting unit by the Ohio IMA.

The advantages of the IMA-LAP involvement are many. At soldier level, the IMA reservist receives additional training and experience in the logistics assistance process. At Reserve-component unit level, logistics assistance is more timely and responsive during the critical period of weekend drills; the IMA can offer logistics assistance on more than a once-a-year basis. The Active Army benefits as well: the full-time LAO has a substantial reduction in travel expense, and he can stay in the mainstream of the LAP.

The IMA is usually available for weekend duty. If he is not equipped to solve the logistics problems during his visit, he is able to transfer the problem by message to the responsible agency for resolution. When an IMA thus identifies major problems, the supporting Active Army LAO chief has numerous resources available to assist the reservist in finding a solution.

The third phase of the training program requires the IMA to perform annual training concurrently with units that are scheduled to activate at his mobilization station. The reservist's direct interface with those Reserve units enables him to assess strengths and weaknesses in their readiness posture. Another benefit gained from this phase is that the senior supply NCO performs annual training with his IMA chief in a realistic environment. At the end of the third phase, the IMA is ready to assume all duties and responsibilities of operating a logistics assistance office upon mobilization.

When mobilization occurs, the IMA is assigned to a predetermined mobilization position to assume the duties he has been trained for. Officers are assigned as chief of an installation LAO at one of the more than 50 mobilization stations, while NCO's are assigned as the senior readiness NCO's with the same activity. Often these are the same stations with which the IMA's have been training.

The Army Logistic Assistance Program has implemented a unique way of putting the One-Army concept into practice and improved logistics assistance to the Reserve components. It is a program that gives Reserve officers and NCO's a chance to assist Reserve units on a year-round basis while preparing them for their mobilization duties.

Thus, the program benefits the individual Reserve soldier, the Reserve units assisted, and the Army as a whole. The marriage of the IMA and LAP continues to pay greater and greater dividends toward improving Army readiness. Perhaps other logistics organizations can learn from this novel use of the Reserve components. ALOG

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MANPRINT–Mark of the Soldier

Today's "be-all-that-you-can-be" Army is in a period of transition. It is undergoing the most extensive modernization in its 211-year history. New weapons and equipment of more than 400 systems are currently being developed and fielded. Even in this high-technology environment, however, Army leaders continue to refocus on a fundamental premise: People are our greatest resource.

To ensure that new equipment is designed with the soldier in mind, a new program has emerged. The program entails more than manpower and personnel integration, the phrase from which the acronym "MANPRINT" is derived. The MANPRINT program encompasses a broad spectrum of people-machine considerations during the materiel acquisition process: human-factors engineering; manpower; personnel; training; health hazard assessments; and system-safety assessments.

Quite simply, the goal of MANPRINT is to equip the soldier rather than to man the equipment. Since MANPRINT activities are designed to be initiated in the concept-exploration phase of the materiel acquisition process, the Army Training and Doctrine Command (TRADOC) is a lead and key MANPRINT player. True to its mission, TRADOC represents the *user* in the materiel acquisition process.

The soldier—the most important asset in the Army—has always given us the winning edge on the battlefield. Yet far too often, the soldier, as the user of the high-technology equipment, is the last to be considered in new weapon system design and development. He is thus forced to fill the gaps caused by poor system design or lagging technology and may not be able to perform on the battlefield as well as anticipated.

We owe the soldier the very best equipment—equipment that is reliable, easy to operate, easy to maintain, and easy to repair. The principles of MANPRINT put the soldier on an equal basis with hardware in new system design and development.

In simple terms, MANPRINT helps us to see the soldier as a vital part of a system and to consider its impact upon him throughout the materiel acquisition process. In spite of this seemingly "simple" explanation, it is difficult to incorporate the six distinct considerations that comprise the MANPRINT program into the materiel acquisition pro-

cess.

How does the MANPRINT program operate? This question has no simple answer. Nor is there a single formula. In fact, there are many ways to ensure that MANPRINT factors are evaluated at regular intervals during the materiel acquisition process.

The MANPRINT process begins with a definition of the problem to be solved—for example, the lack of standardization in the driver's compartment of a tracked vehicle that has resulted in a fatality. In order to solve this problem, one may find that a written MANPRINT management plan helps to establish MANPRINT goals and an audit trail. Issues that could be considered and added to a MANPRINT management plan might include investigation of the military occupational specialities of the drivers, the training they received, their skill levels, the tasks involved, and the design of the system, in addition to a safety assessment.

The MANPRINT program requires a team effort and consequently is everyone's responsibility. But of those most closely involved, TRADOC has the overall responsibility of ensuring that MANPRINT considerations are addressed as the system advances through the materiel acquisition process, whether through a product-improvement program or through new system development. The Soldier Support Center, Fort Benjamin Harrison, Indiana, is TRADOC's executive agent for integrating the MANPRINT program; representatives from Soldier Support Center-National Capital Region are available to advise and assist proponent centers and schools on MANPRINT matters. The Army Logistics Center, Fort Lee, Virginia, serves as TRADOC's executive agent for MANPRINT in all matters pertaining to reliability, availability, and maintainability analyses and integrated logistics support. The Combined Arms Center, Fort Leavenworth, Kansas, TRADOC's executive agent for operational evaluation, ensures that MANPRINT issues are identified and addressed in the independent evaluation program for each system. If a TRADOC system manager is chartered for a system, the manager is responsible for documenting MANPRINT data and using MANPRINT analyses to influence system design.

The MANPRINT team effort begins when problems are discovered during the mission area analysis. A MANPRINT analysis is done by the proponent combat developments organization at the center or school responsible for the system. Results from this analysis should tell us something specific—for example, that the system is unsafe, that it is too complicated for the soldier to operate and maintain, that the design contributes to the problem, or that the system presents a health hazard. The results might show that the problem could be resolved merely through a change in training requirements. If such were the case, the training developments organization would come on board to analyze training needs.

The Army Materiel Command enters as the principal MANPRINT team player after the decision is made to proceed from the concept-exploration phase to the demonstration-and-validation phase.

The first official TRADOC guidance on MANPRINT was published on 17 September 1985; TRADOC Draft Circular 602-XXX, prepared by the Soldier Support Center-National Capital Region, Alexandria, Virginia, explains how MANPRINT will be addressed in TRADOC. Army Regulation 602-XX, Manpower and Personnel Integration, has been prepared by the Office of the Deputy Chief of Staff for Personnel and is currently being staffed.

The MANPRINT program challenges force systems designers, systems developers, and Army program managers to be people-oriented, ensuring that our new systems will not hamper the soldier's ability to fight and win.

We must always be ready to ask, "Can we reasonably expect a soldier to effectively fight and win using this new weapon system, or are we asking him to fight and win *despite* this new weapon system?" The Army must make MANPRINT work to ensure that soldiers truly *are* all they can be. ALOG

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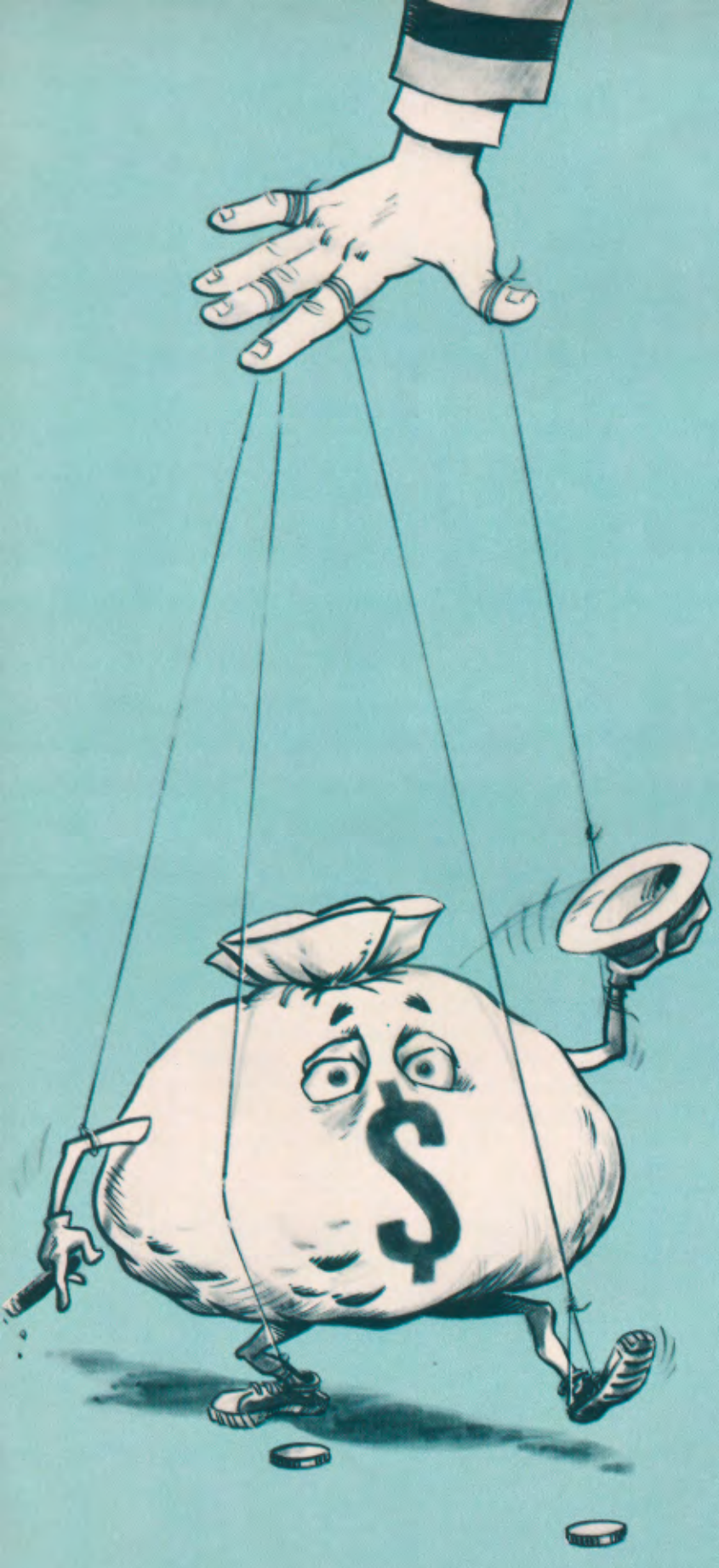

Who Controls

The author suggests ways to put the commander in control of his unit's logistics spending.

Money, money, money—the world operates on it and the men who control it have great responsibility. These facts have not been lost on the nondivisional battalion commander, who is finding that his requirements for close and careful accounting of his unit's expenditures are increasing, as are his problems in controlling funding. The commander should obtain some type of formal budget and supply training for his financial managers. However, if formal training is not immediately available, there are four things the commander can do to quickly improve his battalion's financial system.

But first, a little background is needed. The complexity of the financial reports used in the Army Logistics System is great. For example, at Fort Bragg, North Carolina, the battalion financial manager must integrate the results of three different reports to determine his unit's financial position. Those reports are interrelated but often are not received simultaneously. The first report is the daily transaction listing, or 09B report, which is produced from the daily standard Army intermediate level supply subsystem (SAILS) computer cycle. It lists only those requisitions that the direct support unit (DSU) could not fill and had to pass on to the national supply system. The second is the DSU cost transfer report, a weekly report that lists

Spending?

by Major Robert F. Lommel

each transaction and its cost to the customer unit. The third is the activity detailed cost report (ADCR), which is produced from the installation's standard financial system (STANFINS) computer cycle. The ADCR is similar to an individual's checkbook in that it lists the cumulative expenditures of the customer unit on an annual basis.

There is often a gap of 2 to 6 weeks between the time the unit receives the 09B and DSU cost transfer reports and the appearance of the data in those reports on the ADCR. This gap makes it difficult for the unit to determine the amount of money it has actually spent as of a given time. To obtain an accurate, current tally, financial managers must often resort to manual computations.

Many of the problems facing financial managers can be traced to their lack of knowledge of the Army financial system. The mistakes made by inexperienced or untrained financial managers often embarrass commanders, particularly when financial problems are traced to a lack of accounting accuracy rather than actual overexpenditures. Inexperienced financial managers often do not realize the importance of accurately maintaining the fund control register, which provides a cumulative total of expenditures for the fiscal year by document number. The average financial manager is also unfamiliar with the workings of the stock fund. He is not sure how stock fund purchases affect the unit's budget; or how the stock fund manager influences the spending process throughout the fiscal year; or how he, the financial manager, should create and control his unit's annual budget.

The typical financial manager also lacks an extensive knowledge of how the supply and financial systems interact. For example, some financial managers will cancel procurement, Army-funded items (which are free to a unit) when a budget is close to overexpenditure, and will leave on order operation and maintenance, Army-funded items (which are charged against the unit's budget).

Another difficulty may occur if the battalion is assigned to operate a direct support unit (DSU) for nondivisional units, because the financial manager must then supervise the funding for authorized stockage list (ASL) items. In a nondivisional situation, an ASL functions like a revolving account, under which the DSU stocks items for resale to customer units. The DSU computer calculates the proper ASL stockage levels, based upon past customer requisitions, and automatically orders them. The DSU receives no credits for ASL items until customer units actually pay for them.

A typical ASL account at Fort Bragg may have $500,000 obligated against it. This amount will be reflected on the ADCR almost immediately, but DSU sales to customer units or credits against the order may not appear on the ADCR for another 6 months. To further complicate life for the financial manager, the small credit balance that an ASL account generates during the year is normally reflected on the ADCR during the eleventh month of the fiscal year. If those credits are not spent before the end of that fiscal year, the unit will lose them.

Since trained comptrollers are not assigned below the division level, the nondivisional battalion commander almost always has an inexperienced financial manager. To meet the manning requirement and increase his control over the annual budget, the commander usually assigns the sharpest self-starting soldier available to the manager position. This soldier must literally teach himself the financial system. His supervisor is usually an inexperienced lieutenant or captain whose previous experience as a platoon leader or company commander qualifies him as a staff officer, but does not provide him with the extensive financial and budget experience needed to cope with the financial leadership role of the battalion.

Fortunately, there are four things, short of formal training, that a nondivisional battalion commander can do to quickly improve his funds control system. He should—

- Let the battalion financial manager manage the levels of obligations and commitments as they occur. These transactions are most important to

the battalion during the last 60 days of the fiscal year.

- Use a fund control register religiously to maintain a running balance of the battalion account.
- Centralize the control of funds at the battalion level, allowing the subordinate companies to spend their budgets only within specified limits.
- Lead the company commanders in a monthly review of the status of battalion funds. This review will graphically portray each unit's responsibility for the overall battalion financial program.

These simplifications will improve the internal battalion financial system and compensate for the lack of trained financial personnel.

The best way to ensure proper financial management is for each corps to institute a corps training program for its nondivisional units. Each supervisor working with the budget at the battalion level or higher should have some nondivisional supply experience. This experience will provide an understanding of the relationship between the supply and financial systems and a working background for manipulating both systems for the unit's maximum benefit. The well-trained financial manager will ensure that credits owed his unit by the supply system are indeed received and will be able to identify and correct financial errors made by the DSU's.

The future always seems to provide fewer discretionary funds than a battalion really needs. The lack of training demonstrated by poor management and inept use of funds can severely limit the battalion's ability to complete its mission. A good working knowledge of the financial and supply systems allows the financial manager to effectively manipulate the numerous "pots of money" at his disposal to support such activities as new tactical system deployments, reserve affiliation visits, and field exercises. Effective logistics support and force readiness depend on proper financial management. ALOG

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Army Logistics in Retrospect

Machine Tools of the 19th Century

A number of major inventions and developments in mass production equipment took place in the United States in the 19th century, largely because of the Army's need for small arms.

The milling machine was invented and perfected primarily by Government armories and private firms under contract to the Government for the production of small arms. Its origins are not altogether clear, but small arms contractors such as Eli Whitney and Simeon North played major roles in its early development. Its further refinement before the Civil War occurred both in Government armories, especially Springfield Armory, and in private gun contractors' factories such as that of Robbins and Lawrence of Vermont, a firm that held several small arms contracts from the Army.

Similarly, the turret lathe and Blanchard lathe were developed primarily by contractors producing small arms for the Army. The Blanchard lathe was a key invention for standardization of arms because it allowed irregularly shaped gun stocks to be cut by machine rather than by hand. It was invented by Thomas Blanchard in response to manufacturing needs at Springfield Armory and was further developed at both Harpers Ferry and Springfield armories. Blanchard's lathe operated by tracing an exact model while cutting another copy of the model. This principle was later introduced into metal working as well.

These inventions were soon used in a wide variety of other operations in addition to small arms manufacturing.

Keeping the ASL Forward

by Lieutenant Colonel William M. Causey, Jr., and First Lieutenant Katherine M. Thomas

A USAREUR support battalion takes to the rails to provide forward resupply of repair parts

Insufficient mobility for maintaining forward support of class IX repair parts during combat is one of the biggest logistics headaches at the divisional level. On the fast-moving, highly consumptive battlefield forecast by the Army's Air-Land Battle doctrine, divisional support units must be deployed far enough forward so that they can respond to the needs of the combat units they are supporting. Similarly, the authorized stockage list (ASL) of repair parts must be mobile enough so that parts can be provided to combat units when needed.

Unfortunately, the supply system seldom has enough parts vans, or prime movers to pull the vans, to provide adequate transportation for repair parts resupply. Nor are parts vans usually suitable for efficient warehousing, since they tend to be cramped and unheated and have limited bin space for storing bulky items.

Faced with an inability to obtain a sufficient number of vans and prime movers, the 299th Support Battalion, 1st Infantry Division Forward, in U.S. Army, Europe (USAREUR), improvised a rail-and-road transportation package capable of moving its repair parts ASL in one lift. The major innovations in the battalion's transportation scheme were the use of locally available storage bins and railroad boxcars.

In researching methods for storing and moving its ASL repair parts, the 299th Support Battalion found a partial answer in a storage bin developed by the *Bundeswehr* (the West German Army). This securable storage bin is 52 inches wide, 30 inches high, and 34 inches deep, and weighs 168 pounds when empty. The bin has lifting points to fit materials-handling equipment and can be stacked. The battalion procured 200 bins.

Having at least temporarily solved the problem of how to store its repair parts, the battalion still lacked sufficient mobility to move those parts forward. The new bins could be stacked two high on flatbed trailers. If 40-foot-long trailers were used, the battalion would need 8 tractors to transport the bins, adding significantly to the shortfall of prime movers. The solution to the problem came from the *Bundesbahn* (the West German railroad) in the form of covered boxcars.

The battalion's ASL transportation concept was tested during a major training exercise conducted at the Hohenfels Training Area in March 1985. While maneuver units engaged in Army training and evaluation program (ARTEP) testing, one of the exercise's major objectives was to evaluate the 299th Support Battalion's ability to support the maneuver units according to Army doctrine as the latter operated under wartime procedures.

The 299th Support Battalion was able to secure a maneuver-rights area 20 kilometers southeast of Hohenfels. This is approximately the distance for forward support envisioned in Army doctrine. The battalion's headquarters, division materiel management center, supply and transport company, and adjutant general company were situated at tactically appropriate sites in the town of Parsberg. The medical company was located at the smaller village of Hermansdorf, 5 kilometers north of Parsberg, and B Company, the direct support maintenance unit for the 1st Infantry Division Forward, occupied Beratzhausen, 10 kilometers to the southwest. Beratzhausen was chosen as the location for B Company because the town's train station was the only one in the surrounding area readily available for use.

B Company was heavily involved in supporting pre-ARTEP training in the Munsingen Training Area until the time for the Hohenfels exercise. The decision to move the entire ASL was made when the new storage bins were received, 2 weeks before the scheduled deployment to Hohenfels. Thirteen boxcars were required to make up the battalion's

transportation shortfall. Six boxcars were used to transport and store the 200 storage bins; 2 boxcars carried M60 and M113 track, road wheels, and parts kits; 3 boxcars carried large but essential class IX warehouse parts; and 2 boxcars moved reparables, including batteries, tires, and some major assemblies. The battalion's three organic M750 repair parts storage vans, six milvans with repair parts, and five M127 semitrailers were transported on flat railcars. These flatcar loads were unloaded in the maneuver-rights area, while the boxcars were spotted on a side track adjacent to the Beratzhausen train station. In this way, the ASL was deployed on 13 March and then redeployed on 30 March.

The deployment of the ASL was highly successful. Of the 4,010 lines of the battalion's ASL, 3,890 were uploaded and taken to the field. A total of 2,001 requisitions were processed during the exercise. The demand accommodation rate was 72 percent, including over 79 percent of the requisitions in the 02 priority category. Both of these percentages were 20 percent higher than those recorded in garrison.

The improved supply performance can be attributed to the composition of the ASL and the nature of the demands created by intensive maneuver. The ASL is tailored to replace those repair parts identified as combat requirements. Intensive maneuver by the combat units created a great demand for such repair parts while reducing the temptation to order the "nice-to-have" but not really essential items normally requested in garrison. The 2,001 requisitions were equitably spread between the 02, 05, and 12 priority categories, indicating that the customer units were indeed replenishing their prescribed load lists.

Air line of communication (ALOC) repair part shipments can be expeditiously processed to field locations, as was demonstrated during Reforger '84. During the Hohenfels exercise, the ALOC shipments were programed for delivery to the Beratzhausen railhead. Unfortunately, administrative problems allowed only two direct shipments to Beratzhausen. The remaining shipments went to the 299th Support Battalion's home location in Boeblingen and were transshipped to the maneuver-rights area.

The boxcars provided a real boost to operational support. When the battalion arrived in the exercise area, there were 20 inches of snow on the ground and temperatures were below zero. The boxcars, along with the parts vans, kept the parts dry and clean. Processing of repair parts took place in a tent adjacent to the railhead. As the snow melted, this area turned into a quagmire, but the area next to the train tracks remained passable because of its concrete pavement. Hardstand roads parallel to the railhead made ground transportation possible.

☐ **Soldiers of the 299th Support Battalion open a storage bin containing repair parts.**

The supply operation blended into normal railroad activity and was almost undetectable from the air. With the boxcars for storage, stake-and-platform trailers could be used for hauling major assemblies forward or returning used assemblies to the general support base. The trailers were also used to transport ALOC shipments as well as other repair parts replenishments from higher supply sources.

The 299th Support Battalion practiced the mechanisms of class IX resupply as close to wartime doctrine as possible. The maneuver units' field trains were sited within the direct support area and were included in the battalion's rear area combat operations plan. Maneuver units processed all requisitions through the division materiel management center in Parsberg. All 02 priority requisitions were screened manually against the ASL and, if the repair part was on hand, the customer could "walk-through" the requisition. All remaining requisitions were processed through the DAS3 computer located in Parsberg. Emergency requisitions could be passed to the division logistics officer (G4) over the 1st Infantry Division Forward's administrative and logistics FM radio net.

Since the battalion's repair parts vans remain uploaded in garrison, the computer locations of parts are the same in peacetime as in wartime. The bins containing the majority of the remaining ASL also have this advantage. Location accuracy was therefore not sacrificed between garrison and field situations.

Before this training exercise, the majority of the technical supply platoon had remained in garrison to receive, store, and issue stock. During the exercise, the entire platoon deployed with the ASL, thereby providing more soldiers hands-on experience in rewarehousing parts into the new storage bins, uploading the bins, and setting up a tactical class IX operation. More soldiers were also exposed to the real-world problems of setting up equipment and maintaining security in an urban environment.

No major operation can be conducted without problems, and this exercise was no different. Some of the more significant problems were—

- Uploading and transporting the bins to the railhead and then downloading them into the boxcars for shipment to Beratzhausen was a time-consuming endeavor that took approximately 30 hours to complete. With more experience, this time could be decreased.
- Downloading at the end of the exercise presented similar problems. Customers were notified of downtime far in advance. The chain of command was also very helpful in encouraging customers to space requisition processing throughout the exercise, which saved the battalion from a flood of requisitions when the exercise ended.
- The storage bins frequently had to be manhandled during loading because of cramped conditions in the boxcars. The boxcars also lacked heat and light, so soldiers had to use flashlights and vehicle headlights when working at night.
- Customer pickup of repair parts is a problem in garrison but it becomes even more of a problem in the field. To remedy this situation, one boxcar was dedicated solely to customer parts. Partitioned sections were made for each customer's parts using plywood already positioned in the boxcar. The battalion was thus able to provide a common pickup site for all customers. The amount of parts not picked up was discussed at the nightly commander's update.
- Peacetime restrictions on the use of the train station presented other problems. The 13 boxcars tied up 230 meters of siding, while the repair parts vans were placed among local industrial sites. Operating next to the railroad tracks required all personnel to pay more attention to safety, while the surrounding urban environment increased the need for security precautions.
- Dispersal of operations hampered communications. A German commercial telephone could not be obtained for use at the railhead. B Company is authorized only two secure FM radio systems, but they were in use elsewhere. Landlines were run between the company command post and both the class IX platoon and battalion headquarters. A total of 31 miles of line was laid to connect battalion elements, but maintaining serviceable lines throughout the highly trafficked maneuver-rights area was almost impossible.

Despite these problems, the advantages of moving the entire ASL forward were clearly obvious. More was required of the customer, but more parts were provided in a more timely, responsive fashion. The maneuver units left the training exercise with greater confidence in the ability of the 299th Support Battalion to sustain them during battle. The exercise also provided battalion personnel with valuable experience in wartime logistics operations.

The use of boxcars provides great flexibility in moving repair parts rapidly from one location to another and deploying them close to the maneuver units. If required, the bins can be offloaded to stake-and-platform trailers for movement forward from the railhead. There are inherent costs to uploading and downloading; but if the customer is resupplied while in the field, he is better prepared to perform maintenance upon his return to his home station. In summary, the 299th Support Battalion found that using the storage bins and railcars to move and issue repair parts increased its ability to provide forward support. ALOG

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First Lieutenant Katherine M. Thomas is the class IX responsible officer and supply platoon leader for the forward support company, 299th Support Battalion. She holds a bachelor's degree in economics from Rockhurst College, Kansas City, Missouri, and received her commission from the University of Kansas. She recently graduated from the Quartermaster Officer Advanced Course.

Army Computer Systems

by Colonel James H. Powers

STEP-UP—a new methodology called "systems through an using prototyping"—will get better computer systems to the

Many of the computer problems that I have read about in the civilian sector and witnessed in the Army have at their core not bad technology but bad communications. At Development Center Lee, Fort Lee, Virginia, we have changed procedures to achieve good communication. The results have been impressive.

Development Center Lee is a subordinate element of the Army Information Systems Engineering Command, with headquarters at Fort Belvoir, Virginia. Our mission is to develop standard automated logistics systems for the Army in the field. Collocated at Fort Lee with the Army Logistics Center, our relationship, simply stated, is as follows: the Logistics Center *defines* an automated requirement and we *build* the system. In practice, however, the job is not that simple.

Until recent years, our track record was not good. It took from 5 to 7 years to develop and field a system, and sometimes even longer. Given the speed with which state-of-the-art technology moved, we often had an obsolete system by the time it was ready to be fielded. Why? Antiquated procedures stifled effective communication.

A new methodology called STEP-UP—meaning "systems through an evolutionary process using prototyping"—will help us improve communication. The method was approved 2 years ago, on a trial basis, by the commanders of the Army Computer Systems Command and the Logistics Center.

Certain basic procedures and assumptions underlie STEP-UP. Automation professionals from Development Center Lee and the Logistics Center are collocated—in the same room, on the same team. They have no specifications at the outset; they begin with only a definition of where in the Army hierarchy the automated system is needed, along with a basic concept of what it should do. System specifications are the output, rather than the input, from their dialogue. Using state-of-the-art hardware and fourth generation software packages, they develop the system in concert.

The target system for this test of STEP-UP was the standard army retail supply system, level 1 (SARSS-1). At the outset, little was known about SARSS except that it was to operate at the direct support unit (DSU) level to automate requisitioning, receiving, warehousing, and inventorying.

At first, the collocated teams had some false starts. The two teams had in the past thrown specifications back and forth, as if over a wall. But that wall was removed by STEP-UP, which took some getting used to. Finally the teams moved out. In 4 months they designed, developed, and tested a system of about 175,000 lines of code. It did not end there.

At that point, SARSS-1 users from combat divisions throughout the world were invited to Fort Lee to preview and critique the system. About 80 sergeants and warrant officers, future users of SARSS-1, took us up on the offer. On the first day of our demonstration, a warrant officer asked, "How come you guys always field obsolete systems on obsolete equipment?" That was the starting point of dialogue with our future customers.

During the 5 days of the demonstration, we used an on-line computer terminal linked to a large-screen display to demonstrate, function by function, menu by menu, the system we had developed. There was a rich dialogue, which was sometimes also heated. We learned a lot from our customers, and they learned a lot from each other. Under normal procedures, arbitration of conflicting opinions ("MACOM positions") resulted in delay of final system specifications. Not here. As a result of dialogue, we received over 150 recommended changes to the prototype system we had developed. After they had been discussed on the floor, we asked customers to write their recommendations on a form we had developed, which we collected after each day's session.

Each evening the SARSS team would sit around, long into the night, reviewing and discussing each recommendation. The next morning the customers would be given feedback: "This enhancement will

Step Up

evolutionary process
Army faster.

be in the system when we field it. . . . This one, maybe—here's the problem we're up against. . . . This one can't be done—here's why."

The result of this feedback and dialogue was very visible after 5 days, when the sessions concluded. The customers had a feeling of "ownership," since they had been involved in developing the product they would use. We had discovered another STEP-UP partner—the ultimate user of our system. It is noteworthy that at the conclusion of the demonstration, users said they would be willing to take the system that day, without any enhancements. Good communications had cleared the air of myths and unfounded opinions.

We did not stop there. We did not, at this point, despite all the dialogue and enhancements, say, "OK. That's it. No more changes."

The first unit to receive SARSS was the 24th Infantry Division (Mechanized) at Fort Stewart, Georgia. With traditional methods, we would have trained the users, loaded the system, subjected it to tests by an impartial agency, and come home. We did all that. But we did more.

Once we trained the users and loaded the system, the customers, although generally enthusiastic, had suggestions on how to make the system even better. We acted on these and delivered the enhancements right on the spot.

The result of this could be observed in user enthusiasm and satisfaction when I visited the 24th. Typical was a sergeant who briefed us on the system at one of the eight DSU's. He had discussed the system, what it did, and how it worked. At the bottom of his chart was the word "Problems," with the numeral "1" after it, but there was nothing following the "1." When someone in the group asked "why," the sergeant replied, with glad-you-asked pride, "Sir, we have no problems. None!" This was a customer, not a member of our team. That kind of customer pride seldom came with the old style of doing business (nor should it have been expected, when our position was one of "It meets the specs").

Currently we have two systems developed under STEP-UP in the field, SARSS and the unit-level logistics system (ULLS). Three more—the standard property book system, redesigned (SPBS-R), the standard Army maintenance system (SAMS), and the standard Army ammunition system, level 4 (SAAS-4)—are close behind SARSS and ULLS. All five are interactive systems, employing the latest microcomputer technology. Drastically reduced development time has been achieved.

But speed in itself is not enough. If we accelerate the production line only to quickly produce an "Edsel," we are not successful. Our measures of success, ultimately, are a satisfied customer and a system that does the job well, both of which we have achieved. Our SARSS and ULLS customers are *very* well satisfied. Because they are involved, they feel more like members of our team than customers. To see that the system is doing the job well, one only needs to examine the initial per-

	Average Before	Average After	Difference
Total errors per cycle in DSU and customer input	418	66	−84%
Percentage error rate per cycle in DSU and customer input	13.3	2.1	−84%
DSU immediate issues per day of available stock	24	921	+3738%

☐ **SARSS-1 performance statistics, 24th Infantry Division (Mechanized), Fort Stewart, Georgia.**

formance statistics for SARSS at the 24th Infantry Division, shown in the chart on page 29.

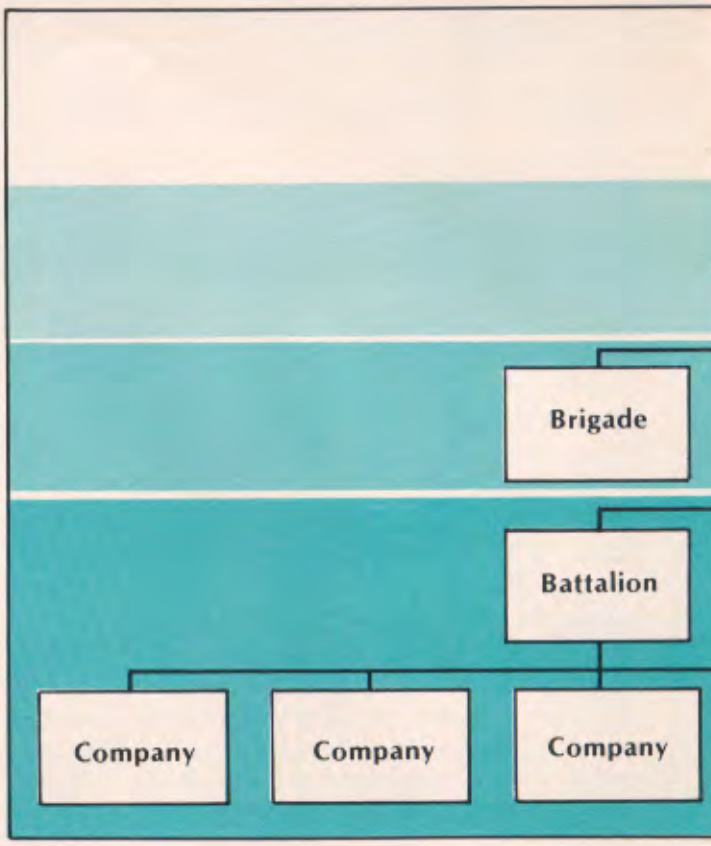
The overwhelming success of ULLS and SARSS, our first STEP-UP systems to be fielded, caused us to analyze the basis of that success. To understand it, one has to take a macro view of technological change and the Army as a hierarchy, which is depicted in the chart on the right. When current procedures for requirements definition were developed, the automated-systems environment was characterized by—

- *Hardware*: Systems were run on large, expensive mainframe computers. Their expense mandated painstaking detail in spelling out functional requirements of automated systems.
- *Location*: Most of these computers were clustered near the upper levels of the Army hierarchy. This proximity to the MACOM's facilitated communication on system specifications between MACOM's and the proponent agency (in our case, the Army Logistics Center).
- *Operation*: Since they were run on mainframes, the systems were operated by data processing technicians. Thus, the specifications were highly technical.
- *Low user satisfaction*: From the user's standpoint, output was like a wheelbarrow full of printed reports; input consisted of punched cards or cumbersome coding sheets that he had to assemble. The data processing technicians at the mainframe were often whipping boys who, when challenged, could only respond, "We're following the specs." This environment would soon be changed, for competition was on the horizon.

Early in 1970, Digital Equipment developed and started marketing a new type of computer, the minicomputer. About 5 years ago, minicomputers were fielded in large numbers throughout the Army. Since they were less expensive, we could buy more and target them at lower levels in the Army hierarchy. But that obvious benefit came with some subtle baggage, and Army policy and procedures were not changing to accommodate it. The baggage came in at least three forms.

First, system users became system operators. Functional people, rather than data processing technicians, were able to operate the new minicomputers.

Second, there was competition. With the reduced price tag of the hardware, units in the field could afford to buy their own equipment. Thus, there was a proliferation of "unique" systems throughout the Army. They served local requirements well, but not the soldier. When he was transferred from one theater to another (or one division



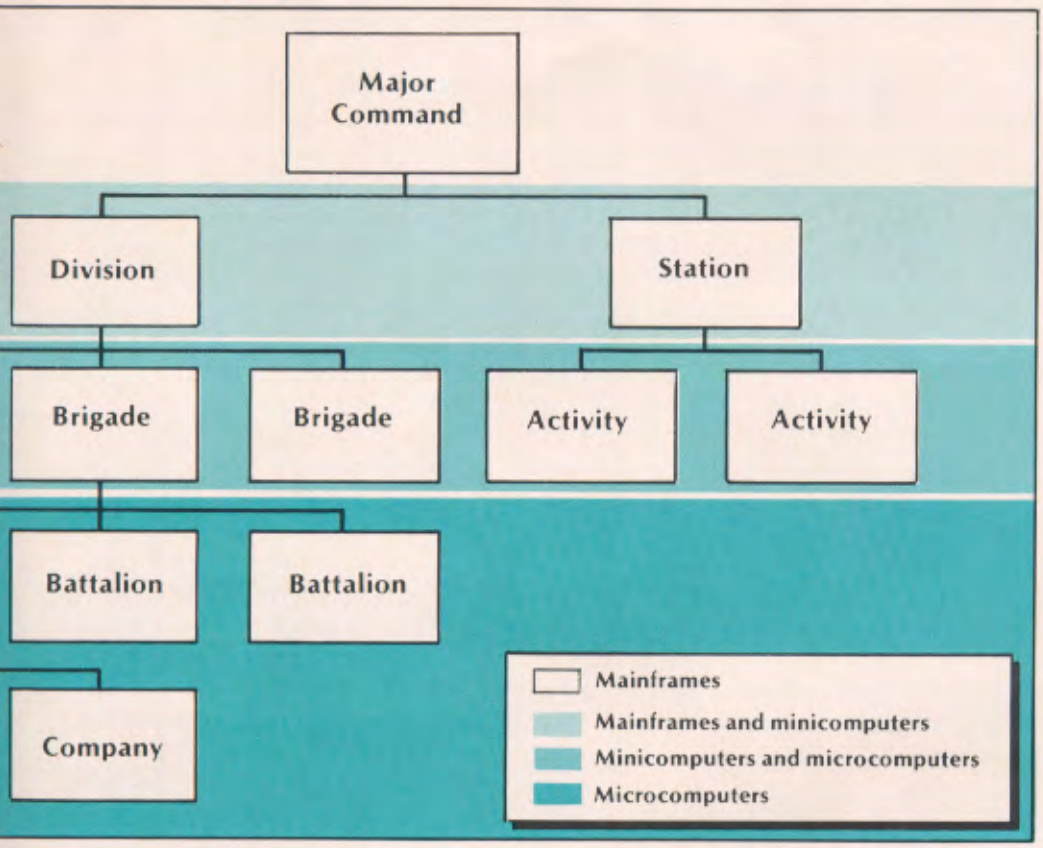
to another), the soldier would often lament, "That's not the way we did it back at. . . ."

Third, there was a built-in communication problem. Given the increased hierarchical distance from the user to the MACOM's and the drastically increased number of ultimate users, requirements definition became a problem from the standpoints of communications flow and functional expertise. Most of us have played the parlor game that demonstrates how much information is lost each time it is passed. With minicomputers, user needs had to be passed a great deal more times through the Army hierarchy than in the old mainframe days.

On the heels of the minicomputer came the arrival of even newer technology, the personal computer or microcomputer. Cheaper, more durable, and more transportable, the microcomputer pushed the targets of standard systems even further down in the Army hierarchy. Both its benefits and "baggage" have been similar to those accompanying the arrival of the minicomputer, only on a vastly larger scale.

However, policy relating to requirements definition and fielding of systems remains about where it was when mainframes were the Army staple. Policies and procedures need to be changed. We are involved in doing that.

I wish I could say we had a monopoly on wis-



Organization distribution of prototype computer systems.

dom and knew what we know now when we decided to try STEP-UP. But that's simply not so. In implementing STEP-UP we have stumbled through a lot of lessons. Some of our experiences and my observations follow.

• *Readiness and savings*: Initial performance data from Fort Stewart point to significant benefits in both readiness and savings. Receipts are processed in hours rather than days; immediate issues of stock on hand from the DSU increased over 3,000 percent; and error rates were significantly reduced. In combination, such improvements resulted in tanks and trucks being removed from a deadlined status much faster. These results are being realized in the field years earlier than would have been the case with our old systems-development methodology.

Further, each day removed from the logistics pipeline to Europe is worth millions of dollars. The DSU-processing-time segment of that pipeline has always been a problem because we did not have the proper systemic tools in place for the people to do their jobs. With SARSS, the Army stands to significantly reduce that segment. Resultant savings also will be significant. Again, that savings is accruing now, rather than years from now.

There are also some subtle benefits: "shadow clerks," no longer needed, are able to return to the duties of their MOS's; clerks, able to keep up with their work, are not required to skip training; and finally, there is pride, which is highly visible at the 24th. The clerks are no longer messengers of an inefficient logistics system. They can provide the kind of responsive support their customers want.

Savings are also achieved on the developmental side. Our SARSS development team will be in place about 2 years, rather than 5 to 7 years. Not only will it be available to develop new systems sooner, but in the process we'll save over $1.5 million in salaries.

• *Motivation*. I have been in our Army over 23 years. I think I know how to motivate people. Despite that, I have been surprised at some of the motivational results of the STEP-UP process. One of the contributors is the fact that people and agencies have been involved in a concurrent rather than a sequential process.

For example, thanks to the support of the commander of the Quartermaster School and Fort Lee, his "TRADOC schoolhouse" people have been involved with us from the start. Because of that partnership, the Quartermaster School has been able to provide us with advice on educational considerations of the help menus of SARSS. We have been able to tailor these tutorial subsystems so that they will support both the user in the field and the

TRADOC educational process. With the old process, our relationship would have been sequential: we'd develop the system, and then they'd start gearing up to train soldiers for the Army personnel pipeline. Sequential processes breed polarization and fingerpointing. Concurrent processes breed teamwork and enthusiasm.

When we were getting ready to go to Fort Stewart to field our first system, I often noticed the lights burning late at night, and I'd stop in to see how things were going. I found fatigue. Often I stumbled into folks (rather, they stumbled into me) who had been up 56 hours straight. But they chose to do that because they were fired up. I also found pride and enthusiasm. They could see the success that would result from their efforts.

Most members of the team arrived at Fort Stewart weeks before Easter and stayed through Easter weekend itself. I arrived for my look-and-see visit a few days after Easter. When I talked to the assembled team, my first words were "Happy Easter." They just laughed and clapped. They were fired up. You could cut the pride in that room with a knife. They were possessed by the two prime motivators—responsibility and results. Under the old way of doing business, many of the original team members would never have seen the results. Transfers, retirements, promotions—even death—would all have taken their toll. People like to be responsible for something and see the results of their efforts. Most members of our highly motivated teams are civilians, a worker category often stereotyped as "bureaucrats." We don't hire bureaucrats in the Federal Government; we "grow" them in bad work environments.

• *Flexibility*. With microcomputers, we have a new fielding advantage that did not exist with mainframes and minicomputers. Micros are so cheap that we can bring some along to the field, harness user recommendations, and make enhancements right on the spot.

With the old way of doing business, user recommendations would be recorded, prioritized, brought back to home station, and acted upon. This method does not breed a feeling of "ownership" among users.

• *Accuracy*. There are probably some conservative thinkers who believe that the developing and fielding methods I have described will result in chaos. Developing systems without a detailed requirements document certainly entails some risks, and so does making changes in the field. Although I cannot deny these potential problems, nonetheless I can show success—stunning success.

Good people will do a good job if you let them. In a normal system-fielding scenario, the only fixes you make on the spot are aborts or hard stops. There are usually quite a few of these. In fact, there have been instances of fielding standard systems where there were so many aborts that the fielding was called off and everybody returned to the drawing boards. In fielding SARSS, there were no aborts. Not a single one!

• *People*. To effectively use STEP-UP, you need quality people. We have been blessed with an abundance of them. With Logistics Center proponents and our technicians sitting across from each other, face-to-face, things move quickly.

We need people who know their business cold. Delays like "let me go check with my supervisor" or "let me go check how you do that" keep counterparts waiting. Delays based on lack of expertise have to be minimized. When they are, the results are striking. The SARSS experience of producing 175,000 lines of code by 15 people in 4 months is about 1,000 percent faster than normal performance in the private sector.

STEP-UP has truly been a step up for the Army. Yet, much work remains to be done. It takes time to change attitudes, policies, and procedures—but that's a good thing. As big as we are, we'd be out of control if change occurred too rapidly. We are currently sharing our lessons to influence that change during this exciting period of transition for Army automated systems.

One final note about something that has nothing to do with computer systems. The reason I am able to write this is because we *have* been very successful. But that success was not guaranteed when we started climbing the mountain called "STEP-UP." As a matter of fact, much risk was involved. On some places where our footing was not sure, we might have slipped and fallen. We were in some instances violating regulations and policies (which we are now involved in changing). Despite the risk, we got full support from our leaders. It is appropriate that the ultimate manifestations of their courage was captured in last year's Army theme—"Leadership." Had someone up the line said "do it the normal, safe way," we would still be developing SARSS—and growing bureaucrats.

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CREDIT WHERE CREDIT IS DUE

by Captain William C. Bennett

Logisticians form the lifeline of any armed force. The quartermasters push supplies forward using transportation assets kept combat-ready by ordnance maintainers. Every military unit employs soldiers from the logistics support branches—Quartermaster, Transportation, and Ordnance—to sustain battle and achieve ultimate victory.

The great deeds of the combat arms are well chronicled and the soldiers in those branches are showered with tributes and awards. In peacetime, infantry soldiers are recognized for their technical and tactical proficiency by award of the expert infantryman badge. In wartime, they can earn the coveted combat infantryman badge. The standards for earning these badges are necessarily high, and the fact that the badges exist adds to the esprit of infantry units and instills pride in the individuals who are awarded one of the badges. The value of such badges is not lost on the Army Medical Department either, which recognizes outstanding technical proficiency and performance by awarding the expert field medical badge to its soldiers.

Logisticians should also have a visible means of recognition. They greatly contribute to the success of any operation. Their skills are myriad and their jobs are as demanding, both mentally and physically, as those of the combat arms.

The logistics branches should wholeheartedly support the institution of an "expert logistician badge" award program. Tom Peters, of *In Search of Excellence* fame, pointed out that the Air Force maintenance crews in the Tactical Air Command staged a remarkable turnaround in performance by becoming visibly associated with their aircraft and allowing the maintainers to bask in some of the recognition accorded the "flyboys." It becomes painfully obvious that this kind of recognition increases productivity at little cost. The reason it is painful is because we must question why logisticians have not adopted such an award symbol sooner.

Criteria for award of an "expert logistician badge" could follow guidelines similar to those set for award of the expert infantryman badge. Since combat arms soldiers expect logistics soldiers to accomplish a multitude of supply and service functions, the logistics skills category would test a variety of skills selected from the three logistics support branches. The differences would be that weapons and equipment proficiency tests would be tailored to those found in logistics units and knowledge of logistics skills would equate to the infantryman's knowledge of combat skills.

Professionals in the logistics corps deserve more than their current lot. An expert logistician badge would serve as a unifying force to soldiers from these branches who are found in many different types of units throughout the Army. It would build that same sense of pride shared by infantrymen and would create that increased efficiency and effectiveness to which Tom Peters alludes. ALOG

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COMMENTARY is a forum for exchanging information. If you have an idea, suggestion, or proposal that will improve logistics operations, write it up and send it to us. Any length up to 600 words is acceptable. Contributions from all levels and ranks are invited. Submissions should be specific and constructive and should be useful to more than a single activity. Send to: COMMENTARY, *ALOG* Magazine, ALMC, Fort Lee, VA 23801-6044.

Cold Weather POL Operations

by Major James E. Wright
and Colonel Charles C. Perry

Since we generally fight the way we train, training must be as intense and demanding as possible. One of the key maxims used by military planners is to expect the worst and plan for it. In cold weather, even routine or simple tasks become monumental challenges. A Winter Reforger is designed to test soldiers and their equipment under extreme climatic conditions. Hours are long, the tactical situation changes rapidly, information is often sketchy, soldiers are cold and want to take shortcuts, and communications are constantly interrupted.

Such Winter conditions fostered the petroleum, oils, and lubricants (POL) concept of operations adopted by V Corps in supporting Reforger '85. The exercise involved more than 65,000 soldiers in the field, including 17,000 soldiers from the continental United States, plus elements from the U.S. VII Corps and the German III Corps.

Bulk petroleum resupply was effectively executed during Reforger '85. Mobility fuel consumption for Reforger '85 was 6.2 million gallons compared with 3 to 4 million gallons for previous Reforgers. Reasons for the increase include the previously mentioned Winter factors, plus the force modernization of combat vehicles.

Force modernization has in some cases significantly increased fuel consumption. The M1 Abrams tank consumes about twice as much fuel as the M60-series tank (an average of 5.2 gallons per mile versus 2.5 gallons per mile). The M2 and M3 Bradley fighting vehicles travel 1.7 miles per gallon, versus the 2.5 miles per gallon for the M113 it replaces. The UH-60A Black Hawk helicopter burns approximately 123 gallons per hour versus 89 for the UH-1 Huey helicopter.

All modes of distribution were used except barge. Of the total 6.2 million gallons, 4.3 million gallons, or 69 percent, were shipped by rail tank cars and 0.3 million gallons were extracted from a Central Europe Pipeline System (CEPS) emergency off-take point. The remainder was moved by tank trucks. A variety of issue points was available, including two CEPS depots, two fixed class-III points, seven railheads, four field system supply points, three simulated fixed storage sites using 5,000-gallon tankers, and one off-take point.

Before describing POL operations conducted during Reforger '85 in greater detail, we should first review routine POL procedures. Distribution of POL is based upon a push system. Bulk fuel is not requisitioned; rather, requirements are forecast and POL is delivered until the receiving unit is full.

Typically, four POL products are provided for Army operations in Europe—mogas, DF2, diesel-fuel blend, and JP4. Blended diesel fuel is routinely distributed to units with M1 tanks, but other

units also receive it during prolonged cold-weather operations.

The push system of petroleum supply begins at theater level and ends in the using units. The 200th Theater Army Materiel Management Center (TAMMC) coordinates the resupply of V Corps with general support bulk petroleum by rail, highway, barge, air, and pipeline. (For Reforger '85, most POL was shipped by rail and picked up by units at CEPS depots.) From railroads and CEPS depots, bulk fuel is transported to divisional and nondivisional supply and service companies by transportation medium truck companies (petroleum).

Although not in keeping with published doctrine, in Reforger '85 divisional supply and service companies received fuel at their trailer transfer point. If empty trailers were available, a full trailer was exchanged for an empty one. If such an exchange could not be made, the fuel was discharged into collapsible fabric tanks at a fuel system supply point. From the trailer transfer and fuel system supply points, fuel was delivered to the user by a combination of 5,000-gallon tankers and bulk-POL refuelers.

Objective-oriented Improvements

Long before Reforger '85 began, we developed objectives for POL operations that would duplicate a wartime scenario as closely as peacetime constraints would allow. These objectives were to—

- Test emergency off-take point procedures for POL resupply from the CEPS.
- Validate the area-support concept.
- Validate POL trailer transfer operations.
- Evaluate POL distribution outside the V Corps area.
- Support the equivalent of a four-division force with bulk fuel and packaged products during the exercise.
- Conduct an interoperability exercise with NATO tank trucks.

To improve the effectiveness of Reforger POL training, V Corps implemented several changes, which were designed to increase the speed and flexibility of bulk petroleum distribution within V Corps.

Fuel was extracted at emergency off-take points of the CEPS. Extraction required a kit to reduce the high pressure from the CEPS and a storage capability. The 3d Support Command (SUPCOM) used a 12-tank fuel system supply point to provide storage. Fuel was extracted at a rate of approximately 300 gallons per minute. This was the first time the V Corps used the off-take-point option.

Since M1 tanks were being supported from the emergency off-take point, the fuel was blended in

the field. The procedure entailed pumping 5,000-gallons of JP5 into each of the empty collapsible tanks in the fuel system supply point; then 5,000 gallons of DF2 were added to the tank, producing a 50-50 mixture of DF2 and JP5. The 50-50 ratio was used in the field for simplicity. Although this was the first time field blending was practiced in Europe, it was very successful.

Trailer transfer point operations have been successfully tested twice during major field exercises—in Reforger '83 and '85. In these operations, a full tanker is exchanged for an empty one in about 5 minutes versus the usual 25 to 30 minutes required to pump from one tanker to another. Additionally, there is less chance of a fuel spill and the traffic congestion at the transfer point is reduced. The primary disadvantage is that units do not maintain equipment as well when it is not their own. However, the 3d SUPCOM overcame this deficiency by fielding maintenance contact teams, each with a tailored prescribed load list at its transfer point. While a 5,000-gallon tanker is on site awaiting fuel, it is checked and serviced.

Interoperability with NATO tank trucks was demonstrated for the first time during Reforger '85. Due to the high volume of fuel being consumed, the 200th TAMMC delivered fuel by German Luftwaffe tank trucks to the Giessen class III supply point. Because our allies' equipment is metric while ours is not, interoperability is possible only if adapters are used. This deficiency has been overcome in USAREUR by issuing the Gossler rail-tank-car coupling-adapter and the NATO tank-truck adapter to all units involved in bulk petroleum distribution. These inexpensive adapters are essential to all POL units that will operate in Europe.

Nighttime refueling operations were emphasized to practice concealment and enemy deception. Since performing tasks in the dark is more difficult, we practiced nighttime operations at every available opportunity.

Lessons Learned: Blending Diesel Fuel

After a training exercise is completed, the "lessons learned" are identified and translated into operational plans. One of the most significant lessons learned during Reforger '85 was the importance of using M1-blend during periods of prolonged cold weather.

Before Reforger '85, M1-blend was issued only to USAREUR units with M1 tanks. There are several reasons this policy was in effect. The normal temperature range in central Europe doesn't require blended diesel fuel. Records indicated that the temperature range in the exercise area dropped below the DF2 cloud point only 10 percent of the time. *Cloud point* is the temperature at which the paraffin hydrocarbons in diesel fuel become insoluble and begin to form "wax," about 9 degrees Fahrenheit. Although the prevailing ambient temperature in central Germany rarely falls below the cloud point, such rare weather occurred in January 1985. Just as units were deploying to the exercise, an arctic cold front gripped Europe for several days.

Consequently V Corps was faced with a monumental challenge. Only the 11th Armored Cavalry Regiment and a small task force from VII Corps had M1-blend. The remainder of the Corps was topped off with DF2 in preparation of STARTEX. The conclusion was painfully evident: all the DF2 would have to be blended.

Diesel fuel characteristics. Blended diesel fuel costs more than DF2. The stock fund price of DF2 was 95 cents per gallon. The prices of some acceptable blend stocks were $1 for JP5 and $1.09 for JP8. The exact price of M1-blend varies according to the proportion of blend stock used.

☐ A soldier prepares to switch a valve during an emergency off-take point operation on the Central Europe Pipeline System.

The question raised by these facts is, "If the M1 tank needs blended fuel, why don't the other diesel-burning vehicles?" Indeed, during periods of prolonged cold weather, all diesel-burning vehicles require fuel with a lower cloud point.

The M1 tank is more sensitive to waxing because of its gas turbine engine and its self-monitoring computer. The gas turbine engine is more sensitive to waxing problems because of its inherently higher fuel consumption (twice as much fuel has to be filtered), its single fuel nozzle (which is affected not only by waxing tendencies but also by increased viscosity), and the absence of a recirculation system commonly used in all diesel engines. The sensitivity of the gas turbine engine is further compounded by the computer that monitors the fuel flow to the engine and will shut the turbine down if the fuel flow is below standard. This safety feature activates when enough wax crystals have collected on the fuel filter to restrict the fuel flow. Although the performance level of other diesel vehicles is reduced, they continue to operate because warmed fuel is slowly introduced into the fuel tanks after start-up by the fuel recirculation system.

The standard diesel fuel, used by all allied forces in Europe, is DF2, with NATO symbol F54. This fuel has a cloud point specification limit of minus 13 degrees Centigrade (9 degrees Fahrenheit) and a pour point (the lowest temperature at which the fuel will flow) specification limit of minus 18 degrees Centigrade (0 degrees Fahrenheit).

Corrective actions. All diesel fuels contain varying quantities of paraffin hydrocarbons. At the cloud point, some of these paraffin hydrocarbons will precipitate (i.e., become insoluble) and form discrete wax crystals. While the fraction of the fuel in the solid state may be only a small percent of the total (i.e., less than 1 volume percentage), the wax crystals can gradually form a matrix analogous to a honeycomb, which restricts fuel flow, plugs fuel filters, and causes operability problems.

Blending DF2 with the previously mentioned kerosene-based aviation turbine-fuels or high-flash-point solvents is an effective method of depressing the cloud point of DF2 (or other diesel fuels). Generally, the change in cloud point resulting from a blending of two fuels will depend on the cloud point of the two respective products; for example, a mixture of 60 percent DF2 and 40 percent JP5 has a cloud point of minus 4 degrees Fahrenheit versus 9 degrees Fahrenheit for unblended DF2.

This was, in fact, the most significant lesson learned from Reforger '85. An M1-blend (60 percent DF2 and 40 percent JP5) must be used during periods of prolonged cold weather. Since these periods cannot be accurately predicted, POL units must be ready for this possibility every Winter. The V Corps has requested that USAREUR routinely stock M1-blend, or JP8, all year in war reserve sites and provide it at class-III points during Winter. The conversion of all units to M1-blend during the exercise was hailed as an outstanding initiative by both CONUS and USAREUR exercise participants.

The most desirable location to climatize diesel fuel by adding kerosene-based aviation-turbine-fuels is at the refinery or source depot. Once fuel is distributed, it is more difficult to blend. Using units don't have the time or facilities to perform the mixing properly.

Another lesson learned was that JP8 (NATO F34) is an acceptable substitute fuel for either DF2 or JP4; in fact, NATO is presently considering conversion of JP4 (NATO F40) to JP8 (NATO F34) for all aircraft systems. Although the cost of JP8 is higher, this plan offers the replacement of two fuels (DF2 and JP4) with one. The primary advantage is ease of storage and distribution.

Mogas or JP4 should *never* be blended into diesel fuel as a means to lower the cloud point. The combination of either of these fuels with diesel fuel creates an extremely hazardous mixture that can be ignited either by some external ignition source or by a self-generated electrostatic charge. Adding as little as 5 percent of either gasoline or JP4 to diesel fuel will create an explosive mixture.

Two factors complicated the blending of the diesel fuel. The most pressing issue was lack of ullage (available space) to accommodate the addition of the JP5. Second, all the other USAREUR units were in need of M1-blend at the time.

The maneuver box for Reforger '85 was outside the normal peacetime location of V Corps. Consequently, the Corps could not rely on its fixed support facilities.

At the beginning of the exercise, the POL units experienced a surge in bulk fuel requirements. This has happened repeatedly in major exercises and is now incorporated into V Corps' general defense plan. There are several contributing factors. Although units may deploy full, a long road march consumes enormous amounts of fuel. Winter operations amplify this increase, because additional fuel is required for heaters and equipment, which must idle to keep crews warm. Finally, there are always a few bulk POL vehicles that deploy empty for maintenance and other reasons.

Cold weather frequently brings other problems

as well. It is not unusual for equipment components to freeze during periods of prolonged cold weather. Petroleum units experienced frozen valves due to water contamination, plus difficulty starting pumps due to weak batteries.

The combination of these circumstances could very easily have delayed, or even stopped, the exercise had it not been for the persistence of petroleum personnel at all levels throughout V Corps and its attached units. But problems were overcome one by one.

Adding blended stock or high-flash-point solvent to a vehicle experiencing problems will not provide immediate relief, as the two fuels must be mixed to lower the respective cloud point. At the onset of fuel waxing problems, the only immediate solution is to apply heat. Any safe means of warming fuel tanks, lines, filters, and engines will dissolve the separated wax crystals. Acceptable methods include heated buildings and tents, heat lamps, and heater ducts. Replacing fuel filters or submersing the old ones in warm fuel will also relieve the problem.

It is impossible to keep water out of fuel because of storage and equipment breathing (moisture in the air condenses within a fuel tank environment). This problem is even more severe in Winter than in the Summer because condensation can accumulate and freeze, thus blocking fuel flow. However, there are several preventive measures that POL handlers can take to lessen the likelihood of water freezing in the fuel.

Every time DF2 or M1-blend is issued, it should be passed through a filter separator to remove dirt and water. Water should also be drained from the filter separator frequently. Water bottoms in diesel tanks must be drained off daily.

Additionally, since all water cannot be removed from diesel fuel, an icing inhibitor should be added to the diesel fuel during cold weather. The same fuel system icing inhibitor required in JP4 due to the cold temperatures at higher altitudes should be used in diesel fuel.

Other Lessons Learned

Although the most significant lessons learned from Reforger '85 dealt with preventing cold-weather DF2 problems, other lessons were reinforced. Communication, for example, is a never-ending challenge. When units move from one location to another, reports are due, or problems surface, there is never enough communication. Logisticians must anticipate requirements and doggedly pursue alternate means of passing information.

Reports are required to assess the logistics posture of subordinate units, including POL consumption and supply. In the absence of communications, our policy has been to use the last-known consumption rates. This has proven to be a reliable technique since fuel is pushed until units are full.

□**Winter snows challenge refueling operations.**

The use of host-nation rail-tank-cars for wholesale distribution of fuel is indispensable. Since the goal is to move the greatest volume possible, each rail tank car moves the equivalent of three 5,000-gallon tankers. Furthermore, if 10 or more tank-cars have a common destination, dedicated trains allow nonstop throughput of the fuel.

In their zeal to make things happen, planners sometimes overlook the factor of equipment availability. In V Corps, 350-gallon-per-minute pumps and filter separators are limiting factors. The "plumbing" necessary to establish a railhead is available only in the FSSP. Consequently, this tradeoff must be considered during planning.

Reforger is always a challenge, and 1985 was no exception. The outstanding efforts of petroleum specialists at all levels made it a success. ALOG

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ALOG RECENTLY PUBLISHED

AR 1-27, Chief of Staff, Army, Reduction of Administrative Workload for Unit Commanders Program, 20 February 1986.

AR 360-81, Command Information Program, 21 January 1986.

AR 680-340, Standard Civilian Personnel Management Information System (SCIPMIS) (RCS CSGPA-1509), 10 January 1986.

AR 700-138, Army Logistics Readiness and Sustainability, 27 December 1985.

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DA Pam 351-4, Army Formal Schools Catalog, 15 January 1986.

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Enlisted Ranks Personnel UPDATE, Issue Number 7, including AR's 600-200, 601-280, 614-200, and 635-200, 15 January 1986.

Message Address Directory UPDATE, Issue Number 4, including AR 105-32, USMCEB Publication 6, and USN PLAD-1, 24 January 1986.

Officer Ranks Personnel UPDATE, Issue Number 7, including AR's 611-101, 611-112, 614-100, and 624-100, and DA Pam's 600-3 and 600-11, 30 January 1986.

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DOD Directive 4005.1, Industrial Preparedness Program, 26 November 1985.

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DOD Directive 5128.1, Assistant Secretary of Defense (Acquisition and Logistics), 19 November 1985.

DOD Instruction 4140.55, Procurement Lead Time for Secondary Items, 9 December 1985.

DOD Manual 4140.26-M, Change 4, Defense Integrated Materiel Management Manual for Consumable Items, 21 November 1985.

DOD Manual 4160.21-M, Change 8, Defense Utilization and Disposal Manual, 17 December 1985.

DOD Regulation 4500.32-R, Volume 1, Change 8, MILSTAMP Transportation and Movement Procedures, 12 December 1985.

MAIN SUPPORT BATTALION DESCRIBED

Recently published FM 63-21, Main Support Battalion—Armored, Mechanized, and Motorized Divisions, explains how to obtain and provide support in the division support area. The manual describes the methods of operation, functions, and capabilities of the main support battalion, which replaces the supply and transport, maintenance, and medical battalions in divisions organized under J-series tables of organization and equipment.

HEAVY DIVISION MAINTENANCE EXPLAINED

Maintenance operations within the heavy division (Division '86) are explained in FM 43-12, Division Maintenance Operations.

The manual emphasizes the requirement to fix equipment as far forward as the tactical situation permits. While it is aimed at service support planners and operators, the manual is also intended to be a guide to commanders and staffs of supported combat elements.

CLRP REG REVISED

A revision to AR 11-1, Command Logistics Review Program (CLRP), is now available. It establishes DA Form 4965, CLRP Observation Work Sheet, as the standard form for CLRP reports, replacing a number of forms now in use. The new form provides space for identifying and discussing a particular observation, making recommendations, and recording follow-up actions taken on the recommendations. ALOG

ALOG DIGEST

ALPC REVIEWS LOGISTICS PRODUCTIVITY

Attendees at the 21st annual Army Logistics Policy Committee (ALPC) meeting reviewed and discussed a number of new and ongoing programs intended to improve productivity in Army logistics.

Topics under review included productivity improvements in retail- and wholesale-level maintenance and supply, transportation productivity initiatives from the unit level to the Military Traffic Management Command, job order contracts for installation facilities improvements, hazardous waste minimization, and competition in contracting. In addition, representatives from the major commands, the Army logistics staff, and the Defense Logistics Agency reported on their organizations' efforts to improve logistics productivity.

The ALPC meeting, held in February at Fort Lee, Virginia, was chaired by the Deputy Chief of Staff for Logistics, Lieutenant General Benjamin F. Register, Jr., and attended by senior military and civilian logisticians.

CHANGES IN RESERVE OFFICER LOGISTICS TRAINING RECOMMENDED

A task force studying Reserve component (RC) officer logistics training has concluded that traditional training methods must be modified to meet the needs of RC officers. The task force, chartered by the Secretary of the Army and headed by Major General Louis H. Ginn III, USAR, found that many RC logistics officers feel they are not adequately trained for their wartime missions and that they have difficulty keeping abreast of changes in logistics doctrine.

Based on a survey of RC officers, the task force estimated that 26 percent of RC officers assigned to logistics units are not branch-qualified for their positions. However, RC officers seldom have the time and assignment flexibility to attend resident courses at the Army's logistics schools. The task force also found that no training is available for RC officers assigned to multifunctional logistics units such as corps and division support commands and materiel management centers.

To meet the training needs of RC officers, the task force recommended that courses and methods of delivering instruction be changed. Specifically, the task force recommended that—

- Existing courses be repackaged into exportable modules (lasting from 4 hours to 2 weeks) that can be offered onsite to RC officers by mobile training teams. These modules will be presented on weekends as "cram" courses.
- More training be offered at regional sites, with the sites determined by geographic concentrations of RC logistics officers.
- The logistics schools develop courses tailored for RC officers, including refresher courses and orientation courses for officers beginning assignments for which they are not branch-qualified.
- The Army Logistics Center be designated the proponent for developing training courses for officers assigned to multifunctional units.
- The caliber of Army correspondence courses and USAR schools be improved.
- A Reserve Components Logistics Officer Training Advisory Council be appointed at DA level.

The Army Chief of Staff has approved the study and its recommendations are being staffed.

TECH SERVICE REGIMENTS SET

The commandants of the Ordnance School, Quartermaster School, and Transportation School—the technical service chiefs—are implementing their plans for bringing the combat service support (CSS) branches into the Army regimental system.

The plans, recently approved by the Army Chief of Staff, establish the Chief of Ordnance, the Quartermaster General, and the Chief of Transportation as the regimental commanders of their branches. Each will be the single voice for his regiment and will guide the plans and policies for branch career management, professional development, force integration, training and education, and concepts and doctrine for both the Active Army and Reserve components.

The CSS regiments will be called the Ordnance Corps, Quartermaster Corps, and Transportation Corps. The regimental homes of the corps are, respectively, Aberdeen Proving Ground, Maryland; Fort Lee, Virginia; and Fort Eustis, Virginia. Each corps will have an identifying crest, flag, and colors. Active duty corps adjutants, chiefs of staff, and sergeants major will be assigned to each of the

corps. "Honorary Colonels of the Corps," "Sergeants Major of the Corps," and "Distinguished Members of the Corps" will be selected from the retired ranks.

Personnel serving in CSS branch specialties or career fields will be affiliated automatically with the particular CSS regiment regardless of their specific assignment. They may associate with the combat or combat support regiment in which they are serving, but their affiliation with the CSS regiment will remain.

REGULATIONS TO BE CUT

The Army Vice Chief of Staff has announced a program to condense and simplify Army regulations.

Under the Army regulations reduction program, the overall number of regulations will be cut by at least one third by June 1987. Regulations covering the same subject matter will be consolidated, and the number of regulations soldiers or Army civilians use at individual work stations will be reduced. A primary goal is to eliminate unnecessary detail and simplify the mechanics of implementation to more accurately reflect the purpose of Army regulations and the Army's management philosophy of decentralized execution.

An Army official said the program has potential for streamlining all regulatory publications.

AMC SEEKS LOGISTICS EXCELLENCE

In its first 6 months, the Army Materiel Command (AMC) logistics excellence program has generated more than 125 proposals for improving logistics management at AMC activities. Thirteen AMC major subordinate command installations and activities are participating in the 3-year program, which began last July.

The AMC logistics excellence program parallels the Department of Defense model installation program for improving base-level management of working and living conditions. It is designed to improve logistics policy, guidance, and procedures and give local commanders more autonomy in improving efficiency and economy in operations.

Among the proposals approved for testing under the program are—

- Increasing the Red River Army Depot commander's purchase approval authority from $250 to $3,000 for audiovisual items. This is expected to eliminate purchase request processing man-hours and delays in the procurement cycle.
- Discontinuing mileage data reporting at Rock Island Arsenal to eliminate data collection and processing time.
- Permitting the commander of Letterkenny Army Depot to approve the acquisition of automatic data processing equipment valued up to $300,000. Increasing the previous $10,000 limit will reduce request processing time.

Semiannual reports to AMC headquarters on approved proposals must specify man-hour and dollar savings, intangible benefits, where and how savings were reapplied or reinvested, and any adverse impacts.

Red River Army Depot, Texas, recently conducted the first complete depot-level overhaul of a Bradley fighting vehicle. The pilot overhaul was designed to see if Red River has adequate procedures, equipment, facilities, and trained personnel to begin full-scale Bradley maintenance. In the photo above, a depot mechanic works on the steering section of the Bradley in the pilot overhaul. Red River will be the Army's primary maintenance point for the Bradley and is scheduled to overhaul 25 of them in 1987.

PRE-POSITIONING SHIP OFFERS HEAVY-LIFT SUPPORT IN INDIAN OCEAN

A heavy-lift pre-positioning ship, loaded with materiel to support potential Army operations in Southwest Asia, is now on station in the Indian Ocean.

The vessel, the *American Cormorant*, is a submersible ship, which means that it can lower its front half into the water to discharge watercraft. In its Indian Ocean duty, the ship carries Army watercraft and port operations equipment, including tugboats, lighter-aboard-ship barges, landing craft utility, landing craft mechanized, floating cranes, and materials-handling equipment.

The *American Cormorant* is owned by the Military Sealift Command but manned by civilian contractor personnel. The command and the Army are studying the need for acquiring a second heavy-lift pre-positioning ship.

☐ **The** *American Cormorant*

AUTOMATIC RETURN OF REPARABLES EXPANDS

The Army is coding more class IX items for automatic return to depot-level maintenance under its automatic return item program. Approximately 89 percent of eligible items have been coded for automatic return, and Army officials hope to code all such items by the end of fiscal year 1986.

Under the automatic return item program, soldiers in the field can send an item coded for automatic return directly to a depot for repair or storage. They do not have to submit a report of excess to the item manager and then wait for disposition instructions. Items coded for automatic return are listed in a quarterly compilation called the automatic return item list (ARIL), which also identifies the depots responsible for repairing or storing particular items. By consulting this list, soldiers can see if an item is eligible for automatic return and where it should be sent.

The automatic return item program differs in several respects from the controlled retrograde program (see ALOG magazine, March-April 1986, page 40). The automatic return item program operates throughout the Army, while the controlled retrograde program is in effect only in designated areas (primarily Europe and Korea). The controlled retrograde program covers items in classes II, IV, and IX, while the automatic return item program applies only to class IX reparables. All depots participate in the automatic return item program, but primarily area-oriented depots are involved in the controlled retrograde program. The major difference is in purpose: the controlled retrograde program is basically a supply program designed to return excess items to the supply system faster, while the automatic return item program is mainly intended to speed the return of reparable items to depots for maintenance programs.

MAINTENANCE AWARDS PRESENTED

The fourth annual Army Chief of Staff Awards for Maintenance Excellence were presented at the annual convention of the American Defense Preparedness Association at the Shoreham Hotel, Washington, D.C., on 24 April. The winners, by component, category, and command, are—

Active Army MTOE Units

- Light: HHC, 197th Ordnance Battalion, USAREUR, Muenchwelier Army Depot.*
- Intermediate: 533d Transportation Company, FORSCOM, Fort Benning, Georgia.*
- Heavy: Company B, 44th Signal Battalion, USAISC, Heilbronn.*

Active Army TDA Organizations

- Light: Miesau Army Depot, USAREUR.*
- Intermediate: 56th Signal Company, USAISC, Camp Darby, Italy.*
- Heavy: U.S. Army Field Station Augsburg, INSCOM.*

Army National Guard Organizational Maintenance Shops (OMS's)

- Light: OMS 3, 211th Engineer Company, Lemmon, South Dakota.
- Intermediate: OMS 9, 1st Battalion, 229th Field Artillery, Newcastle, Pennsylvania.

• Heavy: OMS 5, 53d Infantry Brigade, Eustis, Florida.

U.S. Army Reserve MTOE Units

• Light: 227th Quartermaster Company, Niagara Falls, New York.

• Intermediate: 962d Ordnance Company, Plattsburgh, New York.

• Heavy: 969th Maintenance Company, Horseheads, New York.

Units marked by an asterisk are Army nominees for the Secretary of Defense maintenance award.

STANDBY WAR BUDGET READIED

For the first time since 1939, the Department of Defense (DOD) is drafting an emergency procurement budget that would be used to buy weapons and ammunition during the early stages of a major war.

The idea behind this effort is to determine in advance what will be needed in the first months of a war and, based on those data, develop a standby budget for submission to the Congress in the event of a war. Having a budget already prepared will greatly reduce the time needed to begin industrial mobilization. The budget will also serve as a guide for both industry and the armed services in planning wartime production.

In drafting the budget, DOD has asked the services to submit lists of items that will be in heavy demand during the first 6 months of a war. The budget should be completed later this year.

FIELD SHOWER PLANS OFFERED

Platoon- and company-size units may now fabricate a field-expedient, portable shower unit to use when they participate in extended field exercises where standard shower facilities are not available.

The shower unit can be constructed in 8 manhours using approximately $300 worth of locally procured or reused items. Any 24-volt electrical source will power it. It is designed to operate with the 1 1/2-ton, 400-gallon water trailer; but it can be modified to operate from a water tap, larger water tanker, or, with a garden hose and screen, from a stream or river. With the 400-gallon water trailer, the unit will provide a 2-minute cold shower for 20 or 30 soldiers. A heating element may be added. When disassembled for storage or transport, it fits into a 1- by 2- by 12-foot space and weighs 15 pounds. It takes 3 to 5 minutes to place in operation.

The shower unit was recommended under the supply and maintenance assessment and review team (SMART) program and tested at the 24th Infantry Division. A materials list and construction plans for the shower unit may be obtained by writing—Commander, 24th Infantry Division (Mech), ATTN: AFZP-GL-SMART, Fort Stewart, GA 31314, or by calling AUTOVON 870-4700 or -4707.

DEPOT AIDS OVERSEA DEPLOYMENT

Anniston Army Depot, Alabama, recently served as the railhead for two Alabama Army National Guard units deploying to South Korea for the exercise Team Spirit '86. The units—the 142d Signal Brigade and the 279th Signal Battalion—used depot facilities and equipment and the expertise of depot employees to load almost 400 vehicles on railcars for shipment to west coast ports. Once they reached the ports, the vehicles were transferred to freighters bound for Korea.

The guardsmen found that the depot provided an efficient and secure site for collecting and loading their vehicles. Anniston personnel discovered that they could help the National Guard units without interfering with regular depot operations. Anniston will be used for the return of the vehicles when Team Spirit ends this Summer.

☐ **Vehicles await shipment at Anniston.**

ALOG EMPHASIS

NORTHAG IS LOGEX '86 SITE

The Army's annual logistics exercise, LOGEX '86, will be held at Fort Pickett, Virginia, from 10 to 22 August. The exercise will depict the employment of a U.S. corps and supporting units in the Northern Army Group (NORTHAG) area of Central Europe. More than 3,000 Active and Reserve component personnel from the four services and from the allied armed forces of Belgium, France, Great Britain, the Netherlands, and West Germany will participate.

TRANSPORT GUIDE PUBLISHED

The Military Traffic Management Command has published a new edition of the Transportability Fact Book. The book provides procurement officials and mobility planners with 1-page synopses of the transportability status of 35 major equipment systems now in development. To obtain copies of the Transportability Fact Book, write to—Commander, MTMC Transportation Engineering Agency, ATTN: Guidance Branch, Transportability Engineering Division, P.O. Box 6276, Newport News, VA 23606-0276, or call AUTOVON 927-4646 or commercial (804) 599-1106.

DEPOT MAKES POWER UNITS

Under a program designed to meet the Army's growing requirements for electricity in the field, Tobyhanna Army Depot, Pennsylvania, produced 2,741 mobile electric power units in fiscal year 1985. The program is a cooperative venture with the Army Troop Support Command, which supplies Tobyhanna with trailers and generators for assembly into mobile power units. Tobyhanna makes mobile power units in 19 configuations with electrical outputs ranging from 3 to 200 kilowatts.

STUDIES LISTED

Bibliographies of studies on the Falkland Islands War and MANPRINT are available to authorized persons. Write DLSIE, ALMC, Fort Lee, VA 23801-6043, or call AUTOVON 687-4655 or commercial (804) 734-4655.

FOREIGN AID OFFICES MERGE

The Army Materiel Command (AMC) recently integrated its international programs office into the Army Security Assistance Center. In addition to its mission of administering the Army's security assistance program, the Security Assistance Center is now responsible for international cooperative research and development programs, acquisition of foreign hardware and technology, and AMC support to staff talks with allies. Officials believe the consolidation will improve planning of foreign defense relationships while providing allied nations with a single liaison for materiel and technological interchange.

HAZMIN STARTS

On 1 June, all Army Materiel Command (AMC) installations will implement the AMC hazardous waste minimization (HAZMIN) program. Installation commanders must now certify that the HAZMIN program is in place when treating, storing, or disposing of hazardous wastes generated at their installations. The AMC HAZMIN program is designed to reduce and, if possible, eliminate the generation of hazardous wastes, to minimize present and future threats to human health and the environment, and to eliminate untreated hazardous waste by 1992.

LOG SYSTEMS HANDBOOK OUT

The Logistics Evaluation Agency has published a handbook that describes new logistics materiel and automated systems, including those to be fielded in the near future. The Logistics Systems Handbook-1986 will be distributed to designated activities. Activities with a specific need for the handbook can obtain a copy by writing to the U.S. Army Logistics Evaluation Agency, ATTN: DALO-LER, New Cumberland Army Depot, New Cumberland, PA 17070-5007, or by calling AUTOVON 977-7352.

EUROPE TESTS U.S. MEAT

Six Army and Air Force commissaries in Europe are selling chilled beef and pork from the United States in a 6-month test mandated by Congress. If the test shows there is a demand for these items, regular shipments of chilled American meat to European commissaries will begin. Far Eastern commissaries have been receiving chilled American meat for several years.

INTERN CENTER RENAMED

The Army Materiel Command Intern Training Center at Red River Army Depot, Texarkana, Texas, one of the five schools of the Army Logistics Management Center (ALMC), has been redesignated the School of Engineering and Logistics. Of the other four schools, three are located with ALMC at Fort Lee, Virginia. The fourth, the Joint Military Packaging Training Center, is located at Aberdeen Proving Ground, Maryland.

FORCE MOD REPORTS CITED

Force modernization reports on lessons learned during the initial fielding of the UH-60A helicopter, M60A3 tank, M901 improved TOW vehicle, M4K rough-terrain forklift, M1 tank, M198 howitzer, bridge erection boat, and tactical fire direction system are available. Reports are now being prepared for the M939-series 5-ton trucks and commercial utility cargo vehicle, and one is planned for M2 and M3 fighting vehicles. To obtain the reports, write to—Commander, AMC MRSA, ATTN: AMXMD-EI, Lexington, KY 40511-5101, or call AUTOVON 745-3393 or -3831.

1st LOG ITEMS SOUGHT

The 1st Corps Support Command (COSCOM) Association is seeking information, photographs, and artifacts for its newly established museum. Persons who served with the 1st Logistical Command (1950-1970), the 12th Support Brigade (1965-1972), the 1st Field Army Support Command (1970-1972), or the 1st Corps Support Command and their associated units should contact the 1st Corps Support Command Association, ATTN: PAO, 1st COSCOM, Fort Bragg, NC 28307-5000.

☆GOVERNMENT PRINTING OFFICE: 1985-461-046/5

Coming in Future Issues—

- British Army Logistics
- Promoting Logistics Excellence
- Reconstituting a Combat Force
- Guntrucks of Ambush Alley
- NCOLP and How It Works
- Fueling the Keystone
- Supply Support for the Army
- Do You Remember MOS 76N?
- New Technology for Supply Training
- Duster Busters at Dona Ana
- Unitized T-Rations
- Funding Foreign Military Sales
- Comparing U.S. and Soviet Maintenance Practices
- Fighting in the Rear
- Contracting Base Operations
- Commanders' Responsibilities for Hazardous Waste
- Supply Efficiency
- Measuring Maintenance Capability
- How to Make a 'MARC' on Manpower
- Reutilizations: First Source of Supply