Chapter 2

Logistics Theory

“A real knowledge of supply and movement factors must be the basis of every leader’s plan; only then can he know how and when to take risks with those factors, and battles are won by taking risks.”

—Napoleon

“. . . it [the description of logistics] precludes that view of logistics which sees it only as a game for the G-4s and the mathematicians—a game to be settled with loading tables, slide rules and transportation schedules.

Logistics becomes, in fact, the very core of generalship . . . to get military forces into a theater of war in superior strength and husband that strength until they shall prevail.”

—S. L. A. Marshall
Having reached a common understanding of the nature of logistics, we turn to an examination of the theory of logistics. This examination will provide insight into key aspects of this function that, in turn, will serve as the basis for creating effective logistics.

THE EVOLUTION OF LOGISTICS

Logistics is as old as organized warfare and, like war itself, has evolved considerably over time. Some changes, such as the introduction of new methods of transportation or new ways of obtaining supplies, have influenced logistics directly. Other changes have been indirect, the byproducts of the use of new techniques and weapons. Changes in warfare often cause momentous and unexpected changes in the conduct of the logistics function. An understanding of the evolution of logistics provides key insights into the changes and challenges facing logistics in the future.

It is possible to distinguish several general periods within the evolution of logistics. Premodern armies had relatively simple logistics needs. Warriors brought their own weapons to the field and provided their own means of mobility, their own feet or a horse. The primary logistics concern was feeding the army; this was generally done through foraging or local procurement. With the emergence of modern armies in the 17th
and 18th centuries came the initial development of dedicated logistics systems and services. The introduction of cannon and firearms created new requirements for supply and transportation services. The makeup of these armies and the nature of warfare during this period generally discouraged the use of foraging or pillage as a means of supplying the army. As a result, forces had to be largely self-sufficient. This led to the creation of a logistics system consisting of fixed supply points called magazines and large, unwieldy baggage trains. The logistics system required to sustain an army at once became both a key limiting factor and a major vulnerability. The need to establish magazines in advance of any campaign restricted strategic mobility, while the requirement to transport large quantities of provisions and other supplies inhibited tactical mobility. In recognition of the importance of the logistics system to these armies, attacks on magazines, baggage trains, and lines of communications became significant actions of war for the first time.⁴

The industrial revolution radically changed warfare and logistics. One of the major changes was the impact upon the scale of warfare. Weapons, ammunition, machinery, uniforms, equipment, and even foodstuffs could be produced at a greater scale than ever before. In addition, mechanization of production significantly reduced the labor requirement, freeing up manpower for service in mass conscript armies. A second major change brought on by the industrial revolution was the increase in lethality afforded by the application of new
technologies in weaponry coupled with the ability to mass-produce both weapons and ammunition. Finally, developments in transportation such as the railroad and steamship and later the airplane and automobile significantly enhanced the strategic, operational, and tactical mobility of armies and their support systems. As a result of these innovations, military forces grew larger in size, could deliver unprecedented firepower, and were increasingly capable of rapid movement.

The industrial revolution transformed logistics from an important aspect of warfare to an essential prerequisite for the conduct of war. Mass armies consumed vast quantities of food, ammunition, and other supplies. Modern weapons and equipment created the need for new services such as maintenance and salvage as well as for new commodities like fuel and spare parts. The management of rail and shipping networks became crucial to delivering forces to the battlefield and sustaining those forces once they arrived. Logistics considerations came to dominate the strategic and operational levels of war. The ability of a nation to translate industrial capability into military resources and its capacity to sustain the military effort became crucial factors in determining whether to go to war. Decisions on where and when to initiate campaigns were in large part resource decisions. Major operations could not be conducted until the necessary buildup of troops and supplies had been effected by the logistics system.

The influence of these changes is clearly seen during World War II. The Japanese attack on Pearl Harbor was precipitated by the perceived threat to Japan’s access to strategic resources.
The Allied grand strategy of “Europe First” was based in large part on the initial inability of the logistics system to support simultaneous offensives in both theaters. Major operations such as the invasions of Normandy and the Philippines were preceded by months of logistic stockpiling.

The next major step in the evolution of logistics is only now beginning to emerge. The information age will have significant effects on all aspects of warfare, and logistics is no exception. Many of these effects will have a positive influence on logistics. The development of more capable weapons and equipment will likely result in a decrease in the size of units and a reduction in the quantity of equipment. This result should reduce the volume of logistic support needed. Modern electronics and information systems are making possible major advances in both equipment design and maintenance management. Sustainability is now considered a critical factor in the development and procurement of new weapons and systems; acquisition of efficient and maintainable equipment will also reduce the logistic burden. Improvements in information processing and communications are already permitting better management of resources than ever before. Better management in turn leads to greater responsiveness and efficiency in the provision of logistic support. The evolution of open information networks and architectures will allow the exchange of data and processes with the commercial sector, enabling us to draw upon resources and capabilities outside the military logistics system.
At the same time, the information age will also present significant new challenges for logistics. While the prevailing characteristics of the information age are variety and rapid change, we believe that the basic nature of warfare will remain much the same as it has always been: a violent collision of opposing wills driven by complexity, friction, and chance. However, the battlespace of tomorrow could be significantly different than the one we fight in today.

One of the emerging trends is the expanding battlespace. Improvements in mobility are permitting forces to move more quickly over longer distances than ever before. At the same time, the increasing lethality and reach of weapons enables the engagement of targets at greater ranges than ever before, compelling military units to disperse even farther in order to survive. This dispersal, in turn, creates a nonlinear array of forces with considerable separation between units and an intermixing of friendly and enemy forces to a greater extent than ever before. The battlespace of the future could also become relatively empty with much smaller forces possessing an increased destructive potential spread over greater intervals. Greater distances between combat forces and their supporting elements, as well as between the belligerents, will require our logisticians to extend their reach. Knowing how, where, and to what extent forces will be employed throughout the battlespace, anticipating and planning for their sustainment needs, and providing the mobility necessary to deliver the required support will be a considerable challenge in the extended battlespace of the future.
A second emerging trend is the *continuing compression of reaction times during operations*. Advanced weapons and information systems provide the capacity to locate the enemy, concentrate forces, and engage targets more rapidly than ever before. The notion of generating ever-increasing speed over time, or tempo, takes on greater relevance as we attempt to accelerate our information processing and decisionmaking to outpace that of our adversary’s. In the battlespace of the future, operations will be spatially dispersed, but observation, decisionmaking, and reaction intervals will become shorter and shorter. Lack of time presents a particular challenge to logistics, since logistics relies in large measure upon anticipation and planning to overcome the physical constraints posed by the mass of its commodities and the distances over which they must be delivered. The resourcefulness and ingenuity of logisticians will be tested by the need to provide ever-more-responsive support to keep pace with faster operating tempos.

Another trend in future operations has been emerging for some time: the requirement for our forces to carry out a *wide variety of missions, many of which lie outside the traditional definitions of war or combat*. Forces that are primarily configured for operations in war are increasingly being required to conduct military operations other than war with little or no advance notice. Circumstances may require simultaneous execution of both types of operations or a transition from one type to the other as the nature of the military action changes. While the basic principles by which we conduct combat and military operations other than war are similar, the subtleties in
application may be extensive. In efforts such as humanitarian assistance and disaster relief, logistics functions assume a preeminent role. These efforts are normally conducted as joint, multinational, and, increasingly, interagency operations. Interoperability of our logistics capabilities with those of joint forces and agencies will be critical. New and unique logistics capabilities will be required, as commanders must consider not only how to support their own forces but also those of other Services, allies, participating nongovernmental organizations, and civilian populations. Since we cannot predict the time, location, or characteristics of the next contingency operation, our logistics system must be sufficiently flexible and adaptable to function across the range of military operations, in major wars as well as military operations other than war.

A fourth trend is the expanding use of advanced technology by military forces. In many cases, the adoption of new technology results in the substitution of quality for quantity. The implication for logistics is that while the overall size of the inventory goes down, the value and relative importance of each individual asset goes up. The need for maintaining individual aircraft is more critical when there are 12 per squadron instead of 20. The need for effective management of assets is more apparent when there are a dozen precision-guided munitions available instead of 100 dumb bombs. The complexity of the tasks involved in supporting a high technology force also increases as the sophistication of its weapons and equipment increases.
A final trend is the ever-increasing integration of military logistics with the commercial world. Many logistics concepts perfected in the private sector are currently being adopted by the military and, in certain cases, major elements of our logistics capacity are under consideration for outsourcing. While efficiencies may be gained through this integration, we must also exercise some caution. We cannot forget the unique requirements imposed upon military logistics by the need to support combat operations. Consider our reliance on commercial transportation for strategic mobility. Is our own commercial air, overland, and sealift infrastructure able to respond to singularly military needs? Will an increasingly international shipping industry, where the majority of ships are no longer owned by American companies, be amenable to mobilization under tense political circumstances? What effect might this dependence have on our ability to move and sustain our forces? Logistics will have to consider these difficult questions and provide practical solutions to ensure commanders receive the support necessary to conduct and sustain operations.

The evolution of logistics provides us with the perspective from which to examine the remaining aspects of logistics theory. It shows the importance of logistics to warfare throughout history and demonstrates that the role and impact of logistics have increased over time. An understanding of the evolution of logistics also gives us some insight into the challenges facing logistics in the future.
THE LOGISTICS PROCESS

Using the evolution of logistics as a foundation, our study of logistics proceeds with a generic description of the logistics process. If logistics is the bridge which connects the resource capability of a nation’s economy to its fighting forces, then the elements of the logistics process are the means by which the transition is made. The elements of the process describe how resources are used to equip, transport, and maintain our forces. The logistics process at any level consists of four steps: acquisition, distribution, sustainment, and disposition. (See figure 2, page 46.)

Acquisition is the procurement of weapons, equipment, facilities, ordnance, and commodities such as food, clothing, fuel, and repair parts. Though usually a strategic responsibility, acquisition can be accomplished at the operational and tactical levels through purchasing or securing locally available material and supplies.

Distribution is the means by which logistic support—matériel, support services, and personnel—get to the operational commander. The means employed is predicated upon what is being moved, its place of origin, lift assets available, and urgency assigned. Distribution is a diverse process, incorporating not only transportation means but encompassing an entire distribution system composed of bases and procedures, such as inventory control methods.
Sustainment is the provision of resources necessary to support operations until the mission is completed. Sustainment facilitates uninterrupted operations through means of adequate logistic support. It is accomplished through supply systems, maintenance, and other services which ensure continuing support through the duration of an operation.

Figure 2. Logistics process.

Sustainment is the provision of resources necessary to support operations until the mission is completed. Sustainment facilitates uninterrupted operations through means of adequate logistic support. It is accomplished through supply systems, maintenance, and other services which ensure continuing support through the duration of an operation.
Disposition is the consumption and/or return and disposal of weapons, equipment, and supplies. The logistics process is complete when supplies and services are used by the supported unit or they are returned to the supporting unit for redistribution, repair, salvage, or disposal. Disposition makes a significant contribution to our ability to sustain forces over the long term and is an essential part of our fiscal and environmental responsibilities.

The logistics process provides the framework for the conduct of all logistic activities. It shapes the design of our logistics system as a whole and underpins the logistic plans generated to support specific operations. Commanders must plan for and supervise the process of acquisition, distribution, sustainment, and disposition to ensure that logistics supports, not inhibits, their operational designs.

**Functional Areas of Logistics**

Because logistics encompasses a wide range of support activities, logistic elements are normally broken down into groupings of six related activities known as functional areas. These six functional areas are supply, maintenance, transportation, general engineering, health services, and other services which include legal, exchange, food, disbursing, postal, billeting, religious, mortuary, and morale and recreation services. Logistics systems and plans are usually developed for each
functional area, and logisticians commonly discuss support concepts in terms of these “commodity areas.” However, while each logistics function is essential in and of itself, all functions must be integrated into the overall logistics system to ensure full support of the operating forces. Developing maintenance plans without regard to their impact on supply and transportation is foolhardy. Health services support planning is impossible without considering supply, transportation, maintenance, and general engineering services.

**LEVELS OF LOGISTICS**

Logistics encompasses a wide variety of activities that serve the needs of organizations as small as a fire team and as large as a coalition of nations at war. While the logistics process and functions cut across the levels of war, the nature of logistic activities conducted at the strategic level are very different from those carried out at the tactical level. For this reason, it is important to consider levels of logistics, just as we discuss levels of war.

Levels of logistics correspond directly to the strategic, operational, and tactical levels of war. At first glance, the differences between the levels of logistics appear to be largely a matter of scale. Logistics at the strategic level of war (strategic logistics) involves greater distances and greater amounts of
matériel than logistics at the operational level of war (opera-
tional logistics). Operational logistics, in turn, involves greater
distances and amounts of matériel than tactical logistics. How-
ever, it is crucial to understand that the focus of logistic activi-
ties is significantly different at each of the levels of logistics. 
Effective support of military evolutions depends upon the suc-
cessful conduct and integration of logistic activities at all 
three levels.

Strategic logistics encompasses the nation’s ability to raise, 
deploy, and sustain operating forces in the execution of the na-
tional military strategy. It is at this level that weapons and 
equipment are designed and purchased, recruiting programs 
are initiated, and permanent bases are developed and main-
tained. Strategic logistics involves the management of air and 
sealift for strategic mobility and the sustainment of forces in 
distant theaters of operations. When long-term military opera-
tions are undertaken, strategic logistics requires extensive in-
teraction with the nation’s industrial base to ensure timely 
support of the military effort.

Strategic logistics should not be viewed as a function ac-
complished by someone else, somewhere else, with little or no 
impact on tactical logistics or the conduct of operations. Logis-
tic investment made at this level determines the type and extent 
of support to the operational forces not only in numbers of per-
sonnel and quantity of food and ammunition available but also 
the quality, effectiveness, and supportability of the weapons 
and equipment we have to use.
Operational logistics addresses sustainment within a military theater of operations. It connects the logistic efforts of the strategic level with those of the tactical level. Taking resources provided from the strategic level, it makes them available in sufficient quantities to the tactical commander to support the concept of operations. Operational logistics involves those support activities required to sustain campaigns and major operations. It normally encompasses three tasks: providing resources to the tactical commanders, procuring resources not provided by strategic logistics, and managing the resources necessary to sustain the campaign in accordance with the intent of the operational-level commander.

Providing resources to the tactical commander is accomplished through the development of intermediate and forward support bases, the maintenance and employment of an effective transportation system, and support of the arrival and assembly of personnel and equipment as they reach the area of operations. Operational-level procurement involves coordination with joint support agencies, contracting for host-nation support, or even the capture and salvage of resources from the enemy. Finally, managing resources entails both the apportioning of resources among tactical forces based on the campaign plan and the rationing of resources over time to ensure sustainment throughout the duration of the campaign. Successful management of logistics at the operational level requires a thorough understanding of the commander’s intent, the development of detailed and flexible logistic plans, and the maintenance of an effective command and control system.
Tactical logistics is concerned with sustaining forces in combat. It deals with the feeding, fueling, arming, and maintenance of troops and equipment. Tactical logistics involves the actual performance of the logistics functions of supply, maintenance, transportation, health services, general engineering, and other services with resources immediately or imminently available. Tactical logistics draws upon resources made available at the operational level and focuses on the provision of support within the force.

While the focus of this publication is largely on the tactical level of war, it is important to restate that successful tactical logistics is dependent upon a strategic and operational logistics foundation. Strategic logistics forms the foundation from which operational logistics enables and sustains tactical logistics. A logistics system must be able to transform resources provided at the strategic level into measurable and sustainable combat power at the tactical level. For this reason, it is crucial that the Marine Corps logistics system be capable of functioning at all three levels of logistics. (See figure 3, page 52.)

THE LOGISTICS SYSTEM

In order to perform the logistics function, a military organization must have a logistics system. A logistics system consists of personnel, organizations, equipment, facilities, training and education, and procedures which are integrated so as to
support the operating forces. A logistics system is tailored in size, structure, and procedures to support the mission, composition, and warfighting doctrine of its military force. Before discussing the particular makeup and characteristics of the Marine Corps logistics system, it is important to develop an understanding of logistics systems in general. All logistics systems have two fundamental elements: a distribution system,
made up of bases and distribution procedures, and command and control.

Distribution Systems
Distribution systems are made up of bases and procedures that are designed to process resources from the time they enter the military system at the strategic level until they are issued at the tactical level. In order to accomplish its objective, the logistics system must have a place from which to provide resources—a base—and a method—distribution procedures—for moving the required resources from the base to the tactical forces which need them. (See figure 4, page 54.)

Bases. Bases are an integral part of the distribution process. They form the foundation of the entire logistics system, providing the fixed points from which resources are acquired, maintained, and distributed. Bases perform several functions besides the obvious purpose of accumulating supplies for later use. Bases are a location for the provision of services, maintenance of equipment, and organization and redistribution of assets, and they often act as the transition point from one form of transport to another (such as from intertheater air or sealift to local rail or road transportation systems). Whether providing simple or diverse services, bases are the most tangible component of a distribution system. Their configuration may be as simple as the cache or as intricate as seabasing. Options available for bases include permanent bases, forward bases, seabasing, and prepositioning. (See figure 5.) The choice of a
particular type of basing depends primarily on the nature of the force and the area of operations. *The expeditionary nature of the Marine Corps normally requires the employment of a combination of basing options to support a particular operation.*

*Permanent Bases.* Permanent bases provide sustained support for large elements of the force. They are normally established within the boundaries of the nation or a close ally where they can be fully developed and protected. Military organizations whose primary responsibility is defense of their homeland normally rely primarily on permanent bases to provide virtually all

![Diagram](image-url)

**Figure 4. Distribution systems.**
logistic support. In contrast, U.S. forces maintain permanent bases within the continental United States and on the soil of U.S. allies to provide strategic- and operational-level logistic support; these bases also are the core for the development of a forward-deployed operational- and tactical-level logistic support network.

*Forward Bases.* The classic technique for overcoming the limits that logistics places on operations is the establishment of forward bases. Forward bases are facilities established within the...

*Figure 5. Logistics basing options.*
area of operations to provide operational- or tactical-level logistic support. Forward bases serve a number of purposes, the most important of which is to increase the responsiveness of the logistics system by moving the source of support as close as possible to the operating forces. Modern equipment and techniques make it possible for forward bases to provide almost every function of logistics, ranging from the performance of complex medical procedures through the overhaul of sophisticated weapons systems. Historically, almost all military forces have employed some type of forward base.

In determining where and when to establish a forward base, there is an inherent tension between the need for security and the desire to provide responsive support. Although absolute security is rarely achieved in war, forward bases should be reasonably secure from enemy action. In wars with well-established front lines, bases are usually located behind the zone where actual combat is taking place. In campaigns characterized by rapid movement, however, bases are sometimes established at times and places where their chief protection is the tempo of operations. Such was the case with Forward Operating Base Cobra established inside Iraq by the U.S. Army’s 101st Airborne Division to support initial air assault operations during Operation Desert Storm. The better protected a base is, the greater the odds that the people working there can focus their energies on the logistic effort. However, the advantages gained by providing a highly secure
environment must be weighed against the considerable benefits that come from locating bases as close as possible to the actual fighting. These benefits include the efficiency of transport and the speed with which the logistics system responds to the needs of the front.

A classic use of forward basing was illustrated by Grant’s 1864 campaign against Richmond. In order to increase the mobility of his marching columns, Grant reduced the rations carried by his soldiers from eight days to three. Each corps was stripped to march with only about one-half its usual supplies. Supplies were restocked from advance depots which had been staged along established rail and water routes. The result was a series of forward bases, positioned far enough ahead along Grant’s route of march to support his movement south to Richmond.6

Seabasing. Ships and boats have been used as forward bases in riverine operations, amphibious operations, and operations in the littoral areas. Seabased logistics is the managed provision of sustainment to units ashore from ships offshore. The advantages of this approach can be considerable. During the invasion of Okinawa in 1945, a 6,000-mile maritime supply line was used to support an invasion force of over 400 amphibious ships and almost 200,000 troops.7 In the disaster relief effort conducted by the 5th Marine Expeditionary Brigade after a typhoon devastated Bangladesh in 1991, Navy and Marine units
provided significant assistance to the host nation without the need to establish a presence ashore or draw resources from the already overburdened local infrastructure. Ships can serve both as a means of moving supplies into a theater of operations and as mobile warehouses for resupply within that theater. Certain kinds of ships can provide useful facilities, to include small hospitals, maintenance capabilities, freshwater condensers, living quarters, and galleys. Seabasing reduces the need to establish logistics facilities ashore, thereby reducing the footprint and vulnerability of the land-based portion of the force.

Seabasing is not without its drawbacks. The chief prerequisite to the use of ships as forward bases is friendly control of the surrounding water. If a forward base on land is properly laid out, it takes considerable enemy action to destroy it. A ship at sea, on the other hand, can be sunk by a single torpedo, antiship missile, or mine. The most recent example of this took place in the Falklands war of 1982, where a British ship serving both as an improvised aircraft carrier and as a depot for aviation supplies was sunk by a single Exocet missile. The movement of support between the seabase and shore is critical and must receive proper priority in the allocation of transportation assets. If ship-to-shore transportation assets are limited, the need to move combat forces may conflict with the need to move logistics resources ashore.

In the past, seabasing was appropriate only under limited circumstances. While it provided for greater economy, it often resulted in a loss of responsiveness due to time/distance
factors, difficulties in communications, and the effects of weather on ship-to-shore movement. Generally it provided little more logistics capability than supply, hospital assets, and limited maintenance facilities. Today, however, advances in amphibious shipping, aircraft, landing craft, and communications and information systems are rapidly improving the ability to perform seabased logistics. A seabased logistics system which employs these capabilities will often be able to provide logistic support with equal or greater flexibility and responsiveness than could be provided from forward land bases. This enhanced capability, coupled with the increasing requirement to reduce the dependence of our forces on all types of land bases, will result in greater emphasis on seabasing in the future.

*Prepositioning.* Prepositioning is a variation of forward basing. Prepositioning is the staging of equipment and supplies in a forward location for use by a force at some future time. One of the oldest and simplest forms of prepositioning is the cache, the technique of concealing a small quantity of supplies in a hidden location for later use. Today, military forces use prepositioning as a means of decreasing the time it takes to respond to a crisis by reducing the need to transport large quantities of supplies and equipment to the area of operations. Large countries preposition equipment near their borders for use by units or reserves stationed in the interior. Nations with commitments to an alliance may preposition stocks on the territory of their allies both as a sign of commitment as well as a means to increase responsiveness.
U.S. military forces in general and the Marine Corps in particular make extensive use of prepositioning. Forward-positioned equipment and supplies are intended to bridge the gap between the time a force’s initial supplies run out and the time that strategic resources begin to flow into the theater of operations. Prepositioned stocks may be stored ashore at permanent bases on the territory of allies or aboard military or commercial shipping. Included in these prepositioning programs are weapons and equipment to outfit combat formations, supplies, repair parts, and the transportation, medical, and maintenance equipment needed to provide basic sustainment to a deployed force.

The flexibility and responsiveness which prepositioning offers are illustrated by the employment of maritime prepositioning ships in support of recent operations. During the initial days of Operation Desert Shield, a Marine air-ground task force (MAGTF) of over 15,000 Marines was deployed a distance of 12,000 miles to link up with prepositioned equipment and supplies on board the ships of Maritime Prepositioning Squadron Two. Within 11 days, the 7th Marine Expeditionary Brigade was fully combat-capable, providing the first heavy forces for the defense of Saudi Arabia. The resources of the prepositioning ships were used to sustain the MAGTF as well as the forces of other Services and allies while full logistics capabilities were being established in theater. Maritime prepositioning ships have also demonstrated their utility in supporting military operations other than war, providing support to
humanitarian assistance operations in Somalia and disaster relief efforts in the Philippines.

We must consider a number of factors to determine which basing options to employ within a logistics system. The most important of these factors is the basic mission of the military force. A continental power will use a different type of basing scheme than a maritime power. A force primarily organized for territorial defense will place much less emphasis on forward basing or seabasing than military forces structured for expeditionary operations.

The second major factor is security. Bases must be protected. Protection is normally afforded by locating bases at safe distances from direct combat or by allocating sufficient forces for base defense. Permanent bases located deep in the rear area are generally more secure than forward bases, but the responsiveness of the support provided is also often greatly reduced. Employing forward bases in close proximity to the front increases responsiveness, but significant forces may be needed to defend these bases; forces used in base defense cannot be used for other operations. Seabasing offers increased security in many situations but at a potential cost of some degree of responsiveness.

The final factor is tempo. As a general rule, it takes far longer to amass supplies or establish maintenance resources at a base than it does to expend or use them. An extreme example is provided by the Gulf War. In that conflict, coalition forces
spent 6 months accumulating supplies at forward bases but exhaus
ted many items of supply in less than 100 hours of com-
battle. Because it is far easier to expend supplies and services
to accrue them, the maintenance of a high operational tempo will often depend on the speed with which forward bases
can be established. This requires the investment of resources:
having adequate goods and services, sufficient means to trans-
port them to the forward base, and skilled logisticians who can
effectively manage those assets. The choice of a basing scheme
can influence tempo. For example, prepositioning can generate
tempo by reducing the demand on strategic transportation as-
sets. At the same time, prepositioning can inhibit tempo if the
equipment and supplies are not prepositioned at the right
locations.

As a forward-deployed, expeditionary force-in-readiness,
the Marine Corps employs a combination of basing methods.
We use permanent bases to carry out strategic logistics func-
tions and to support the development of forward-deployed op-
erational- and tactical-level logistics capabilities. As a naval
force, the Marine Corps has always made extensive use of
seabasing. The Navy-Marine Corps team has pioneered inno-
vation in the conduct of logistics functions afloat. Examples in-
clude modern hospital ships, the aviation logistic support ship,
and the offshore petroleum distribution system. Seabasing will
become even more critical in the future since the characteristics
of future operating environments will require greater security
for forces ashore and less reliance on developed infrastructure
within the area of operations. At the same time, seabasing will become more attractive as emerging technologies increase our capabilities to do seabased logistics. Prepositioning has become an essential part of our logistics concept, allowing us to increase responsiveness and generate tempo at the strategic and operational levels. Finally, the Marine Corps uses forward basing once forces are established ashore. Some of these expeditionary bases are collocated with a beach, port, or airfield where they provide the necessary links to seabased resources. Others are positioned close to the front in order to provide responsive support to the operating forces.

**Procedures.** To provide logistics resources to the forces from the bases just described, the other major component of a distribution system is a set of procedures. Reduced to its simplest form, there are two types of procedures that can be employed to effect distribution. The first places almost total responsibility on the unit needing support. When a unit requires support of some type, it generates a request. The logistics system provides resources from the bases in response to the request. This type of procedure is known as “demand-pull” or simply “pull.” At the other extreme, it is possible to design a system that provides resources without any action on the part of the unit receiving support. Resources are delivered to the base and automatically allocated among the units supported by that base according to planned schedules and formulas. This method is referred to as “supply-push” or simply “push.”
The push concept uses calculations of anticipated logistics requirements to position or deliver resources where and when they are likely to be needed. While normally associated with supply, the push concept can be applied to most logistics functions. Medical facilities can be prepositioned based on projected casualty rates in certain sectors. Maintenance teams can be moved forward in anticipation of future requirements. Push logistics develops detailed plans for the provision of support and provides resources on some type of schedule. The push concept relieves the tactical commander of much of the burden to project logistics requirements and request the support; it provides regular and generally dependable support. On the other hand, because push logistics relies on anticipation and planning, the tactical commander may be overburdened by excess quantities of certain items while going short in others. The push concept requires accurate estimates for the tempo of operations and corresponding consumption rates. Underestimating results in shortages while overestimating results in unnecessary resources spread throughout the area of operations. In addition, pure push systems usually lack the flexibility to respond to the dynamic needs of combat.
In the pull method, the operating unit directly controls the orders for resupply as well as calls for engineering, maintenance, and other support services. The supported unit takes on greater responsibility for anticipating and defining requirements as well as ensuring that those requirements are submitted in time to arrive where and when required. The advantage is that the tactical commander receives only the support that is actually needed. This permits forces to enhance their mobility by carrying the minimum quantities of supplies or support assets. The benefit to the logistics system is greater efficiency through the reduction in the overall quantity of resources required. While pull systems may be more efficient, their effectiveness depends on the logistics system’s ability to successfully react to the extensive requirements that may be placed upon it. The success of the pull technique has greatly improved with enhanced communications and information management, as well as a more responsive distribution network. However, there will always be limits to the ability of any system to react to the uncertainties of war.

In war, consumption rates can be unpredictable, communications between the operating forces and the support infrastructure may be limited or unavailable, and delivery times may be uncertain. The dilemma for the commander is whether to rely on “push” support based on anticipated needs or on “pull” support as determined by user demand. Marine logistics
traditionally employs a combination of both methods. (See figure 6.) Initial sustainment is provided by the push method; strategic and operational agencies push most of the projected logistic support into the area of operations based on the anticipated level of operations. Tactical units receive routine support, such as resupply of food, water, and ammunition, on a standard schedule based on their consumption rates and employment. At the same time, units pull specific kinds of logistic

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**Figure 6. Push versus pull distribution.**
support, such as maintenance, engineering, and medical services, from task-organized combat service support units or detachments on an as-required basis.

A related aspect of distribution procedures is the method used to actually deliver the resources to the supported unit. There are two principal distribution methods. In supply point distribution, resources are staged at a base or other point and the supported unit comes to that base or point to obtain its supplies or services. The using unit is responsible for transportation to and from the supply point. The other method is unit distribution. In this method, the logistics system delivers supplies and services directly to the supported unit. The supporting logistics unit provides transportation to the supported unit.

Supply point distribution is more efficient for the logistics system but places a greater burden on the supported units. Unit distribution is generally more responsive to the needs of the operating forces but requires the dedication of significant transportation assets. While certain situations might require the use of one method over the other, the two distribution methods are normally used together to effect the delivery of resources.

Command and Control
The second component of the logistics system is command and control. The best distribution system in the world is useless without an effective means for using that system to take the necessary actions. Command and control is fundamental to all military activities. Command and control is the means by
which a commander recognizes what needs to be done and sees to it that appropriate actions are taken. In logistics, command and control helps the commander to recognize what support is needed and to see to it that the support reaches the units who need it.

Command and control of logistics capabilities links the distribution system to the planning and execution of operations. A critical task of logistics is to facilitate the effective use of limited resources to support operations. Command and control is the means to ensure this effective employment of resources. Logistics command and control aids the commander in accomplishing three essential tasks: anticipating future requirements, allocating resources, and dealing with uncertainty.

Planning is the component of command and control that provides the primary means of anticipating future requirements. Planning is crucial to all military activities, but it is essential to the effective conduct of logistics, given the quantity and variety of resources to be provided, the diverse nature of the logistics requirements to be satisfied, and the impact of time-distance factors on the provision of timely support. Logistics must stay one battle ahead of operations in order to support the commander’s intent and help shape the battle or campaign. Effective logistic planning identifies future requirements and designs solutions to satisfy those requirements. Logistic planning ensures that the necessary resources can reach the area of operations through force deployment planning and that all
operations can be adequately supported through *sustainment planning*.

Logistic planning benefits from the scientific nature of logistics. Since logistics deals in quantifiable resources and tangible factors, analytical methods, formulas, and calculations can help to develop logistic plans. In this respect, logistics has taken advantage of the increasing availability of modern communications and information systems. Information technology has enhanced the collection of usage data, the tracking of assets, and the processing of requirements, providing more detailed and accurate information upon which to base plans. At the same time, we recognize that there are limits to what can be quantified and that logistic plans and calculations are only as reliable as the operational assumptions upon which they are based.

While planning can aid us in anticipating requirements, we recognize that even the best supported forces will suffer shortages of supplies and services. This may be the result of poor planning, enemy action, an unanticipated shift in the character of an operation, or simply an unforeseen change in the fortunes of war. Whatever the cause for the shortage, command and control must provide the means for allocating limited resources in accordance with the requirements of the situation. Most logistics systems employ a system of priorities to help resolve this dilemma.
Priorities constitute the relative order of need for a commodity or service. Priorities may be assigned based upon the particular mission or tasks assigned. For example, the unit carrying out the most critical task often receives first priority for support. Sometimes the importance of a resource to a unit’s continued effectiveness may determine priority. In this scheme, units with the most urgent need for supplies or services in order to keep operating will have first call on those resources. Distributors of virtually all commodities and services employ some type of priority system. The use of priorities is most critical in the allocation of combat-essential or life-sustaining resources such as ammunition or medical support. Priorities for the distribution of scarce resources can also depend on the pattern of battles and engagements as well as what is happening in the overall campaign. The establishment of priorities and the allocation of resources in accordance with those priorities is a function of command, not logistics. Command and control implements the priorities determined by the commander.

The value of establishing priorities in logistics was illustrated in the Korean war. After the Chinese entry into the war, the 1st Marine Division was surrounded near the Chosin Reservoir in northern Korea. The division needed significant supplies to fight its way out, but overland supply routes were cut off. Resupply of troops in the reservoir area became the first priority for the Combat Cargo Command of the Far East. A massive aerial resupply effort followed, providing the division
with the ammunition, food, fuel, and other supplies it needed to conduct a breakout.\textsuperscript{12}

We recognize that uncertainty is an inherent characteristic of war and that it will be impossible to anticipate and plan for all future requirements. Logisticians spend much of their time dealing with unanticipated demands. For this reason, logisticians must develop considerable expertise in solving a great variety of problems. The command and control procedures, organizations, and support structure that aid logisticians in their work must provide flexible tools that aid, rather than hinder, rapid and responsive problem solving.

Because the stakes of war are so high, the cost of failure so great, and the needs of comrades-in-arms so urgent, logisticians will often be tempted to focus all of their energies on dealing with unanticipated demands on an ad hoc basis. In many cases, this will be appropriate. In others, there will be a pattern to these demands that suggests a change in approach that leads to a solution to the problem. In the fighting around Metz in the fall of 1944, for example, American logisticians were overwhelmed with emergency requests for 60mm mortar ammunition. As the U.S. supply system was, at that time, stretched to its breaking point, logisticians decided that the way to deal with these requests was to fabricate mortars that could fire the supplies of 50mm mortar rounds that had recently been captured from the enemy.\textsuperscript{13}
Effectiveness versus Efficiency

Successful logistics requires both effectiveness and efficiency. While we would like to obtain total effectiveness and complete efficiency in our logistics system, we must usually accept a degree of inefficiency to ensure effectiveness or must sacrifice some measure of effectiveness in order to achieve greater efficiency. This reality creates an inherent tension, as we attempt to find the proper balance between effectiveness and efficiency.¹⁴

If we had unlimited resources, we could devote all our attention to effectiveness. We could provide each unit with supplies and services not just for its immediate needs but for any possible future needs. Distribution would be based on a push system and would use the unit distribution method of delivery, relieving the supported unit of most logistics responsibilities. Planning factors would include generous safety margins to ensure resources were always available. Command and control would be highly decentralized with each unit having its own full-service logistics organization and capability.

We must be careful, however, not to equate the effectiveness of logistics simply with the quantity of goods and services which are provided. Providing too many supplies can be as disruptive as not having enough. Consider the use of margins for error. While it may seem that we should include margins for error in all our calculations, this practice can significantly reduce the overall effectiveness of the logistics system and
degrade the quality of support it provides. Margins for error translate directly into the need to procure additional items, increased inventory at many points in the distribution chain, and increased strain on storage and transportation. Supplies that are superfluous are just as expensive to buy and just as ponderous to move, store, distribute, and account for as necessary stocks. Service requirements that were overestimated can result in overabundance at one point and deficiencies at another.

Rather than attempt to provide “a little extra, just in case,” we must strive to make accurate requirements forecasts and be prepared to adapt and innovate when those forecasts fall short of the mark or when weather, enemy action, or some unforeseen circumstance renders those predictions obsolete. As the situation changes, our logistics system must have the flexibility and responsiveness to make the required alterations in the chain of production, transportation, and distribution.

On the other hand, if the objective is simply to maximize efficiency in our logistics system, we would probably use a pure pull system, filling requirements only in response to a specific request. We would rely primarily on supply point distribution, minimizing the burden on the logistics system to deliver supplies and services. Logistic planning would continuously refine formulas and calculations in an effort to achieve increasing precision in predicting requirements and allocating resources. We would attempt to reduce the amount of resources on hand to the lowest possible level, providing little or no safety margin
to deal with unforeseen occurrences. Command and control would be highly centralized in an effort to ensure positive control of all assets at all times.

In an effort to improve efficiency, military logistics is attempting to apply logistics techniques developed in the commercial sector where ‘just-in-time’ inventory management and improved methods for forecasting demand are well established. We should not hesitate to employ any technique which offers a means to increase our capabilities. However, in considering the adoption of these techniques for military purposes, logisticians can never forget that their objective and the environment in which they operate differs significantly from that of their business counterparts. Business is focused on the provision of a product or service in a safe and cooperative environment. Methods that prove efficient in peacetime will not necessarily succeed under the far more demanding conditions of war. For example, the ability of a parcel service to deliver a package anywhere in the world in a matter of hours is based on the assumption that no one is shooting at the aircraft carrying that package.

The essential lesson of this discussion is that we must balance effectiveness and efficiency in the conduct of logistics. Efficiency contributes to effectiveness. While we always need to consider efficiency in our logistics system, effectiveness in the support of operations takes precedence over efficiency. Logistics must consider not just efficiency and cost-effectiveness, but operational readiness and the requirement to deliver
support in an environment characterized by violence, danger, friction, uncertainty, fluidity, and disorder. We must sacrifice some measure of efficiency to maintain effectiveness. Furthermore, we must ensure that efficiency does not become an end unto itself. Effectiveness should always be the defining feature of our logistics system.

**APPROACHES TO LOGISTICS**

Having studied the evolution, process, functions, and levels of logistics, as well as the elements of logistics systems, we conclude with an examination of approaches to logistics. We can place approaches to logistics on a spectrum according to their degree of independence. At one end of the spectrum is complete dependence on outside sources for support. Military units which have no organic support capabilities draw all sustainment from the local surroundings. Ancient armies that lived by foraging used this approach, as do certain modern guerrilla groups. At the other end of the spectrum is total self-sufficiency. The force brings with it everything it needs to sustain its efforts. (See figure 7, page 76.) While no force achieves complete independence from use of local resources, 18th century European armies, colonial armies in the 19th century, and modern naval forces most closely approximate self-sufficient forces.
A military force’s approach to logistics must be tailored to its own warfighting philosophy or strategy. Around the world, the vast majority of military units are designed to fight within their own countries or on the territory of an immediate neighbor. Forces organized for territorial or home defense generally have limited logistics organizations. They do not expect to fight far from their permanent bases and can draw on local sources for basic supplies. Conventional armies and air forces have extensive support requirements. While they normally have organic logistics organizations to satisfy unique military requirements for ammunition and maintenance, most armies and air forces, even those configured for forward deployment, rely heavily on local procurement for basic commodities such as water, food, fuel, or construction material.

In contrast, forces developed to conduct expeditionary operations tend to be more self-sufficient. Expeditionary forces are often explicitly designed, trained, and equipped for overseas service. Their organization and equipment emphasize economy, flexibility, and deployability. Expeditionary forces

Figure 7. Approaches to logistics.
often operate in areas where resources or infrastructure are limited. Many universal items like fresh water, lumber, or even sand are not reliably available in these parts of the world. Consequently, an expeditionary force must be prepared to carry, have delivered from a permanent base, or fabricate every single item it needs. Naval forces configured for expeditionary operations are the most self-sufficient. They are capable of conducting operations independent of support from permanent or forward land bases for an extended period. They are self-reliant, self-sustaining, and adaptable to the most austere environments.

In practice, most military organizations use a mix of organic capabilities and locally procured resources to sustain their operations. The Marine Corps, however, is a naval force designed for expeditionary operations. The nature of the operations we conduct and the environments in which we operate demand an approach to logistics that emphasizes self-sufficiency.

**CONCLUSION**

We have examined a variety of theoretical aspects of logistics. The evolution of logistics demonstrates that warfare and logistics are inextricably linked; changes in warfare can have a profound impact on logistics while changes in logistics capabilities can in turn alter significant components of warfare. The evolution of logistics also shows that the relative importance of
logistics as a function of warfare has been steadily increasing. The logistics process provides a framework around which to build a logistics system. The discussion of the functions and levels of logistics illustrates the scope, complexity, and interrelationships of logistics and demonstrates that a logistics system must be capable of carrying out all six functions and operating at all three levels of logistics in order to fully support the operating forces. In examining the makeup of any logistics system, we identified bases, distribution procedures, and command and control as key elements. We noted that Marine forces must make use of a variety of basing options, a combination of push and pull distribution procedures, and flexible and responsive command and control. Finally, we compared approaches to logistics, ranging from complete self-sufficiency to total dependence. We concluded that expeditionary warfare requires the Marine Corps to provide forces that are largely self-sufficient. In the next chapter, we discuss the features of a Marine logistics system based on the characteristics described above.