INTERTECT

Emergency Logistics

EMERGENCY LOGISTICS

Frederick C. Cuny
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INTRODUCTION

The purposes of this paper are:

1. To describe the conceptual framework;
2. To identify principles of organization;
3. To describe general aspects of a logistics system; and
4. To provide some operational hints and suggestions.

Logistics is not a highly-complicated activity, yet few organizations properly implement logistics operations. There are too few experienced or trained logisticians working in the field of emergency operations and, as a result, a key component of emergency operations often becomes fraught with problems and costly delays.

Logistics for emergency relief operations is different from most other types of logistics systems. The need for speedy delivery of supplies, coupled with non-standard customs procedures, serves to complicate the system and create logjams from the initial stages of an operation. Unless an organization is properly prepared to address the problems at the outset, they can quickly multiply and further delay deliveries. This paper will give a general overview of emergency logistics, identify common problems, and offer some suggestions on how to overcome the most common obstacles.

Definition

A good working definition of emergency logistics is:

> "The practical art of establishing lines of supply, providing the commodities, and the transport to move them."

The term "lines of supply" is a key concept; logistics should be thought of as a linear system — a flow of supplies from point to point. Another way to view logistics is as a system of supply, where items (or commodities) flow through the system in one direction and the system of controls sends documents flowing back in the other direction. For example, supplies such as food move down the system while requisitions and reports flow back in the other direction.

The Importance of Logistics

Logistics is the lifeline of a relief operation. People depend upon food and other supplies in the system.

Logistics is usually the most expensive part of an operation. For example, a truck that can move across unpaved roads costs approximately $50,000 U.S. dollars; its trailer may cost $10,000 - 15,000 or more. Therefore, a 100-truck fleet with spares costs approximately $10 million (not including fuel, maintenance or insurance).

Because it is so expensive, logistics is the most problematic aspect of a relief operation. In part, this is because it is the activity most subject to corruption, especially when the goods involved are in short supply in the host community. Whenever there are competing demands for food, fuel and other relief supplies, then thefts, pilferage and diversions can be expected.

The costs of logistics operations are often increased because the agencies are inexperienced in handling commodities or are not familiar with the limitations of transport or the complexities of the various stages of a logistics system. In logistics, time equals money — when a procured commodity sits in a warehouse or on a ship, it costs the agency even while it is not in motion. During the Ethiopian famine of 1985, the final cost of food doubled due to the long delays encountered in the ports and in trying to transport the food inland.

As vital as logistics activities are in an emergency relief operation, there are few trained emergency logisticians; most of the people handling logistics have gained their knowledge by trial-and-error, and many consistently make the same mistakes. At the international level, there is no central coordinating body to try to relieve competition in procurement or transport and, at the country level, there is rarely a group set up to schedule arrivals of ships or planes to relieve port congestion. Thus, it is no wonder that logistics delays and costs mount so quickly.

The Scope of Logistics

Logistics covers the movement of many different items but, in emergency logistics, movement of food is its primary and most important function. The movement of medical supplies, especially vaccines, is also important but is usually much smaller in scale and requires specialized equipment and arrangements. Additional activities include movement of non-food items such as tents, household supplies, fuel and equipment; and movement of people from one site to another.

The Element of Time

An important objective of a logistics operation is to reduce transit time, especially in the earliest stages of an emergency. Often, decisions are made more on the basis of time than on cost. Time becomes the criterion against which all initial decisions are measured. In this sense, the time element is unique to emergency relief logistics and makes it distinct from other forms of logistics operations.

CONCEPTUALIZING LOGISTICS

Components of a Logistics System

Logistics is a set of interrelated components. The primary components are the physical elements of the system or the hardware; the secondary components are the various controls, sometimes called the software.

Primary components include warehouses and other storage facilities; transport such as trucks, planes, ships and/or other carriers; and special facilities such as fuel depots, garages, milling facilities, cold storage for perishables, and cold storage facilities for medicines.

Secondary components include:

1. A control system consisting of:

   (a) Procurement;

   (b) A monitoring system (waybills, call forwards, requisitions, etc., which are used to track the operation); and

   (c) The persons who coordinate the shipments and carry out checks and audits of the supplies in the system.

2. A distribution system which controls distribution of the commodities in the refugee camps or settlements.

Model of a Typical Logistics System

The following is a conceptual model of a typical logistics system. The objective is to move supplies from their source (the supplier) to their destination (the refugees):

Source		Destination
S		R
(Supplier)		(Refugees)

The movement of supplies is carried out through a series of movements (transport) and intermediate stops at warehouses, represented diagrammatically in the drawing below:

W	→	T	→	W
(Warehouse)		(Transport)		(Warehouse)

Supplies are shipped from the supplier by truck or rail to a warehouse on the dock at the port of shipment, then transported by ship (or in some cases by plane) to another warehouse at the port of entry in the country of asylum:

S	→	T	→	W	→	T	→	W
(Source)				(Dock)				(Port of Entry)

At the port of entry, the commodities are cleared and then transported again to another (regional) warehouse and from there to a warehouse in the refugee camp:

S	→	T	→	W	→	T	→	W	→	T	→	W	→	T	→	W
				(Port of Entry)				(Regional Warehouse)				(Regional Warehouse)				(Camp)

From the warehouse in the refugee camp, the commodities enter the distribution system and move directly to the refugees:

S	→	T	→	W	→	T	→	W	→	T	→	W	→	T	→	W	→	DS	→	R
												(Regional Warehouse)		(Camp)				(Refugees)		

Conceptually, the overall system can be divided into three stages. The first stage is from supplier to port of entry; the second stage is from the port (after clearance) to the refugee camp or settlement (in most cases, through an intermediate warehouse in the vicinity or region of the

refugee camps); the third stage is from the camp warehouse through the distribution system to the refugees.

S → T → W → T → W → T → W → T → W → DS → R
[---------First Stage----------][------Second Stage--------][--Third Stage--]

Control Responsibilities

Responsibility for controlling logistics in the first stage lies with the purchasing agent (in UNHCR, the procurement section). Control begins with the specifications of the order. The supplier is responsible for meeting the specifications, shipping the commodity, and delivering it in good shape to the port of entry. (Note: insurance does not extend beyond the port of entry. For this reason, in most cases the supplier will not accept responsibility beyond the acceptance of the commodity in the port of entry.)

Once the shipment has been cleared, a relief agency is usually the consignee and takes responsibility for onward shipment to the refugee camp; thus, the agency is responsible for control in the second stage. Most of the effort (and problems) occurs during the second stage, primarily because agencies are not adequately prepared for this task. Ideally, responsibility for control is vested in a person known as the "traffic director". The traffic director controls delivery schedules, assignment of supplies, and decisions regarding when to ship from the port of entry to intermediate warehouses and/or the refugee camps. The traffic director is usually the chief logistician and, in some situations, may be the local procurement officer.

In the third stage — distribution in the refugee camp — the camp administrator (or, in the case of scattered sites, the agency in charge of distribution) is responsible for control.

Conceptually, the control system looks like this:

Procurement & Supplier Consignee (Traffic Dir.) Camp Admin.
S → T → W → T → W → T → W → T → W → D → R
[---------First Stage----------][------Second Stage--------][--Third Stage--]

Local Procurement

So far, we have described a full-scale international logistics system. There is, however, a way to significantly reduce and simplify logistics, by local procurement. With local procurement, it is possible to eliminate

all of the first stage and most of the second as shown in the diagram below:

S (Local Supplier) → T → W → DS → R

It is usually possible to contract with local suppliers to deliver needed commodities directly to the refugee camps.

Logistics Coordination

The most important person in a logistics operation is the traffic director, whose responsibilities include:

1. Controlling procurement and distribution;
2. Controlling transport, i.e., controlling allocation of trucks or other vehicles and where they go;
3. Monitoring the warehouses;
4. Directing allocations of supplies to the intermediate warehouses and from there on to the camps; and
5. Planning the overall distribution system in cooperation with the camp administrators.

The traffic director must be based in the field, have adequate transport to be able to move up and down the system from the refugee camp to the port of entry, and be able to control the fuel allocation for the vehicles in the logistics system. Ideally, the traffic director is an experienced logistician from an agency that has extensive experience in moving large quantities of supplies and is thoroughly familiar with priorities in a relief operation. In summary, the traffic director should be the focal point for all coordination in a logistics system.

Decision-making

The need to make early logistics decisions in an emergency cannot be overemphasized. Early decisions save money and lives. This is especially true regarding food and medical supplies. The longer basic decisions are delayed, the greater the cost will be. For instance, if it takes two months from the time food is ordered to the time it arrives in a refugee camp, delaying a decision to procure and ship the food by even a week means that a portion of the food will probably have to be expedited by air, increasing the cost perhaps ten-fold. If the decision is delayed even longer, it simply may not be possible to meet all the needs; as a result, lives may be put in jeopardy unless alternate sources of food can be found.

System Planning

At the very outset of an emergency, planners should conceptualize and plan the entire logistics system. It is important to define the key roles and responsibilities of all personnel at each stage and to set up the records and controls required to monitor the flow of supplies through the system. Too often, organizations attempt to set up the system in a piece-meal fashion, resulting in confusion, delays and higher costs.

LOGISTICS CONTROLS

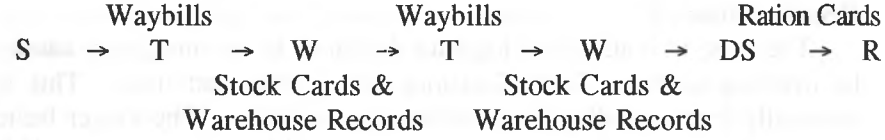
Control over commodities in the logistics system is carried out with the use of various types of documents. As supplies go down the system from supplier to destination, the documents include:

1. Waybills or bills of lading. These shipping documents are used to control the shipment during transport.

2. Stock control cards and warehouse records. These documents control the supplies while they are in a warehouse.

3. Ration cards. These provide the primary commodity control within the distribution system.

This system can be diagrammed as follows:



The paperwork which controls the flow or rate of movement of supplies while they are in the system consists of:

1. Call forwards. These documents are issued to summon supplies already in the system.

2. Requisitions. These issue a call for supplies that need to be ordered or sent from a buffer stock further up the system.

3. Purchase orders or contracts. These are issued to suppliers by procurement officers to initiate the purchase of supplies not already in the system.

The Primary Documents

The two documents that control Stage I and II logistics are the waybill and the stock card.

Waybills are used to record the cargos being shipped and to certify that they have been received by the transporter in good shape and are being delivered in the same shape and quantity as received.

Normally a waybill will have an original plus three or four copies. When a transporter delivers the supplies to a warehouse, the waybill is signed and the transporter uses a copy as his invoice for payment. Other copies are maintained by the shipper at the point of origin and the warehouseman at the destination. Additional copies are used to notify the traffic director that the goods have arrived at the specified location.

Stock cards are the primary means of controlling supplies in the warehouse. They provide not only a storage record but also a record of the in-and-out balance of the commodities within the warehouse. One card is generally kept for each type of item in the warehouse.

Accountability

It is important that the chain of accountability in a logistics system be clearly understood by all parties. In the warehouse, the accountable

person is the storekeeper. During transport, accountability lies with the driver or person conveying the commodity.

Responsibility during shipment is transferred from storekeeper to driver by means of a waybill and from driver to next storekeeper at the point of off-loading with a receipted waybill.

Checkers should be employed at each transfer point to check the goods loaded or off-loaded and certify that all are accounted for. Damages or losses should be recorded on the receipted waybill, indicating overage, shortage or damage. Again, the driver is responsible for shortages or damages in transit.

Distribution Systems and Controls

In an emergency, refugees will usually congregate at a relief center or in refugee camps. It is important to establish a distribution system that ensures the timely and equitable distribution of food and other critical supplies.

There are generally two ways to distribute food in an emergency: by individual or by group.

An individual distribution system is generally utilized when people arriving in a camp come as individuals or as single families rather than as a larger social group such as a clan or village. Group distribution is used when the basic social structure of a community is intact and village or community leaders can be easily identified (and when they still have authority among the refugees).

Individual distributions are dependent on a registration system and use of registration or ration cards to identify people and record when they have received their food allotment.

Group distribution also requires a registration system but individual ration cards are not required so long as the community leaders keep lists of those who should receive food based on family units and age distribution.

As a general rule, group distribution is preferable because it is quicker and easier to administer, and because it offers refugees a role in food decisions and helps to re-establish traditional community structures.

However, in some cases group distribution should be avoided, at least in the initial stages of an emergency. These situations include:

1. Severe food shortages. If the people entering the camp are severely malnourished, and if food supplies are irregular, group

distribution programs may inadvertently lead to food discrimination, resulting in higher mortality rates among the vulnerable groups.

2. When indentured or "captive" servants/workers are among the population. If food shortages exist, the heads of the groups may not allocate sufficient food to the workers despite their needs, and mortality could be high.

3. When armed insurgents are suspected of using food to control a refugee population. In 1979, Khmer Rouge cadres hiding among the refugees in Thailand tried to maintain control over the people by gaining control over food distribution. While an individual distribution system did not completely eliminate their attempts to enforce discipline, it did significantly erode their authority.

Problems of Control in Distribution

One of the major problems encountered in distribution control is multiple registration. A registration system with ration cards works well only if people are assigned to a specific spot or shelter within the camp or settlement and periodic cross-checks are made to match the numbers against the locations.

Role of Procurement in Logistics Control

The role of procurement in logistics control is often not clearly understood, even by procurement officers. Control in the system begins with the setting of technical specifications for the items being purchased. These specifications establish the quality of the commodity.

Other decisions made at the time of procurement also affect quality and the likely condition of the supplies when they arrive at their destination. For example, specifications regarding packaging of foods can determine how well they travel, the percentage of loss that can be expected en route, and how long the commodity can be maintained in a destination warehouse. What may appear to be a minor decision about the type of bag to use for food — cloth or polypropylene — can have a major effect on shelf-life and transportation requirements.

In most international relief organizations, procurement offices are located in the headquarters of the organization and procurement officers are often far removed and sometimes unacquainted with conditions in the

field. Unless the field staff provides thorough and clear specifications, complications are likely to develop. Therefore, it is extremely important that the procurement process begin with requests from the field. Ideally, procurement officers or personnel thoroughly briefed in procurement procedures should be assigned to the logistics team in the field and given responsibility for preparing the procurement specifications; then the primary role of a procurement officer at headquarters should be to facilitate and support requests from the field. While this is undoubtedly difficult, given donor pressures and the reality of donor constraints, it is important that organizations strive to focus their procurement activities at the field level, not at headquarters.

STORAGE FACILITIES AND EQUIPMENT

Warehousing

Selection of warehousing is important since relief supplies are likely to spend a good deal of time in these facilities.

1. Size. The warehouse must be large enough to store the types and quantities of supplies that are being stockpiled. If a variety of goods are being stored in one place, then the warehouse plan should be based on the most bulky commodity.

   Food grains usually require more space than other relief commodities. As a rule of thumb, one ton of grain normally occupies a floor space of one square meter and a volumetric space of one cubic meter. Therefore, calculating the amount of storage space needed is fairly easy; if 500 tons of grain must be stored, for example, a warehouse of approximately 500 cubic meters of storage space is required. (For more details on storage requirements, see UNHCR Handbook for Emergencies, p. 42.)

2. Permanent buildings. When storing grain, it is usually best to select permanent buildings with hard-surfaced (preferably concrete) floors. Almost any type of building can be used for storage, but those with minimal windows and large access doors are generally best since the likelihood of pilferage and theft is reduced with fewer windows. Storage of grains on the second

floor should be avoided as the structure is unlikely to have been designed to withstand the heavy weight.

In remote locations, or in refugee camps or settlements, it may be necessary to construct temporary warehouses. In some situations, adequate supplies of local materials may be available. Wherever time and weather conditions permit, small-scale warehouses can be built using local resources and employing refugee and/or local labor.

3. Prefab structures. Use of prefabricated flexible, plastic warehouses is increasing in emergencies, and many models are now available. A primary criterion for selection should be its demonstrated wind resistance and climatic suitability. Before procuring a prefabricated warehouse, the method of anchoring the warehouse to the ground should be ascertained. In 1985, one-third of the warehouses procured for emergency relief operations in eastern Sudan were destroyed within a two-week period because they were insufficiently anchored to the ground and were unable to withstand high winds.

4. Selection criteria. Other than space, the main overall consideration for warehouses is the amount of protection provided for the items stored. Within the storage enclosure, commodities must be protected from:

   (a) The climatic environment;
   (b) Theft; and
   (c) Rodents and other pests.

5. Organization. Warehouses must be well-organized. Different commodities must be clearly identifiable and all supplies must be within easy reach. Warehouses should be organized on a first-in, first-out (FIFO) basis so that food and medicines can be kept as fresh as possible.

6. Controls. Access to warehouses must be controlled. Ideally, controls begin outside the building with a fence, good lighting and a controlled gate. Within the warehouse, controls include limited access to the building, interior lighting and limited access

to the supplies by persons entering the building. At a minimum, workers who are authorized to enter should have some means of identification.

From the very outset, it is important that stock controls, stock cards and other key paperwork be available and that warehouse operators be thoroughly familiar with proper use of the control documents.

Storage Equipment

The most common means of providing additional protection to goods in storage is use of plastic sheeting and canvas tarpaulins. Both have only a moderate ability to provide protection against moisture and no ability to protect against insects or rodents.

Recently, two new items have been developed to help store food grains in temperate or dry climates: bulk-grain silos and storage cubes. These containers are ideal for relief operations; they are light and easy to transport and move on site. The containers are gas-tight and are made of a PVC sheet 0.83mm in thickness with long durability under conditions of solar ultraviolet (UV) irradiation. The primary advantage of this system over conventional plastic silos or other grain storage systems is that the storage containers are hermetically-sealed. The effect of hermetic storage is that, while the container is sealed, the oxygen concentration drops to between 6%-8% and carbon dioxide concentrations rise to approximately 11%. Thus, insects cannot survive in the bag, and costly and potentially hazardous fumigation is unnecessary.

As with most synthetic materials, rodents can gnaw through PVC liners. However, the design of the containers and the way the material lies over the grain provide slippery surfaces that make it extremely difficult for rodents to make an incision with their teeth.

Two basic designs are available: a circular silo for bulk storage of unbagged grains, and a cubical container for storage of bagged grains. The silos are made in sizes from 50 to 1,000 metric tons, while the storage cubes are normally produced in sizes corresponding to truck bed cargo loads (10 to 50 tons).

The designs enable the containers to be used in various ways throughout the logistics system.

Some common uses of the silos include:

1. Auxiliary dockside storage. Large 500-1,000 ton silos can be used to provide temporary bulk storage at ports when inland transport cannot clear the food from the wharves promptly. With these units, costly port congestion can be relieved and spoilage of food on the wharves can be prevented.

2. Overflow storage at regional logistics bases. Silos can be used to provide additional storage for unbagged grains at regional food storage depots or distribution centers. In order to relieve port congestion and bagging delays, bulk grains can be moved inland on lorries, transferred to storage silos, and then bagged at a regional depot or distribution center.

3. Storage of locally-procured grains. In camps or settlements where local procurement of supplies is undertaken or where the refugees produce a portion of their food needs, the silos can be use to store and protect the grain. (They were originally designed to improve village grain storage and to reduce losses.) Since the silos are hermetically-sealed, losses from moisture, insects and rodents are minimized.

Storage cubes may be used for:

1. Temporary dockside storage of bagged grains. Cubes can provide temporary safe, weatherproof storage space for bagged grains at overcrowded wharves until the food can be transported inland. They can be obtained in sizes corresponding to the loads carried by lorries, to facilitate logistical scheduling and loading.

2. Temporary storage at forward warehouses or in refugee camps. The cubes can provide additional safe storage for bagged grains until they can be distributed or placed in conventional warehouses.

3. Point storage for cross-line or cross-border logistics. Cubes can be used for staging food into remote areas where conventional storage facilities are not available. Food can be off-loaded directly into the cubes which remain sealed until it is needed.

Grain-Milling

In most cases, grains should be transported in an unmilled state, as milling greatly decreases its shelf-life (by as much as 90% for some grains). Thus, it is important to decide at what point in the system grains will be milled. The two most common places are the port of entry and the refugee camps. As a general rule, it is best to mill grains in the camps or settlements, or to provide the equipment needed for the refugees to mill grains themselves. This reduces losses, speeds delivery and, for some grains, ensures that a greater portion of the nutrients is available for use.

It is important that some milling facilities be provided; if they are not, refugees will almost certainly trade a portion of their food to local entrepreneurs in order to obtain that service. This can result in substantial food losses. Mozambican refugees in Zimbabwe once surrendered 25% of their grains to local millers. Such a loss can drastically affect nutritional status in an emergency situation.

Cold Storage and Cold Chain Facilities

If vaccines are required for an immunization program, it is necessary to establish a "cold chain". Cold chain logistics is a special branch of emergency logistics and one that is almost always problematic. Some vaccines must be maintained within a specific temperature range from the time they are produced until the time they are injected into a patient. Anytime the temperature goes above or below that range, the vaccines can be damaged and lose their effectiveness. In order to establish a cold chain, certain types of equipment and facilities are required. These include:

1. Cold storage rooms at national or regional warehouses;

2. Sealed cold boxes for transporting the vaccines; and

3. Self-powered refrigerators or vaccine bins to store vaccines in the camps.

The most common "break" in a cold chain occurs when vaccines are shipped or stored in containers used also for food and beverages for relief workers. As people open and close the containers to retrieve refreshments, temperatures inside drop below the critical levels and the

vaccines are damaged. It is important that all facilities used to store vaccines be totally dedicated to that purpose.

The World Health Organization (WHO) provides current lists of suppliers of cold chain equipment and approved cold boxes for use in emergencies. These can be obtained from:

World Health Organization
20 Avenue Appia
1211 Geneva 27, Switzerland

Forward Logistics Bases

In an emergency operation, it is often necessary to set up new logistics bases in order to simplify supply operations in the forward areas. These bases can usually be established quickly, especially if existing buildings are available for use as warehouses. If suitable buildings cannot be found, storage cubes may be used until prefab warehouses are erected.

The minimal requirements for a forward base are:

1. Adequate warehouses;
2. Storage cubes or tarpaulins to protect stockpiles;
3. Fuel depot;
4. Vehicle workshop; and
5. Radio, telephone or telex communications.

The site for the base is chosen according to the type(s) of transport delivering and forwarding supplies. Usually a railhead or major road junction is a good location. The most important factor, however, is the amount of time required to deliver goods to the principal places of need in the forward area. In other words, the decision should be made not according to distance alone (the site physically closest to the areas to be served) but rather according to the actual amount of time it takes to travel that distance (the site with the best access to those areas).

A checklist of equipment and facilities for a forward logistics base is found in the Appendix to this paper.

TRANSPORT

As mentioned earlier, transport is the most expensive part of a relief operation. Thus, it is important to select the most appropriate form of transport for specific commodities.

Cargo Factors

The first consideration about a cargo is its weight. Weight is the primary limiting factor in all forms of transport. The heavier a commodity, the more expensive it is to transport and the more rugged (and generally, slower) the form of transport.

The second consideration is volume. Items that are low in weight but large in volume should usually receive a lower priority for transport. For example, plastic jerrycans are often in great demand in a relief operation. They are very lightweight — a thousand weigh only one ton — yet the volume of a jerrycan is such that about thirty take up one cubic meter of space. Therefore, in a transport plane the size of a C-130, it is only possible to bring approximately 1,000 jerrycans cans per flight. Since the jerrycans only cost about $5.00 each, shipping them by air (which could cost up to $100,000 for an international flight) does not make much sense.

Most logistics planners use a rule of thumb known as "cubing-out" to determine the most appropriate type of transport, i.e., striking the right balance between the volume and the weight of an item. Nowhere is this more important than in choosing cargoes to transport by air.

Transport Efficiencies

Ships/barges are the most cost-efficient means of transport but are usually the slowest. Aircraft are the least cost-efficient.

Shipping by rail over long distances is usually more cost-efficient than using lorries; the longer the distance, the more efficient.

While railways are more cost-efficient than lorries, and can sometimes reach areas in the rainy season that lorries cannot, railways are also more problematic in most Third World countries. In an emergency when timeliness is crucial, it may be more advantageous to ship by lorry than by rail. If one truck breaks down, there are still others that are likely to get through; but if one locomotive breaks down, 20 railway carriages can be stopped indefinitely.

In very remote (especially mountainous) areas, pack animals may often be more practical than trucks and other forms of transport.

Criteria for Selecting Vehicles

Important considerations when selecting vehicles include:

1. The distance to be traveled;
2. The terrain;
3. Road conditions;
4. Whether or not streams must be forded;
5. Load-carrying capacity of bridges en route;
6. Fuel efficiency; and
7. Compatibility of the vehicle with in-country maintenance and parts availability.

Determining Fleet Size

In determining the number of vehicles that must be employed for a particular mission, it is important to consider:

1. Time en route, and turn-around times;
2. Load-carrying capacity of the vehicles being used; and
3. Total tonnage needed to serve the target population.

Logistics Staff

Successful implementation depends on a good logistics staff. Most logistics operations are understaffed. A good system requires many people including a traffic director, procurement coordinator, transport coordinator, fuel coordinator, forward logistics officer, inventory control officers, accountants, warehouse staff, procurement officer, and maintenance officers. If not enough qualified people are used, control will be lost (and so will some of the commodities).

Equipment

Equipment that is critical for a relief logistics operation includes telecommunications, control forms (these should be ready before an operation starts), forklifts (special forklifts are necessary to unload planes), pallets to store and stack supplies, and spare parts for vehicles.

Air Transport

With the advent of large military cargo aircraft and large wide-body "jumbo jets", it has become commonplace for relief organizations to ship cargoes by air in the early stages of an emergency. For the most part, this does not make much sense since many of these shipments consist of items available locally or for which local substitutes could be found. With basic health programs, such as UNICEF's Expanded Program of Immunization (EPI), even the necessity of sending vaccines is greatly diminished since adequate stockpiles have been developed in most countries.

Air transport is both costly and, ultimately, of little sustainable impact. Even the largest jet transports, such as the Boeing 747 and Lockheed C-5 Galaxy, have negligible cargo-carrying capacity when compared to other forms of transport. The C-130 Hercules and the Antonov An-28, the most popular transports used in relief operations, can only carry a maximum of about twenty tons of food; that is equivalent to the capacity of one medium-sized lorry without a trailer. Over a typical flight of 1000 kilometers, the C-130 will burn approximately ten tons of fuel. At an average cost of $1,000 per ton, it will cost about $10,000 in fuel alone to deliver the supplies. Compare this to a shipping cost of $50 per ton by sea, or $25 per ton by lorry, and it is clear that air shipments make little sense unless the cargo is truly needed for immediate lifesaving.

Despite the costs, there are often tremendous pressures on relief agencies to fly in supplies for an emergency. Donor governments often make military transport available to humanitarian organizations at little or no cost. In these circumstances, the following principles may be followed:

1. Use of Aircraft. In first-stage logistics:

   (a) Use the largest plane available. Ideal civilian aircraft are the Boeing 747, DC-10, L-1011, DC-8F or Boeing 707; military

aircraft include the C-5 and C-141 transports. Avoid the smaller tactical transports like the C-130 or C-160 Transall for long international flights.

(b) Land as close as possible to the theater of operations.

(c) Ship only items of verified high priority (such as measles vaccines, etc.) or equipment that will facilitate operations (radios, light vehicles, prefabricated warehouses, etc.).

(d) If foods must be shipped, choose those that will provide the highest amount of calories and energy per weight. Avoid sending basic grains.

In second-stage logistics, use aircraft only when all other means have failed. If planes must be used, the following principles may apply:

(a) Generally, the shorter the distance, the more practical the airlift (the aircraft will need to carry less fuel and therefore can carry a greater cargo load).

(b) Avoid the use of helicopters. They are very costly to operate and have a very low carrying-capacity. Helicopters should only be used to stage supplies over very short areas and into remote or isolated sites.

(c) In second-stage logistics, the C-130, the French-German C-160 Transall, and smaller aircraft are more practical since the flights are over shorter distances, less fuel is required and more cargo can be carried. Planes like the C-130 were originally designed as tactical transports and to land on relatively short, unimproved strips.

In summary, if someone else is paying for the aircraft, go ahead and use them; but remember that it will still be necessary to use trucks at both ends of the flight!

2. Ground support for forward air operations. If it becomes necessary to use small or medium-sized planes to deliver priority supplies to remote sites, the following factors must be considered:

(a) Fuel. If the flights are over a range of 500 kilometers, it will probably be necessary to provide fuel at the landing strip in order to permit the transports to carry a full load on every trip. The type of fuel required depends on the type of plane used. Turbo-prop aircraft use jet fuel (Jet A-1 is the standard), while piston-driven aircraft use 100 octane avgas.

Turbine engines burn more fuel per hour than piston engines. Although turbine fuel is cheaper than avgas, it is necessary to have a larger stockpile of fuel available when aircraft with turbine engines are engaged.

(b) Fueling systems. In remote areas, fuel is normally stored either in barrels or rubberized fuel bladders. A pump and hose must be available for fueling the aircraft and must meet certain specifications. The normal rotary pumps used for pumping diesel or petrol into automobiles cannot be used for aircraft since they leave small metal shavings that can damage aircraft engines. Aircraft pumps and hoses have in-line filters. The nozzles have different sizes, depending on the type of fuel being dispensed. Under no circumstances should a pump that has been used for jet fuel then be used for dispensing avgas; even a small residue of jet fuel can contaminate avgas and cause a piston engine to miss.

(c) Defueling and fuel transfers. An expedient way of fueling when using both large transports and smaller utility aircraft is to either transfer fuel directly from the transport to the utility aircraft or defuel the transport into barrels or bladders at the intermediate strip. A recent example from Sudan illustrates how this works. In order to deliver relief supplies to Abeyi, a small town on the edge of the conflict zone in southern Sudan, relief supplies were ferried from Khartoum to an intermediate strip in Kadugli by C-130. They were then transferred to two smaller Twin Otters and flown to

Abeyi which only had a short 2,000-foot strip. To provide fuel for the two smaller airplanes, each time the C-130 landed, it de-fueled approximately one and a half tons of fuel into portable bladders which were then used to fuel the Twin Otters between their trips. Each day the C-130, carrying 20 tons of supplies, made one trip while the Twin Otters, which carried 2 tons each, made five trips per day. The same type of staging and de-fueling can be used to fuel remote helicopter operations.

If all the aircraft in the operation use the same type of fuel, tankering and de-fueling operations are usually more practical than staging fuel in barrels or bladders since the containers take up space in the cargo bay that could be used for supplies while de-fueling uses the aircraft's internal fuel tanks.

OPERATIONAL LESSONS AND SUGGESTIONS

Problems to Expect

Certain problems tend to occur frequently in a logistics operation. The most common are listed below.

1. Problems in Stage 1:

   (a) Procurement delays. These delays are usually a result of bidding procedures, confusion about specifications, or lack of clarity in field requests;

   (b) Donor pressures to accept substitutes; and

   (c) Acquisition of materials that were not requested and are unsuitable for the local situation, climate or terrain.

2. Problems in Stage 2:

   (a) Customs delays (paperwork, clearances, etc.);

   (b) Congestion at the port of arrival;

(c) Inland transport delays;

(d) Theft and pilferage;

(e) Losses due to improper storage or inadequate protection of the commodities while in storage. (The rations for a quarter of a million people were destroyed by one rainstorm in Ethiopia in 1985);

(f) Materials handling delays (e.g., off-loading of bulk grains, bagging operations at the port, etc.); and

(g) Losses from lack of insurance coverage.

3. Problems in Stage 3:

(a) Inadequate storage facilities at the destination;
(b) Inadequate means of protecting supplies while in storage;
(c) Lack of suitable milling equipment;
(d) Theft and pilferage; and
(e) Problems with registration/disbursement procedures.

Selecting a Logistics Agency

Often, the greatest problem in emergency logistics is selection of a suitable agency to operate the system. There are several options that can be taken:

1. Hiring a private firm;
2. Designating an NGO; or
3. Selecting a specialized U.N. agency (e.g., the ILO).

As a general rule, the agencies best suited for the role are those NGOs with experience in managing large-scale food aid programs, especially the US PL-480 Title I and II programs. These agencies already have expertise and personnel familiar with food logistics systems, and in many countries they already have a logistics system set up. Smaller development agencies usually do a marginal job in managing logistics programs.

Operational Hints

1. Always have adequate buffer stocks of supplies on hand to cover the times when logistics operations are not able to keep up with demand and unanticipated emergencies. Plan for an oversupply of 20-50% in an emergency.

2. Buy locally. Local purchase is an important and under-used resource. Wherever available, locally-purchased supplies can provide significant advantages including:

   (a) Saving time;
   (b) Saving money;
   (c) Bridging gaps until other supplies arrive;
   (d) Providing a buffer against supply irregularities; and
   (e) Stimulating the local economy.

3. Simplify the system. The objective is to reduce the number of stops and transfers in the system. This speeds up the operation and reduces theft. Even if simplification increases operational costs, it will eventually reduce total costs.

4. Consolidate facilities to avoid unnecessary loading and unloading or extra staffing.

5. Unify the logistics system. For example, where there are several organizations simultaneously ordering and distributing food in a large operation, unify purchasing and shipping procedures.

6. Create redundancy in transport. If the operation depends on a railway system, for example, the loss of one bridge can halt an entire operation. It is necessary to have alternate methods to deliver supplies, i.e., a back-up system.

7. Define the area of operation. The UNHCR Branch Office is likely to be in the capital, but the operation is likely to be in a remote area. The traffic director should be located in the area of operation, i.e., where the key commodities are located. The area of operation generally extends from the port of entry to the

refugee camps and includes all the communications and transport facilities inside that area.

8. Standardize equipment, especially trucks. This is difficult when a donor wants to provide trucks from its own country, but it is extremely important to standardize vehicles.

9. Make small, manageable shipments to the camps. Shipments should be of a size that can be controlled and not consumed by the refugees too rapidly.

10. Standardize and minimize supplies. A key concept in logistics management is to standardize the types of supplies and equipment being used and to keep the number of articles used in a system to an absolute minimum. Usually, the first thing a logistics consultant will do is reduce the number of supplies in the system until the logistics management controls are in place.

Captive Contractors

One of the major problems is keeping the cost of transport at acceptable levels. Often, local contractors raise prices to unacceptable levels when they know that an emergency is in progress and that a relief organization has few other options for delivering commodities.

To control transport prices, the relief agency has two options:

1. Purchasing a fleet of vehicles and setting up an independent transport operation. This is usually a costly choice and requires that the agency manage and maintain the trucking fleet.

2. Purchasing trucks and then re-selling them to local operators on a work-equity basis. This approach, known as "captive contracting", still requires an investment in the vehicles but places the burden of maintenance on the purchaser/operator. These programs are usually quite popular, and the trucks can be amortized over a period of several years. In return for work-equity agreements, the purchaser agrees to provide transport services at fixed prices for a specified period of time. An added benefit to captive contracting is that the vehicles are usually maintained better than if they are operated by the relief

agency, since the prospective owners have a vested interest in ensuring that the vehicles are properly maintained.

Rules of Thumb for Logistics Operations

1. Use trucks for distances under 500 km., rail for longer distances.

2. Don't build roads for food supplies; instead build up buffer stocks. The only time to build roads for a transport system is when you are moving water.

3. Mill grains in the camps or settlements. This will prolong the life of the grain and will eliminate the need for a complex unloading, bagging and reloading operation farther up the logistics chain.

4. The need to transport supplies by air will be in the early stages of an operation, not later on.

5. If a portion of the food supplies must be purchased overseas, buy food for the general ration from overseas and supplemental food from internal sources (if fresh foods of good quality are available).

6. In Africa, it is generally necessary to import foods for a large-scale operation. In the rest of the world, food can generally be purchased locally.

APPENDIX: CHECKLIST OF EQUIPMENT & FACILITIES FOR FORWARD LOGISTICS BASE

1. Site Preparation
   - Grading and Leveling
   - Road Improvements
     - Surfacing
     - Culverts
     - Drainage

2. Office Buildings
   - Permanent
   - Prefab, Metal
   - Tent

3. Office Equipment
   - Desks
   - Chairs
   - Photocopier
   - File Cabinet
   - Bookshelves
   - Expendable Equipment
   - Office Supplies

4. Warehousing
   - Permanent
   - Prefab, Metal 1000 MT
   - Prefab, Metal 500 MT
   - Prefab, Metal ?
   - Prefab, Plastic 1000 MT
   - Prefab, Plastic 500 MT
   - Prefab, Plastic ?

5. Storage Equipment
   - Silos 1000 MT
   - Silos 250 MT
   - Silos 100 MT
   - Storage Cubes 100 MT
   - Storage Cubes 50 MT
   - Storage Cubes 20 MT
   - Storage Cubes 5 MT
   - Carts/trolleys
   - Forklift
   - Storage Shelves
   - Plastic Sheeting
   - Other _____

6. Radio Room
   - Permanent
   - Prefab, Metal
   - Tent

7. Communications Equipment
   - Radio (SSB)
   - Telephone
   - Intercom
   - Telex
   - FAX
   - Walkie-Talkies

8. Workshop
   - Permanent
   - Prefab, Metal
   - Prefab, Plastic

9. Workshop Equipment
   _____
   _____
   _____
   _____

10. Other Work Buildings
    Permanent
    Prefab, Metal
    Plastic

11. Other Work Equipment
    _____
    _____
    _____
    _____

12. Fuel Depot
    Storage Tank(s)
    Pumps, Hoses, Fittings
    Defueling Stand
    Barrel Storage Area
    Fire-fighting Equipment

13. Airfield/Helipad
    Strip Grading/Leveling
    Fueling Station
        Bladders
        Storage Tank
        Pump (hand)
        Pump (motorized)
    Radio Beacon
    Landing Lights
    VHF Radio

14. Security Facilities
    Guardhouse
    Fencing
    Gates

15. Electrical Systems
    Generator
    Wiring
    Poles
    Light Standards
    Fuel for Generator

16. Water System
    Deep Well (borehole)
    Submersible Pump
    Storage Tank
    Shallow Well
    Hand Pump
    Pipes
    Outlets
    Taps

17. Sanitation System
    Toilets
    Showers
    Incinerator

18. Housing
    Permanent
    Prefab
    Tent

19. Residential Furnishings
    Beds
    Tables
    Chairs
    Personal Storage
    Other

20. Mess Hall/Kitchen
    Refrigerator
    Stove
    Wash Rack
    Gas
    Utensils
    Pots and Pans
    Tables
    Chairs
    Other _____

21. Misc. Facilities
    _____
    _____
    _____
    _____