Sense-and-Respond Logistics

Soon, a computer-based system will decide who gets what supplies, and when.

By George Cahlink

USAF photo by MSgt. Val Gempis

At the peak of Operation Iraqi Freedom in 2003, the Joint Mobility Operations Center at Scott AFB, Ill., was busier than an air traffic control tower on a holiday weekend.

Every four minutes, large digital maps blinked updates showing the paths of 450 cargo aircraft and 120 ships en route to or returning from the Middle East. The traffic system tracked not only the airplanes and ships but also their cargoes—which ranged from Joint Direct Attack Munitions to Meals, Ready to Eat.

Dozens of military and civilian workers from US Transportation Command sat in rows of cubicles below the screens, studying them and an extensive database that tracked the more than five million items heading overseas. That information came in handy as calls and e-mail queries came in from logisticians working at airfields and ports in the Persian Gulf.

Those logisticians wanted answers to questions. How soon would a specific airplane part arrive? When should they expect to see the next batch of troops? What was the due date for the next shipment of meals?

With a few clicks of a computer mouse, the TRANSCOM workers could say not only when a particular aircraft or ship was to arrive but also which shipping container would be carrying what specific item.

In many cases, field logisticians with access to remote terminals could

go online and swiftly receive the answer to their own questions.

This, by all accounts, was a big hit with the loggies, according to Army Maj. Gen. Robert T. Dail, TRANSCOM director of operations. He told a subcommittee of the House Armed Services Committee, "While we certainly have more work to do in transforming DOD distribution, I must emphasize that we achieved incredible success during Operating Enduring Freedom and Operation Iraqi Freedom."

Dail reported that the agency started out tracking 2.5 million items per day and eventually added upgrades that allowed TRANSCOM to monitor nearly six million items flowing through the distribution pipeline every day.

USAF photo by MSgt. Val Gempis

A base warehouse full of parts and supplies is one link in the logistics chain that officials say worked better in recent operations but which must become even more responsive.

Success Stories Rare

Unfortunately, such was the exception, not the norm. Wartime logistics successes were few and far between, especially once supplies got to the theater.

Rep. Joel Hefley (R-Colo.), chairman of the House Armed Services Committee's Readiness Subcommittee, said the Pentagon had spent vast amounts to upgrade its logistic systems after the 1991 Gulf War, without much to show for it.

"Much has improved, but ... the services [still] have stovepiped systems; the systems need to be integrated; and there is a need for total asset visibility," he said.

The Government Accountability Office, a Congressional watchdog agency, found major wartime logistics problems tended to crop up once the goods got into theater, according to an assessment published late last year. The GAO found:

- Backlogs of hundreds of unloaded pallets and containers at in-theater distribution points.
- A $1.2 billion discrepancy between what was shipped to the Army and what the Army acknowledged receiving.
- Millions of dollars in late penalties charged for leased containers that weren't unloaded in a timely fashion.
- Cannibalization of equipment for spare parts, caused by lack of spares or an inability to locate them.
- Huge amounts of excess equipment in Kuwait that departing US troops had failed to sort or forward to other units.

An overall assessment of the logistics operations boils down to a single general conclusion: US troops, supplies, and equipment moved to war faster and more efficiently than they had in any previous military conflict, but steep challenges face logisticians trying to keep up with a new type of lightning-fast military operations.

Logistics, as a result, is moving to the forefront of military planning. The Defense Department is now developing new logistics practices and making technology upgrades that will move wartime logistics into the 21st century.

In the 1991 Gulf War, the military relied on a "mass-based" logistics system that built up mountains of supplies to make sure the troops did not run out. Over a decade later, in Operation Iraqi Freedom, the military used computer and tracking systems such as those used by Wal-Mart and other retailers to order supplies "just in time."

For future wars, the military will go a step further with a "sense-and-respond" system that will use networks and sensors to create an agile, real-time supply chain.

"Today's logistics models are based on the types of wars we thought we were going to fight," said Navy Capt. Linda M. Lewandowski, project leader for sense-and-respond logistics in the Pentagon's Office of Force Transformation. However, she asked, "is a mass- and attrition-based [logistics] model really going to work?"

On Its Own

Simply put, the sense-and-respond logistics concept relies on battlefield sensors, communications networks, and information databases as the basis for deciding when and how supplies should be delivered to troops and from where they should come.

A field commander needing more ammunition would query an automated system connected to all other units and supplies in the field. The system would decide how best to field that order. It would make that decision on the basis of where the supplies were located, what was in stock, and which units had priority call on them. A unit not in the heat of battle might end up giving its ammunition to one engaged in a fight.

In another scenario, a commander might call off a proposed air strike in favor of using ground forces. If the logistics system knew about the change, it might be able to divert support units or supplies from the air unit to the ground forces.

"Sense-and-respond logistics is not just about transporting stuff," said Lewandowski. "What you are really talking about is being able to give a commander more options."

In some cases, she said, a commander could even choose a slower delivery option if a battle or attack were being waged in stages.

James R. Blaker, chief scientist at

Science Applications International Corp., told a conference last December that the new concept would speed combat operations by sensing and responding to troop needs before supplies run out or as the battlefield changes. He noted that when just-in-time systems faltered a bit in Iraq, logisticians began experimenting with basic sense-and-respond logistics practices.

"Instead of waiting for the communication back from the person that [logisticians] were supposed to supply, they tried to get a general idea of what was going on and push supplies forward," Blaker said.

Lt. Gen. Claude V. Christianson, Army deputy chief of staff for logistics, told the Defense Writers Group in June that the service needs logistics systems that can keep up with the pace of military operations. Before Gulf War II began, he said, the Army in Kuwait was ordering as many as 18,000 parts and supply items per day, using standard logistics systems. However, as the troops moved into Iraq and raced toward Baghdad, logisticians received no orders because the force was moving too fast to connect to the supply chain. Eventually, computer disks were used to track supply shortages. Those disks were shipped back to logisticians for use in filling orders.

USAF photo by SrA. Karolina Gmyrek

USAF airlifters were central to the movement of materiel into Southwest Asia. Airmen also drove trucks delivering much of those supplies and equipment to key facilities within Iraq during combat operations.

Tracking Challenge

Christianson said Army troops probably received only one-third of the equipment needed, and it usually took two to three days to fill a request.

Brig. Gen. Edward G. Usher III, Marine Corps director of the Logistics, Plans, Policies, and Strategic Mobility Division, told a House panel in March that tracking equipment was the greatest challenge that logisticians faced in the war.

A lack of up-to-date information, he said, "resulted in delays, shortages, and at times an inability to expedite crucial parts."

The Office of Force Transformation last summer awarded a $2.9 million contract to Synergy, Inc., to develop and test a prototype sense-and-respond logistics system that would help solve those problems. The system will use commercial off-the-shelf technology such as an Oracle database and the Tibco software that Wall Street firms use to carry out stock market trades. Thus far, the system has completed six technical assessments. In July, it underwent limited operational testing with the US Marines in the Pacific.

A key feature of the system is its collection of "agents"—sophisticated software codes that can review mission and situational data from sensors or humans and decide what products should be ordered, from what sources.

For example, an agent might receive a sensor signal that a fighter is using up fuel and automatically order more. USAF's future aircraft, such as the F/A-22 and Joint Strike Fighter, are being designed with diagnostic equipment that can automatically send signals to mechanics and suppliers as parts wear out.

At its most advanced, an agent for a combat unit might receive a human report about an emerging threat and then borrow ammunition from another unit not facing a threat. DOD is developing complex rules that will guide agents in making such decisions. The Defense Advanced Research Projects Agency has spent more than $70 million on this task so far.

Donald L. Zimmerman, Synergy's chief executive officer, said sense-

USAF photo by MSgt. Keith Reed

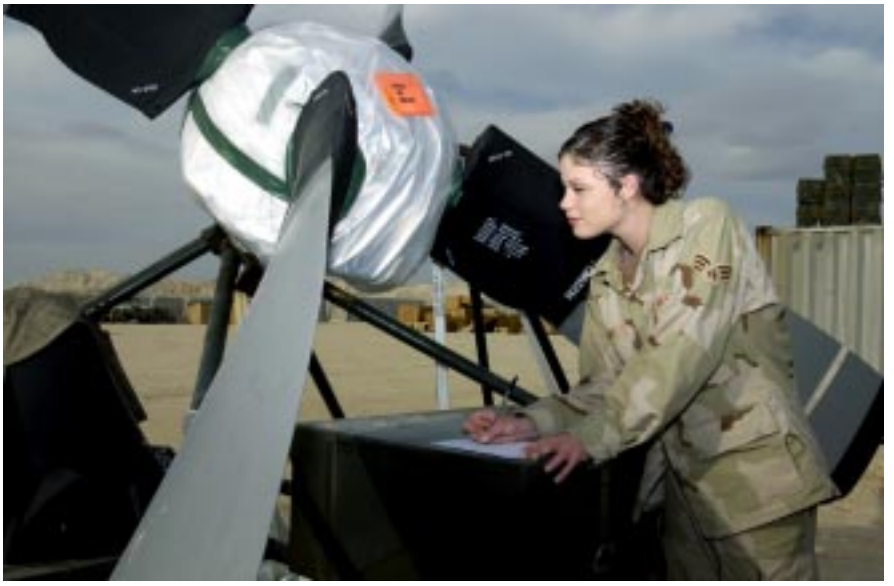
At Ramstein AB, Germany, transportation controllers such as TSgt. Donald Drummer gave directions to airlifters taking supplies into Southwest Asia. Officials want more automation that will "sense" the need for materiel.

and-respond logistics is based on a business philosophy popularized by IBM. The idea calls for developing early knowledge of where the market is going and what customers need.

Lewandowski said the military services need to "buy in" to sense-and-respond logistics, and the system must mature before it can move beyond the prototype stage. Software can be plugged into existing logistics information systems, she added.

Col. Paul Dunbar, USAF's deputy director for installation and logistics innovation and transformation, said sense-and-respond is one of many future logistics concepts being explored by the Air Force.

Last year, the Air Force laid out a comprehensive future logistics strategy, known as Expeditionary Logistics for the 21st Century (eLog21). The new strategy calls for reforming logistics practices and using modern supply chain technology to improve weapons availability by 20 percent without increasing costs.



USAF photo by TSgt. Demetrius Lester

At a Persian Gulf location, SrA. Regina Sewart inventories aircraft propellers delivered for Southwest Asia operations. TRANSCOM managed the flow of nearly six million items each day.

Who's in Charge?

"Right now, you really do not have anyone who is responsible for the supply chain from end to end," said Dunbar. The service has a variety of logistics systems at base, regional, and national levels for ordering and tracking supplies but no single system providing a complete view of the supply chain, he said.

Beginning next summer, the Air Force will begin creating that common logistics picture by moving toward a Web-based system, known as the Enterprise Supply System. Logisticians will tap into a shared database of the Air Force's financial, maintenance, personnel, and contracting information.

The Web system will make it easier to share information across the service. Ultimately, the Air Force will build a single Expeditionary Combat Support System to replace the Air Force's more than 700 unique logistics systems and supply catalogues and provide real-time tracking and inventories.

Dunbar said the service must first establish that system before it can pursue sense-and-respond logistics capabilities. "You need to know what you have to be able to redirect supplies," he said.

Dunbar said the new logistics system will not be ready for at least five years. It will be paid for with the $300 million that the service annually spends on more than 700 individual logistics systems and catalogues, he added.

The Air Force is pursuing several other reforms based on logistics lessons from the wars in Iraq and Afghanistan. Various combat support personnel who open expeditionary air bases are now training together in an exercise known as Eagle Flag. In the past, they'd trained separately and did not have a set way to practice opening air bases.

The Air Force also is creating small packages of materials needed to open bases. The goal is to reduce airlift requirements.

For instance, USAF had been sending support equipment for 1,100 airmen when opening expeditionary bases; that required the equivalent of 14 C-17 cargo loads. Now, the Air Force has created 150-airmen support packages that can fit into a single C-130 and supply sufficient gear to get a base running. The Air Force is also examining pre-positioning that equipment at seaports.

Oftentimes, the most successful military innovations come as a result of wartime pressures.

For example, the Global Transportation Network, a computer system that pulls data from various military networks and outside suppliers to create near-real-time digital maps and databases to track supplies, was in trouble six weeks before the war. The system had been designed to track 2.5 million items and handle 3,200 queries during peacetime, but was handling far more than that as troops and supplies readied for combat. Information normally processed in minutes was taking hours.

Logisticians knew the system needed to be overhauled, but doing so would take nine months and cost tens of millions of dollars. An alternative plan emerged: Buy two new servers and four refurbished models along with other hardware and software upgrades for $1 million and have a more robust system by mid-March. The plan was risky. Servers would be turned off and backups would be used during the upgrade. If a backup failed, the whole system would crash.

TRANSCOM took the risk—and it paid off. As US troops raced up the Tigris and Euphrates toward Baghdad, the digital maps were blinking in the Joint Mobility Operations Center every four minutes showing some nearly six million items moving toward the Middle East.

Logisticians planning the future supply chain systems hope their ideas take hold just as rapidly. ■

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