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**Logistics Distribution In A Theater Of Operations**

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A Monograph  
by  
Major J. R. Mott Jr.  
Ordnance



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**Progress slow in coping with prisoner wave logistics** **Medical units plan for worst hope for best**

*"Valentine Express"*

Pagonis's mission: to move 200,000 men plus supplies 300 miles in 10 days without anyone noticing

**Logistics crucial at the front**

**To convoys, Saudi road is a killer**

**mail service**

**Airlift command confident it can manage evacuation**

**20,000 reportedly have died**

**Allies get ready for terrorists**

**Scud attack shatters war's initial euphoria**

**resources**

**Bartering, scrounging a way of life**

*About 300 tons of mail bound for U.S. forces flowed into Saudi Arabia each day. Getting it to the troops was a job postal workers vowed to do...*

## ABSTRACT

LOGISTICS DISTRIBUTION IN A THEATER OF OPERATIONS by Major John R. Mott Jr., USA, 53 pages.

This monograph studies the relationship of distribution in current operational logistics doctrine and answers the question "Does the U.S. Army have an effective concept for logistics distribution in a theater of operations?" The study focuses specifically on forces deployed in an undeveloped theater. Analysis of this "worst case" scenario identifies the criteria for an effective distribution system. It also focuses on a military contingency that is gaining increased emphasis by defense planners.

The monograph first examines logistics distribution in military and business theory. It then uses history to validate or refine the theory. Operation DESERT SHIELD/DESERT STORM is examined for its contemporary value. Finally, the study reviews current doctrine for appropriateness in light of theory and history.

The conclusion I reach is that current operational doctrine does not include a concept of logistics distribution, but it should. Distribution is a major function of the logistics equation proposed by this study:  $\text{Logistics} = \text{Supply} + \text{Distribution} + \text{Maintenance}$ . In that context, distribution should be the keystone of logistics planning in a theater of operations. Finally, doctrine, as a guideline for planners, should lead in its explanation of the distribution process.

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## I. INTRODUCTION

Current Army and joint logistics doctrine poses a significant challenge to the understanding of the operational planner. There appear numerous terms, concepts, and methods which are inconsistent or overlap in meaning and conveyance. The reason for the confusion is clear. The U.S. Army's conceptual evolution in operational warfare has begun an equally evolutionary change in operational logistics. The face of the current and future AirLand battlefield is changing Army operations and tactics. The doctrinal expression of logistics is struggling to stay contemporary causing terms, concepts, and methods to be in a state of flux.

Among the subjects that need better definition is the Army's methodology for planning logistics distribution in a theater of operations. Theater distribution is what moves an item from the port of debarkation or intra-theater source of supply to the user's location. Without a distribution system, units would be limited to the extent of their on-hand stocks. Current operational doctrine does not include a concept for logistics distribution. This causes two problems for the Army. First, it denies guidance to planners who research the doctrine to learn their jobs. Second, it fails to focus on the most important aspect of operational logistics, the distribution of personnel and supplies throughout the theater.

This study will examine operational logistics and the relative importance of distribution. It will specifically look at operations in an undeveloped theater. This requires us to analyze

distribution at its most basic and demanding level. An undeveloped theater is not prepared to receive military forces. The military will have to bring everything it needs into the theater or acquire it through the host nation. They will then have to distribute it to the units with existing transportation systems or those they develop once in country. The planning for entry of forces into an undeveloped theater is critical because once made, deployment decisions are difficult to change. The planner has to identify current requirements and anticipate future ones as accurately as possible.

A concept that meets the distribution requirements of the undeveloped, or 'worst case' theater should prove useful in almost any military contingency. Distribution has historically played a vital role in the success or failure of military operations. Many commanders' campaign plans have hinged on their ability to distribute supplies from a base of operations to their maneuver units.<sup>1</sup> Napoleon in Russia, Rommel in Africa and the British in the Falklands are but a few. In 1991, history repeated itself during Operations DESERT SHIELD and DESERT STORM. U.S. military logistics successfully deployed hundreds of thousands of ground troops to the Kuwaiti Theater of War and sustained a lightning offensive campaign. "This has been a logistics war from the beginning" said Brigadier General Joe Frazier, Assistant Division Commander, 24th Infantry Division."<sup>2</sup> Between August 1990 and February, 1991, the military distributed 88 million meals, 152



million gallons of water, 94 million gallons of fuel, and 236,300 tons of ammunition to the ground troops.<sup>3</sup>

The focus on Desert Shield/Desert Storm logistics distribution is appropriate for the U.S. Army in light of recent world events. "The challenges of the future demand the United States have the capability to move forces and equipment from the U.S. bases and forward deployments to the scene of the crisis quickly and in enough numbers sufficient to determine the outcome."<sup>4</sup> This movement must include an efficient intra-theater distribution system to allow military operations to be conducted as necessary.

The importance of distribution indicates it should be the cornerstone of operational logistics doctrine. This is currently not the case. AirLand Battle Doctrine defines logistics in terms of six tasks: manning, arming, fixing, fueling, transporting, and protecting.<sup>5</sup> Distribution is addressed only as a sub-task to the six. This study will demonstrate, however, that distribution is 'the' key consideration for operational logistics planning. By failing to present operational logistics in a precise manner, doctrine has failed in its purpose to provide "fundamental principles" to guide military action.<sup>6</sup>

The purpose of this monograph is to examine logistics distribution as a key consideration of operational logistics. The study will specifically answer the question "How effective is current U.S Army doctrine for logistics distribution in a theater of operations?" The study will first theoretically address the

subject of logistics to determine if distribution is a major subordinate function. It will then study the role distribution had in the recent Operations DESERT SHIELD and DESERT STORM. Next, it will review current AirLand Battle Doctrine to conclude the research question. If logistics doctrine effectively explains distribution, the study will stop there. If the answer is no, it will make recommendations as to what the doctrine should look like. The criteria for evaluating the doctrine will be derived from theory, history, and current AirLand Battle Doctrine.

## II. LOGISTICS THEORY:

Brigadier General Huba Wass de Czege defined theory as "a relationship of principles,"<sup>7</sup> Principles, in turn, provide basic or invariable truths which allow us to organize and apply our knowledge.<sup>8</sup> Doctrine contemporizes the theory and principles to provide a set of guidelines for the conduct of activity.<sup>9</sup>

A theory of military logistics provides, as a minimum, two things. First, it defines the subject. Second, it proposes a set of principles to explain its nature. One can then apply the theory to develop a contemporary military logistics concept. The concept provides the notional "how to" based on the state of friendly forces and the anticipated threat. The concept designer then uses the theoretical principles to judge the feasibility of his ideas which, if validated, become doctrine.

Many military theorists provide a definition of logistics in their treatises. Antoine de Jomini calls it the "art of moving

armies."<sup>10</sup> Karl von Clausewitz defines it as "maintenance and supply."<sup>11</sup> A third theorist, Frederick the Great, said of his logistics effort: "I divide the problem of subsistence into two parts, of which one deals with the place and manner of assembling supplies and the other with the means of rendering these magazines mobile and making them follow the army."<sup>12</sup> In other words, he saw two distinct functions, the acquisition of supplies and their transportation to the army's location.

Today's armies are far more complex than in Jomini's, Clausewitz' and Frederick's time. Logistics requirements have changed. Armies are more dispersed, require a broader spectrum of support, and have tremendous mobility. Whereas Frederick could transport supplies for a centrally massed army, the nature of today's military forces require distribution of supplies to a thousand separate locations.

Eighteenth and Nineteenth century armies required only a few items of supplies. The primary concern was food for the troops and fodder for the horses. Ammunition and gunpowder usage was low, petroleum wasn't needed, and maintenance was confined to repair of a few wagons and small arms. Armies, according to Clausewitz, sustained themselves by two methods, foraging and a depot system.<sup>13</sup> Both methods were concerned primarily with feeding man and beast.

Modern armies, however, have a wide variety of equipment, requiring different munitions, fuels, lubricants, and repair parts. Procurement from the local population meets few of an

army's needs. A depot system has utility for a static force, but lacks mobility to support an army on the move. Today's units are also organized by function, so their supply requirements are unique. Management is essential to ensure the right supplies are routed to the right unit.

The logistic definitions of 18th and 19th century theorists have general application to the understanding of logistics, but do not provide the focus needed for modern military operations. What they provide is a base to apply the lessons of technology.

Returning to Frederick's definition, logistics is the acquisition of supplies (supply) and their transportation to the correct location. TRANSPORTATION, however, inadequately describes the deliverance of goods to today's dispersed, mobile army. Distribution is a better term. By replacing TRANSPORTATION with DISTRIBUTION Frederick's definition becomes SUPPLY AND DISTRIBUTION. I add to this Clausewitz' dimension of MAINTENANCE. His term refers to those actions taken to maintain the strength of the army, to include personnel services and equipment maintenance.<sup>14</sup> Jomini's definition, "the art of moving armies" is also accommodated by these three functions.

The full definition of logistics I derive from studying the early theorists is:

**LOGISTICS = SUPPLY + DISTRIBUTION + MAINTENANCE**

This definition theoretically establishes distribution as a key logistics consideration.

The idea of distribution as a primary function of logistics also has theoretical precedence in today's private sector. Paul T. McElhiney considers the definitions of business logistics and physical distribution to be inter-changeable. He defines both as "that phase of economic activity which concerns itself with assessing the needs of goods and services for time utility and place utility."<sup>15</sup> The need for goods and services is FORM UTILITY.<sup>16</sup> TIME UTILITY is the "planning, storage, and sometimes transportation to ensure goods are available when needed."<sup>17</sup> PLACE UTILITY is the transportation"... which moves the goods to where they are needed."<sup>18</sup> Succinctly, physical distribution is "getting the proper amount of the right kind of product to the right place where the customer wants it."<sup>19</sup> The private sector definition of business logistics and the definition which I derived from military theorists are very similar. Form utility is supply, and space and time utility is distribution. This leaves maintenance which is not considered a separate function of business logistics.

It is important to note that business theory does not recognize physical distribution as merely transportation. It includes all the activities that "take a product from the production line to the customer."<sup>20</sup> Place utility alone is the aspect of transportation. Time utility adds planning, storage and some transportation to facilitate availability.<sup>21</sup>

The study of business logistics theory provides three criteria for a military distribution system; form, time, and space utility. There are, however, differences which make the theory inadequate for military use. First, private business targets a stationary population. The military supports a widely dispersed, dynamic force. Second, business strategy targets populations which are profitable. The military accommodates its entire population regardless of cost. Finally, business logistics does not encounter the environment of danger inherent in military operations.

Clausewitz would characterize these differences as "friction." War is dangerous, the realm of chance and uncertainty.<sup>22</sup> Even the simplest tasks become difficult in battle.<sup>23</sup> "Countless minor incidents--the kind you can never really foresee--combine to lower the general level of performance, so that one always falls short of the intended goal."<sup>24</sup>

Business does not experience danger nor the magnitude of friction experienced in war. To demonstrate the difference, I will compare a private distributor, Domino's Pizza, to the U.S. Army. Domino's has two dimensions to their business, production and distribution. They provide service on an area basis to a high density and permanently addressed clientele. Their drivers have well-rehearsed routes and deliver only two items, pizzas and drinks. Production and distribution are simple, customer satisfaction is easily attained, and the risk of non-delivery is low. Domino's can accurately predict a demand surge and prepare

accordingly. Weekends, holidays and major sports events can be accommodated by adjusting employee working hours or hiring part-time workers.

Domino's could not provide the same standard of service at the same cost to a maneuver unit. Military force populations fluctuate in size daily. They are constantly moving and are difficult to access. Franchise owners would have to maintain communications between the producer, distributor, and customer to ensure delivery. Demand surges based on the military conditions would be hard to predict. The company would have to hire additional workers to be ready at all times. Finally, the distributor would have to deal with the threat of having his route interdicted by the enemy.

The Domino's Pizza example demonstrates how we cannot accept business theory carte blanche for military application. It is useful, however, as a basic model for determining criteria for a military distribution system. By accepting the theory that physical distribution is form utility, space utility, and time utility, we can analyze further to determine those additional criteria required to make the model work for the military environment. Again, the differences between the two systems are the size and scope of the supply requirement, stable versus unstable customer populations, scheduled versus constantly changing routes, surge accommodation, and danger. Figure 1 (page 11) shows the additional criteria determined by this study to overcome each difference between business and military logistics.

MILITARY LOGISTICS CRITERIA

Common Criteria: Business/Military Logistics]

- Form Utility (What is needed)
- Space Utility (Where is it needed)
- Time Utility (When is it needed)

ADDITIONAL CRITERIA REQUIRED TO CLOSE THE GAP  
BETWEEN BUSINESS AND MILITARY LOGISTICS

<u>Difference Between Domino's Pizza and Military Logistics</u>	<u>Criteria Needed To Overcome Differences</u>
Scope of supply requirement (Number of items managed, volume, locations)	Supply and inventory control
Unstable customer population	Responsiveness (supports increased number of customers and locations with minimal prior warning.)  Flexibility (Distribution system can shift assets to meet increased req'ts
Changing distribution routes	Command, control, communication of transportation assets. Flexibility
Surge accommodation	Depth in capability Flexibility Responsiveness Improvisation
Danger	Protection

Figure 1



In summary these are command, control, communications, responsiveness, flexibility, in-depth capability, anticipation, improvisation, and protection.

It is important to note here that Domino's operates by what business theorists refer to as a 'maximum profit design'. It provides service to populations that return the greatest profit.<sup>25</sup> Military logistics is more like the "maximum market design." Its objective is to satisfy the customer's requirements regardless of their location.<sup>26</sup> This design "never achieves the lowest total costs because it undertakes to serve all markets and focuses on revenue generation rather than cost minimalization."<sup>27</sup> The airline industry is an example of a business using maximum market design. The risks of satisfying large populations are high and profits are often marginal.

There are those who believe military logistics should be more like private industry. They see the efficiencies of private businesses and say, "why not." The answer is "yes, as long as the system adopted meets the criteria for military logistics."

This chapter has studied both military and business logistics. It has put the two in perspective of modern military conditions. It has also developed criteria for contemporary logistics distribution. They are:

Form utility	Command	Space utility
Control	Time utility	Communication
Anticipation	Flexibility	Anticipation
Depth	Responsiveness	Protection
Improvisation		

### III. LOGISTICS DISTRIBUTION IN AN UNDEVELOPED THEATER OF OPERATIONS: OPERATION DESERT SHIELD AND DESERT STORM:

History abounds with examples of commanders whose operations in undeveloped theaters hinged on a good logistics distribution system. Napoleon failed in Russia because he couldn't feed his troops. Rommel failed in North Africa because he couldn't fuel his tanks. Slim, however, won in Burma because he executed his campaign within his logistics constraints.<sup>28</sup> All three examples demonstrate how sustainment can influence operations. All three, however, lose some credibility for contemporary study because they occurred in a different era of technology. A more appropriate example would be a campaign using current technology and doctrine.

Operation DESERT STORM, the restoration of Kuwait from Iraqi invasion, is an example of modern warfare in an undeveloped theater. The coalition responded to the Iraqi threat by deploying hundreds of thousands of troops with their equipment and supplies into Saudi Arabia from August 1990 to January 1991. Fortunately, the host nation had sufficient port and airfield capacity to receive the influx of military forces. Once in country, however, our forces faced a significant distribution challenge. Roads throughout the theater of operations were limited in number and capacity. Railroads and in-land waterways did not exist. Airfields operated in major population centers, but not in the allied coalition of advance.

As military units moved farther away from their ports of debarkation and into their staging areas, the lines of support

grew longer. The campaign plan positioned units far to the north, into the desert along the Saudi-Kuwaiti border. Usually, only a single road of limited capacity connected them to their base of supply. In late January, lines of support stretched even longer as 150,00 Allied troops secretly shifted an additional 100 miles to the west to prepare for the attack into Iraq.<sup>20</sup>

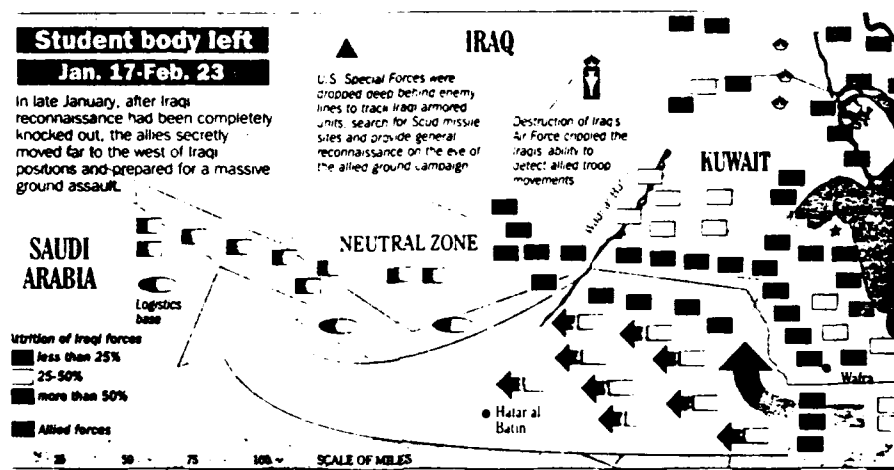


Figure 2

The move required extraordinary operational planning and was, for the most part, an exercise in unit movement and sustainment. The logistics infra-structure of the U.S. Army's maneuver units was not designed to operate over such long lines of communication without the assistance of mass transportation, e.g. railroads. Division and corps logistics structures were designed to support operations in developed theaters such as Europe, not in the expansive deserts of the Middle East.

The major problem then became one of intra-theater distribution. The military's Transportation Command (TRANSCOM) could deliver bulk shipments to Saudi Arabian port facilities with air and sea transportation means (Figure 3).<sup>30</sup> From the ports of debarkation eastward, the limited capacity of the road network constricted the logistics flow.

## Fueling the war

For every three U.S. soldiers on the front lines, there are seven others providing everything from ammunition to toilet paper. Some of the supplies needed by 523,000 U.S. troops in Operation Desert Storm and now they're being sent.

### How supplies arrive

More than 12,000 flights have arrived since start of Operation Desert Shield. They've increased to about 100 flights a day from the USA and Europe. About 90% comes on C-5A and C-141 cargo planes.

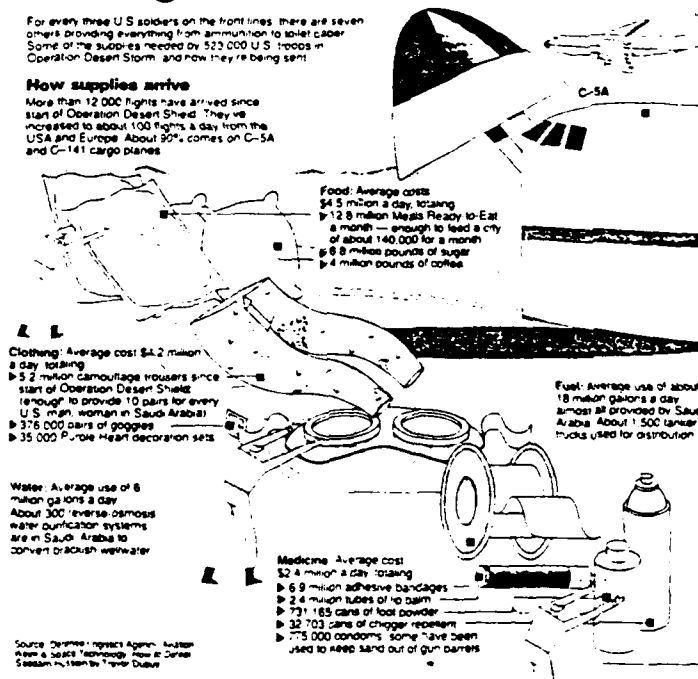


Figure 3

The operational planner had to design a concept of support that could meet the criteria of form, time, and place utility as well as the other military criteria already discussed. Projecting the distribution requirement became critical. Fuel, water, and ammunition consumption was the primary concern. Planners had to

determine both the daily consumption and the stockage buildup rates.<sup>31</sup> The offensive nature of the operation ensured heavy fuel usage. The high density of weapon systems and the necessity to reduce the enemy defenses drove ammunition stockpiling.

Planners also anticipated increased medical, chemical decontamination, and enemy prisoner of war (EPW) requirements. A high casualty rate would require additional medical supplies, water resources, and personnel evacuation. Chemical decontamination also needed water. EPWs required transportation, holding facilities, and sustainment.

As the operation progressed, unanticipated requirements arose. Supporting the media, caring for displaced civilians, and delivering the mail are examples. For the most part, supplies were sufficient for both anticipated and unanticipated requirements. Distribution was the key.

The Army completed its logistics mission without any war-stopping shortfalls. This does not mean the task was easy nor that it was performed without a hitch. "It's simply a massive undertaking," said LTG (Retired) Edward Honor. He was referring to the peculiar challenge of refueling, feeding and watering a force in the Kuwaiti Theater.<sup>32</sup> According to Paul Hoversten, logisticians moved an equivalent of the city of Richmond to Saudi Arabia to support the effort.<sup>33</sup> He counts the top priority to have been "moving gear and personnel to the front."<sup>34</sup> Commanders took risks by placing supply bases as far forward as possible.<sup>35</sup> General Tuttle, the commander of the Army Materiel

Command stated the bases did not require doctrinal-level dispersion due to a lack of air threat.<sup>36</sup> Nor were the enemy's ground forces a threat to the support elements. This eliminated the considerable burden of protection against conventional attack and allowed for better administration of the effort.

The primary mode of transport was truck with backup support from C-130 and C-141 aircraft landing on "makeshift runways."<sup>37</sup> The lack of enemy air threat again made the job easier, though traffic management was a problem. Long convoys traveled hundreds of miles along narrow roads through the desert. Accidents were common and several fatalities occurred on the barren routes to and from the front lines.<sup>38</sup> "It isn't hard to see why head-ons happen so often," reported one driver, "Trucks with extra-wide loads are rattling toward each other on a road that isn't wide enough to hold two Toyotas comfortably."<sup>39</sup>

Delivering fuel was the critical issue. Mechanized divisions on the move used approximately 500,000 gallons of diesel a day, all of which had to be delivered by truck.<sup>40</sup> Rough terrain hampered the mobility of the army's mainstay hauler, the 5000-gallon tanker. Units had to rely heavily on the more mobile, though less efficient 2500 gallon HEMTT.<sup>41</sup>

On the Army's left flank, the 24TH Infantry Division met their mission by using aggressive and innovative logistics techniques. They conducted a 250-mile 'cavalry charge' around the flank of the Iraqi army from 24-27 February (See Figure 4).<sup>42</sup>

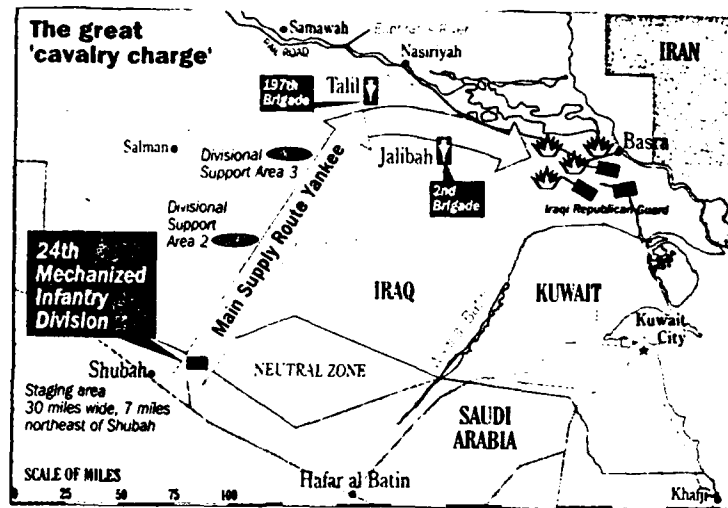


Figure 4

Commanders tailored their logistics organizations to keep the division moving unconstrained. They beefed up their organic support packages with any available transporter to increase distribution capability.<sup>43</sup> Two and one-half million gallons of fuel and 17,000 short tons of ammunition were tucked in behind the advancing combat elements.<sup>44</sup> The following chart shows the daily supply and vehicle requirements for the 24th.<sup>45</sup>

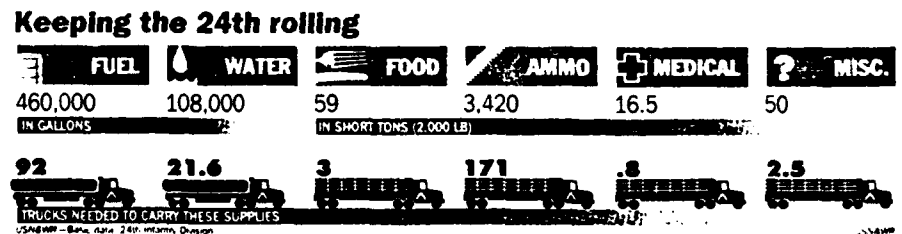


Figure 5

The 3rd Armored Cavalry Regiment, attached to the XVIII Airborne Corps, planned for logistics in a similar manner. They tucked enough logistics in behind their combat elements to allow them free maneuver.<sup>46</sup> The Regiment's organic support capability was enhanced by the addition of 27 HEMMT tankers (67,500 gallons, diesel) and direct support from the 553rd Corps Support Battalion.<sup>47</sup> The 553rd's supply and services included an additional 100,000 gallons of fuel carrying capability.<sup>48</sup>

The Regiment organized its support into two task forces.<sup>49</sup> During the move west, each force displaced to successive support areas. At each location, they established operations and awaited the arrival of the line squadrons.<sup>50</sup> Displacement continued in this manner until the regiment reached its attack position far to the west and within ten miles of the Iraqi border.<sup>51</sup> Because the support moved in advance of the combat units, protection was a key factor. The regimental support areas (RSA) provided their own security with the assistance of a military police detachment.<sup>52</sup> It also made use of the 6 M1A1 tanks and 6 M2 Cavalry Fighting Vehicles in the Operational Ready Float (ORF).<sup>53</sup>

The Army met most of its projected support requirements through detailed planning. It even anticipated and prepared for the tremendous numbers of enemy prisoners of war (EPW) eventually taken. The plan specifically earmarked units for the EPW mission, to include the Army's 14th Military Police Brigade.<sup>54</sup> The U.S. forces built facilities capable of temporarily holding, sustaining, and protecting 120,000 Iraqi soldiers.<sup>55</sup> Saudi Arabia



would eventually receive all prisoners and hold them in its own facilities.<sup>56</sup> Despite the prior planning, the mass surrenders were almost overwhelming. LTG Boomer, commander of marine forces, reported the surrendering Iraqis to be a hindrance to operations. "They are a strain on your resources. I suspect they got a little bit in the way last night" (25 Feb).<sup>57</sup>

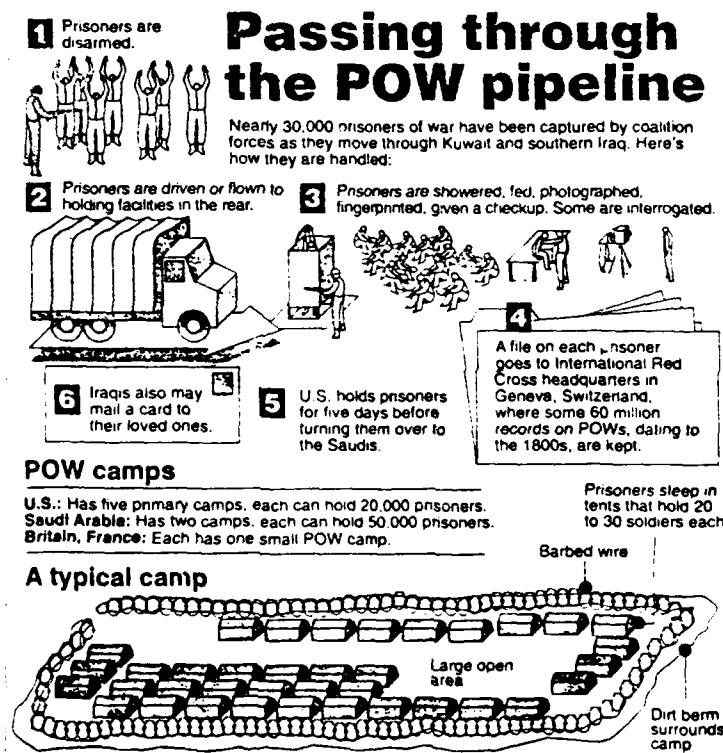


Figure 6

Incorrectly projected requirements caused the greatest frustration. One example was the mail distribution. Mail does

not normally hinder military operations. During DESERT STORM it did. The volume of mail being sent to the troops went far beyond the planning projections. Patriotic support for the troops pushed as much as 300 tons of mail into the distribution pipeline each day--twice the amount for the Vietnam War.<sup>58</sup> Friends and family sent 22 million tons in December alone.<sup>59</sup> This represents 14 times the planning factor currently used by staff officers in the Army Field Manual 101-10-1/2.<sup>60</sup> The resulting overload to the distribution system surprised logistics planners and delayed mail getting to and from the front lines. Soldier morale suffered by being cut off from the news back home. Army Specialist James Brown received his wife's Christmas card on February 13.<sup>61</sup> "I was very depressed, I thought I was going to lose it."<sup>62</sup> Families were complaining to the press and their congressional representatives. "I count the mail right up there with food and water," said Mary Lou Hoover in an interview with the Kansas City Star.<sup>63</sup> For the operational planner, the heat was on. Getting the mail to the troops was not going to force Saddam Hussein out of Kuwait, but it was an operational responsibility that was not going away.

Protection must be addressed at this point. Many of the soldiers killed in the war were in the logistics field. Most of these died from traffic accidents or the tragic SCUD attack on the Dhahran barracks.<sup>64</sup> None of the victims were directly targeted by the enemy, nor could anyone have predicted their deaths. The

SCUD attack in particular characterizes the threat to the rear area - it's unpredictable.

Unfortunately, logistics protection will not be a major issue to come out of the war because the enemy never really threatened the support activities. The Dhahran barracks incident may be perceived as an atypical occurrence and lose its significance as a lesson learned. The caveat to logistics success in DESERT STORM should be that it succeeded in the absence of enemy interference. The movement of thousands of trucks along a few improved roads could have been costly if the enemy had been better prepared. A more capable enemy could have targeted and severely damaged the dispersed units. Finally, support to movements like the 24th Division would have carried far more risk had they been under fire.

It is critical for the operational logistics planner to factor the loss of logistics capability due to enemy activity. This decrement includes those sustainment personnel dedicated to protection as well as the men and equipment lost to enemy fire.

DESERT STORM validates most of the logistics distribution criteria developed in the previous chapter: FORM, SPACE, and TIME UTILITY; DEPTH; ANTICIPATION; FLEXIBILITY; IMPROVISATION; and COMMAND, CONTROL, and COMMUNICATIONS. FORM, SPACE and TIME UTILITY remained basic to mission accomplishment. The what, where, and when became critical in the undeveloped Kuwaiti theater because distribution means were strained. The limiting factors were the transportation modes and assets available to move

logistics forward. Identification, acquisition, and reception of the right items (form utility) into theater was the first task. Thereafter, distribution of those supplies throughout the theater of operations (space and time utility) was the key.

The operational planners for DESERT STORM designed a distribution system that supported the commander's intent. It had in-depth capability to support operational maneuver. It also anticipated surge requirements such as the 60,000 POWs. Unprojected requirements (such as mail) required flexibility. A lack of capability (such as fuel hauling equipment) required improvisation. To tie it all together in an expansive desert required a correctly structured force (command), control of limited assets, and communications.

The war did not validate PROTECTION as a key sustainment function. FM 100-5, Operations, states, "Enemy air, missile, ground, and unconventional warfare forces will attack the support system as part of a coordinated battle or campaign plan."<sup>85</sup> The SCUD attack on the Dhahran barracks, though costly, failed to demonstrate the force degradation that occurs from an attack on the rear area. Regardless, this study retains protection as a criterion because of its significance to distribution operations.

Finally, a new criterion can be added from studying the war-CONTINUITY. DESERT STORM demonstrated how planning for continuous logistics throughout the theater is essential for success. Operational logistics begins when provisions enter or are acquired in-theater. It ends when they reach their customer.

#### LOGISTICS DOCTRINE TERMINOLOGY:

Webster defines logistics as, "the branch of military science having to do with procuring, maintaining, and transporting materiel, personnel, and facilities."<sup>66</sup> JCS Publication 1-02 defines it as, "The science of planning and carrying out the movement and maintenance of forces."<sup>67</sup> The United States Army's definition of logistics is a little harder to nail down. TRADOC Pam 11-9 includes it under the umbrella term combat service support (CSS): "The support and assistance provided to sustain forces, primarily in the fields of logistics, personnel services, and health services." FM 100-5, Operations, uses the terms 'operational CSS' and 'sustainment' interchangeably: "Those logistical and support activities required to sustain campaigns and major operations."<sup>68</sup> Other Army manuals provide other definitions, but on one thing they agree, there are key functions to be performed. FM 100-10, Combat Service Support, lists the basic tasks of CSS to be "manning, arming, fueling, fixing, and moving."<sup>69</sup> FM 100-5 calls the "key sustainment functions" arming, fueling, fixing, transporting, and protecting.<sup>70</sup> TRADOC Pam 11-9 states, "The basic functions of the CSS BOS (Battlefield Operating System) are manning, arming, fueling, fixing, distribution, providing sustainment engineering, and the provision for military police support."<sup>71</sup>

The diversity of these terms and definitions is confusing to anyone attempting to learn military logistics. Many are redundant, overlap, or are subsets of another. For the Army to operate

The task of the operational planner is to ensure there is sufficient capability to receive the provisions and distribute them all the way forward. His visibility of logistics cannot stop at the brigade or division rear boundary. It must be continuous to the foxhole. The idea of continuous or "seamless" logistics is discussed further in the next chapter.

#### IV. ANALYSIS OF LOGISTICS DOCTRINE:

So far, this study has accomplished three things. First, it presented a theoretical argument for distribution to be a major function of operational logistics. Second, it gave the argument historical precedence with the example of DESERT SHIELD/DESERT STORM. Finally, it used DESERT SHIELD/DESERT STORM to validate criteria for a concept of logistics distribution in a theater of operations.

Not only is current logistics doctrine confusing and a significant challenge to the operational planner, it also fails to define and explain the role of distribution in operational logistics. This chapter will evaluate logistics distribution in current operational doctrine. Criteria for evaluation will be those derived from theory and validated by the historical example. The evaluation will be the basis for deriving doctrinal implications and study conclusions.

smoothly, doctrine needs to communicate a common language. For the numerous logistics definitions identified, this means reducing them to the lowest common denominator. Collated, the defined functions of logistics are:

MANNING	PROTECTING	ARMING
MOVING	DISTRIBUTION	TRANSPORTING
SUSTAINMENT ENGINEERING	FIXING	FUELING
MILITARY POLICE SUPPORT	MAINTAINING	

I derive the common denominators from the theoretical definitions presented in chapter II:

Frederick the Great: SUPPLY TRANSPORTATION

Clausewitz: SUPPLY MAINTENANCE

Business Logistics: FORM UTILITY SPACE UTILITY TIME UTILITY

Combining the three theorists and eliminating redundancies, the common denominators are SUPPLY, DISTRIBUTION, and MAINTENANCE: Supply includes FORM UTILITY and PROCURING; Distribution covers TRANSPORTATION, TRANSPORTING, SPACE UTILITY, and TIME UTILITY; and MAINTENANCE stands alone. As a result, logistics can be reduced doctrinally to three functions: SUPPLY, DISTRIBUTION, and MAINTENANCE.

Applying the common denominators to the long list of defined functions, we can transition to a few useable terms. DISTRIBUTION could incorporate MOVING, ARMING, FUELING, MANNING, TRANSPORTING, and DISTRIBUTION. Maintenance could incorporate

FIXING and MAINTAINING. This leaves SUPPLY to perform one function, acquisition of what the customer wants.

I have reduced all the doctrinal logistics functions into three. This provides the following simple and logical expression of logistics:

**LOGISTICS = SUPPLY + DISTRIBUTION + MAINTENANCE**

This definition, derived from current doctrine, is identical to the definition derived from the theory chapter. Importantly, they both recognize distribution as a key function of logistics.

Draft JCS PUB 4.0, Doctrine for Logistics Support of Joint Operations, has almost the identical definition: "Logistics is moving, supplying, and maintaining military forces."<sup>72</sup> JCS PUB 4.0 recognizes logistics as a complex notion with a "myriad" of functions, but still reduces them to three. It suggests the multidimensional model in Figure 7 to give clarity to the subject:

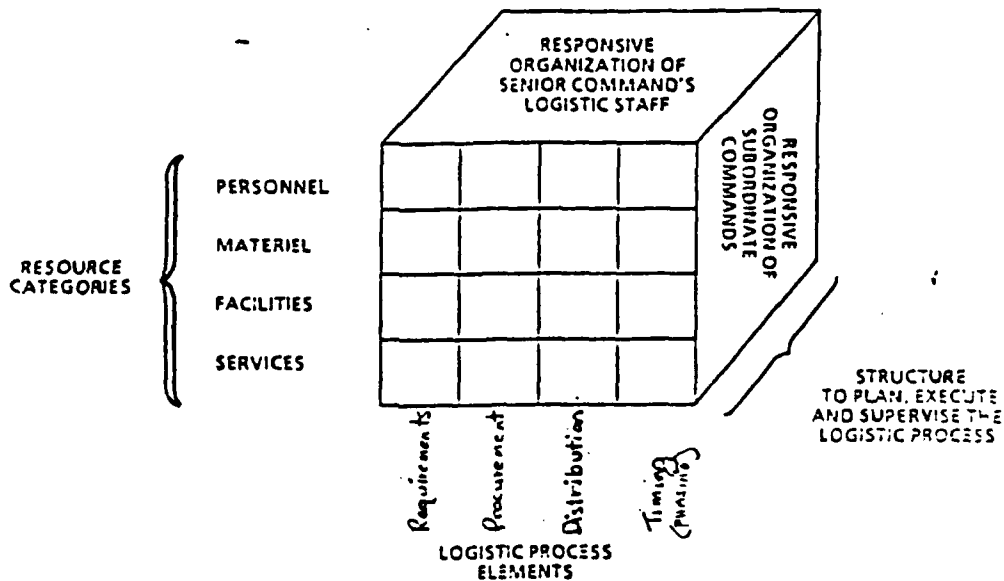


Figure 7



The first dimension is viewed in terms of resource categories, the second dimension consists of four fundamental logistics process elements, and the third dimension is the organizational structure to support the process.<sup>73</sup> The four categories of resources or "means" are personnel, materiel, facilities, and services.<sup>74</sup> The elements of the logistics process are requirements determination, procurement, distribution, and timing.<sup>75</sup>

Again, comparing the draft JCS 4.0 definition of logistics with this study's, the two are almost identical.

JCS PUB 4.0:

LOGISTICS = REQUIREMENTS DETERMINATION + PROCUREMENT  
+ DISTRIBUTION + TIMING

THIS STUDY:

LOGISTICS = SUPPLY + DISTRIBUTION + MAINTENANCE

The JCS definition differs from this study's definition only in that it has a requirements determination and a procurement function vice a supply (form utility) function. It also retains visibility of "timing" in its model, whereas this study considers timing part of the distribution function (space utility + time utility). These are rather minor points. What is significant for this study is that the JCS PUB recognizes distribution as a distinct and major function of logistics.

JCS PUB 4.0 would go a long way towards eliminating the confusion in logistics doctrine if all other JCS PUBs agreed with its definitions. They don't, so we have a similar problem with overlapping terms. JCS Publication 1-02 defines logistics as:

The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations which deal with: a. design, development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; b. movement, evacuation, and hospitalization of personnel; c. acquisition or construction, maintenance, operation, and disposition of facilities; and, d. acquisition or furnishing of services.<sup>76</sup>

The JCS PUBs are the last example I will use to demonstrate how diverse and confusing the doctrinal definitions and concepts of logistics are. This study has logically presented an argument for reducing the definition of logistics to three elements: supply, distribution, and maintenance. JCS PUB 4.0 has reduced the definition to four. The greatest significance of the JCS PUB 4.0 is that it recognizes distribution as a distinct and major element of logistics. This supports the study observation that U.S. Army operational doctrine should contain a concept for logistics distribution in a theater of operations.

For the operational planner, a simplified model applied to developing theater sustainment would be helpful. It would focus on the three key tasks to be performed: supply, distribution, and maintenance. Such a model would not only streamline doctrine to a manageable number of terms, but would focus planners on the key tasks to be performed. Since the lion's share of operational

logistics tasks fall under distribution, a distribution model would be the cornerstone. An analysis of operational logistics doctrine will shed more light on what this model should look like.

#### OPERATIONAL LEVEL LOGISTICS DOCTRINE:

Operational warfare is the "employment of military forces to attain strategic goals in a theater of war or theater of operations through the design, organization, and conduct of campaigns and major operations.<sup>77</sup> The theater of war is a geographical area, integrating all operational forces in that area.<sup>78</sup> The theater of war contains one or more theaters of operations with designated boundaries and lines of operations.<sup>79</sup> It is the purpose of operational logistics to support the forces within a geographical area. During wartime, it sustains them in the conduct of campaigns and major operations.<sup>80</sup>

Doctrinally, the focus of operational logistics is from the theater sustaining base to the base of the forward combat service support unit.<sup>81</sup> From there forward, doctrine considers logistics to be at the tactical level, not operational. I disagree. The operational planner must be able to evaluate the capability of the logistics system from the source of sustainment to the source of the requirement. Restated, operational logistics should manage theater sustainment from the port of debarkation or intra-theater source of supply to the foxhole. This supports the addition of a new criteria-continuity. If the operational planner cannot see a continuous logistics system throughout the area of operations, he

cannot guarantee that sustainment reaches the foxhole. The operational planner should be just as concerned about the capability of logistics at the tactical level as he is about echelons above tactical. The following equation demonstrates the relationship of logistics capability to the logistics requirement:

$$\text{THEATER OPERATIONAL LOGISTICS CAPABILITY} = \\ \text{CAP}_{\text{OPERATIONAL}} \geq \text{CAP}_{\text{TACTICAL}} \geq \text{REQUIREMENT}_{\text{TACTICAL}}$$

The model states that the theater meets its logistics objective if the capability [hence the abbreviation "CAP"] at both the operational and tactical levels are equal to or greater than the tactical requirement. Both levels must satisfy the requirement simultaneously. An abundance of sustainment at the operational level cannot compensate for a shortfall at the tactical level. The system must be continuous and sufficient at all levels. It is critical for the operational planner to understand the relationship. If the logistics planner designs an operation or campaign with only his level of logistics in mind, he may undercut the capability needed at the tactical level. Integration of all levels of logistics is imperative to the operational distribution concept.

An example is a contingency operation in an undeveloped theater requiring entry of forces into a bare-based, desert environment. The operational planner determines the requirements for the ports of debarkation and the theater base of operations.

He, however, leaves the staff estimate and planning for tactical sustainment to the tactical units. This only becomes dangerous if he fails to measure the tactical sustainment requirements and capability or gain feedback to his plan from the tactical support planners. For instance, he may have designed a concept of support which throughputs sufficient personnel and supplies into the theater. Once in country, however, there is scant means to carry the requirement forward. The number of trucks available are too few because other items were placed higher on the Time Phased Force Deployment List.<sup>82</sup> If he follows current doctrine, he might leave tactical logistics planning to others. He might also underestimate the tactical requirements for trucks, pipelines, fuel bladders, and heavy lift helicopters. Limited shipping being what it is, he may fill his operational requirements and leave the tactical ones sitting back at the port of embarkation.

A last word on DESERT SHIELD/DESERT STORM. It is too early at the time of this study to tell if the U.S. effort was doctrinally a logistics planning success or a well executed game of catch-up. It is also too early to evaluate just what doctrinal tools were successful and what tools, in addition to doctrine, proved useful. Two factors were in the Allies' favor which may have covered a few planning shortfalls. First, there was considerable logistics preparation time prior to the ground war. Second, lines of support were safe from enemy interdiction. Whatever the observations from the war are, we need to ensure the correct lessons are learned. They need to be put in perspective

so that we don't change doctrine based on inconclusive evidence.

#### V. DOCTRINAL IMPLICATIONS:

Operational logistics is a joint services consideration. The JCS publication series should, therefore, set precedence for individual service doctrine. The JCS PUB 4.0 definition of logistics is almost identical to the definition developed by this study. It reduces the definition of logistics to a few key functions, to include distribution. I recommend, however, that it eliminate timing as a logistics process element. Theoretically, timing is already part of the distribution process. Once resolved, all other JCS publications and service doctrine should align their discussions of logistics with JCS PUB 4.0.

FM 100-5 Operations, the Army's keystone warfighting manual, should refocus its discussion on logistics to reflect:

LOGISTICS = SUPPLY + DISTRIBUTION + MAINTENANCE

The doctrine should then align all subordinate logistics issues under these three functions. This includes requirements determination, a maintenance concept, and an in-depth concept of operational logistics distribution.

The distribution concept should have form utility, space utility, and time utility as its premise. In laymen terms, a concept for logistics distribution should deliver what is needed, where its needed, when its needed.

Continuous distribution should be the cornerstone of logistics doctrine. By continuous I mean two things. First, logistics distribution must have an uninterrupted flow to the source of requirement. This eliminates unnecessary storage and handling. Second, the system's design should be continuous, or seamless. It shouldn't have distinct levels with different management at each level. The operational planner should envision the distribution system as one piece to be equally facilitated at each level of command. This is a departure from current doctrine which distinguishes between operational and tactical logistics. The operational planner cannot afford to lose the visibility and the understanding of capabilities throughout the entire theater of operations. He must be able to visualize logistics not only at the operational level, but at the tactical level as well. FM 100-5, therefore, should present the distribution equation discussed earlier:

$$\text{THEATER DISTRIBUTION CAPABILITY} = \\ \text{CAP}_{\text{OPERATIONAL}} \geq \text{CAP}_{\text{TACTICAL}} \geq \text{REQUIREMENT}_{\text{TACTICAL}}$$

Next, the concept should have a set of criteria or imperatives. The planner uses them to evaluate his system. Military educators and students can also reference them in doctrine as a training tool. The U.S. Army is not Domino's Pizza. The structure of its distribution system must overcome the peculiarities of supporting war. This study has adopted as criteria the FM 100-5

sustainment imperatives: anticipation, integration, continuity, responsiveness, and improvisation. I recommend integration with a different meaning, however. FM 100-5 focuses on the integration of logistics into the operational and tactical plans.<sup>83</sup> The distribution concept focuses on integrating the different levels of logistics.

I recommend six other criteria as well: command, control, communications, flexibility, depth, and protection. An operational planner can judge the effectiveness of his distribution system by applying these criteria to his concept of support.

The distribution concept should explain accepted doctrinal terms or related concepts that influence its operation. These include base of operations and lines of support.<sup>84</sup> Jomini defines base of operations as "that portion of the country from which the army obtains its reinforcements and resources..."<sup>85</sup> Lines of communication are "all the routes--land, water, and air--that connect an operating military force with a base of operations and along which supplies and military forces move."<sup>86</sup>

The concept should also present accepted techniques of the trade. This study suggests three: power grid analysis, throughput capacity analysis, and use of host nation support. All are in current doctrine and support the accepted distribution criteria.

A power grid is a "transportation and distribution system within a theater"(Figure 8).<sup>87</sup> "It is composed of lines of communication; ports, bases, and airfields; and service units (military and/or civilian) which operate the ports, bases, and



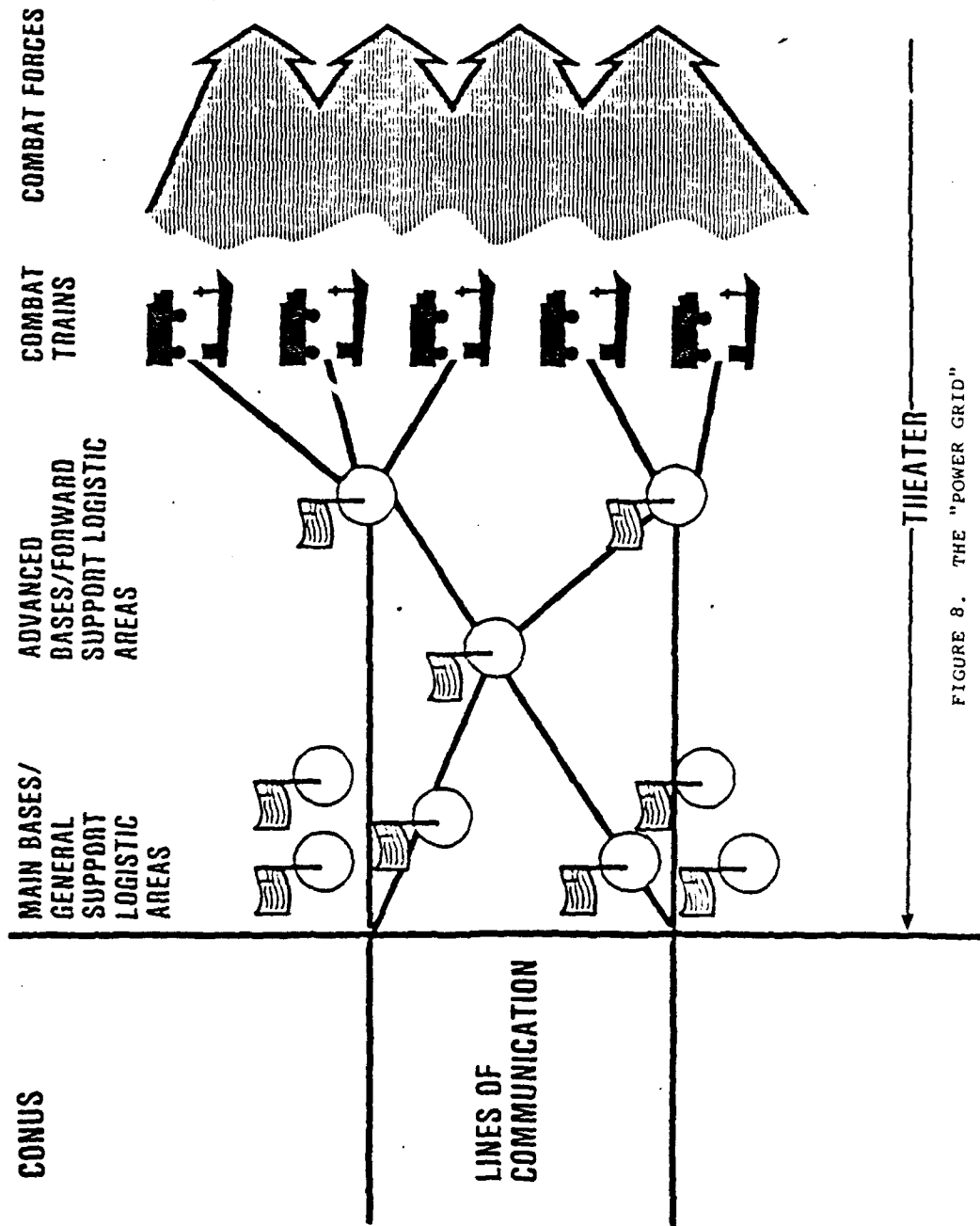


FIGURE 8. THE "POWER GRID"

Figure 8

airfields."<sup>88</sup> The operational logistician analyzes the theater power grid just as the G2 analyses the terrain in his intelligence preparation of the battlefield. He determines the capabilities within the theater so as to evaluate the commander's course(s) of action and make a recommendation. His analysis may have an important impact on the commander's final decision, particularly in an undeveloped theater where resources are scarce.

Distribution throughput is a commonly used technique by U.S. forces. It bypasses intermediate supply activities so as to deliver items forward with minimal handling.<sup>89</sup> Throughput capacity analysis is an integral part of operational logistics planning. It determines how many personnel or short tons of cargo can be brought into the theater and moved through the power grid. As an example, 'terminal' throughput capacity is the "maximum amount of cargo that may be moved through a terminal after consideration of reception, discharge, and clearance factors."<sup>90</sup> This is critical information for the logistician in an undeveloped theater where most personnel, supplies or materiel have to be flown or shipped into terminals. The other throughput consideration is the amount that can be moved forward to the using unit with theater transportation means. This is both a factor of transportation assets available and the transportation network capacity. An example of a tool used for determining throughput capacity is the matrix, Figure 9:

THROUGHPUT CAPACITY MATRIX<sup>91</sup>

(1) <u>Facilities</u>	(2) <u>Reception</u>	(3) <u>Discharge</u>	(4) <u>Clearance</u>	(5) <u>Throughput</u>
Beach-Utah Inaccessible	0	0	0	0
Beach-Omaha LOTS	3,340	3,000	3,240	3,000
Quay #1 Deep Draft	1,300	1,720	2,000	1,300

Figure 9

The third technique for inclusion in the doctrinal concept is the use of host nation support (HNS). For the distribution system, this can mean many things. HNS can provide laborers, transportation assets, fuel, maintenance support, facilities and communications. In an undeveloped theater, it is invaluable in minimizing the amount of logistics that must be introduced by U.S. forces.

The final consideration for logistics distribution in FM 100-5 should be risk assessment. This study defines logistics risk as any course of action which pursues its end with less capability (to include protection) than the logistics estimate requires. Succinctly, its measurement is the difference between capability and requirement. The following chart graphically portrays logistics risk:

## LOGISTIC RISK ASSESSMENT

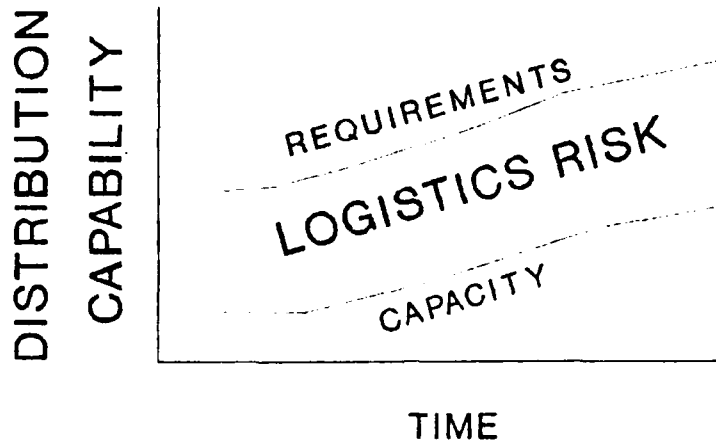


Figure 10

### NON-DOCTRINAL IMPLICATIONS:

A redefinition of logistics and a subsequent concept for distribution has implications in areas other than just doctrine. For instance, a logistics/distribution concept focused on efficient means of supporting operations will signal similar requirements for materiel acquisition, force structure, training, and leadership. Materiel acquisition will target systems that assist the logistician to throughput personnel, supplies and materiel to the customer faster and with less handling. Force designers will structure the logistics units less for static supply activities in the theater of operations and more for transportation of logistics from the sustaining base. Training will gear more on throughput distribution than for issuing from a thousand static supply

points. Finally, the leadership implication is that it will allow the operational commander a better means to exercise his intent.

#### IV. CONCLUSIONS:

The Army does not have a concept of operational logistics distribution. It should. This study has shown the utility of such a concept for planning in an undeveloped theater. It does not stop there, however. The concept is fundamentally correct for any military endeavor requiring delivery of personnel, supplies, or materiel throughout an area of operations. The concept for distribution should be part of the basic concept for logistics:

**LOGISTICS = SUPPLY + DISTRIBUTION + MAINTENANCE**

This straightforward and sound concept would be a keystone for all other functions which are subordinate to logistics. It is absolutely necessary that the military eliminate the plethora of terms and definitions found in doctrine and make it less confusing. It would also focus the operational logistician on his one key task distribution of personnel and supplies from the theater port of debarkation or intra-theater source of supply to the foxhole. A simplified logistics and distribution concept would generate efficient operational planning vice the current doctrine which espouses a multidimensional system beyond comprehension.

An operational logistics distribution concept will serve the Army well. U.S. forces will likely be involved in future

operations in undeveloped theaters. Building a theater logistics infra-structure--specifically a distribution system will be the first order of business. Operational doctrine currently does little to assist the planner in meeting this task. The most critical issue is the perspective which the concept should give the planner. There are three characteristics. First, the operational plan should envision logistics from the base of operations all the way to the foxhole:

THEATER DISTRIBUTION =

CAP<sub>OPERATIONAL</sub> ≥ CAP<sub>TACTICAL</sub> ≥ CAP<sub>REQUIREMENTS</sub>

Once the operational planner understands his requirements and capabilities, he can assess the supportability of the mission. Second, a military distribution concept has imperative criteria to be considered in the planning process. They are either general or specific in nature. The general criteria are form, space and time utility. The specific criteria are command, control, communication, innovation, anticipation, responsiveness, improvisation, flexibility, depth, continuity, and protection. Finally, the concept should include common logistic terms and basic distribution planning tools currently found in doctrine.

Operational logistics doctrine requires more utility and less confusion. A concept of operational logistics distribution will focus planners on key issues and orient the army on a more efficient and responsive means of sustaining the force.

## ENDNOTES

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29. Brian Duggy and others, "The 100 Hour War," U.S. News and World Report, March 11, 1991, p. 34.
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31. The daily supply buildup requirement equals the stockage objective divided by the days to accomplish buildup. Programmed Instruction ALM-66-3090-PI(L): "Supply Planning" (Fort Lee: United States Army Logistics Management College, 1989), p. 7.
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65. FM 100-5, Operations p. 62.

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70. FM 100-5, Operations, p. 60.

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78. FM 100-6, Large Unit Operations (Coordinating Draft) (Fort Leavenworth, Kansas: USACGSC, 30 September 1987), pp. 2-1.
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