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INITIALLY PROVIDES BACKGROUND INFORMATION SURROUNDING UNIT DEPLOYMENTS OF U.S. ARMED FORCES TO CONTINGENCY AREAS. MAKES RECOMMENDATIONS THAT THE DEPARTMENT OF DEFENSE EXPAND THE USE OF BOTH CONTAINERS AND CONTAINERSHIPS TO DEPLOY UNIT EQUIPMENT. ADDITIONALLY, PROVIDES A METHODOLOGY OF CONTAINER SELECTION APPROPRIATE FOR EACH BATTALION-TYPE. THE COMMERCIAL CARRIER'S PERSPECTIVE ON THE USE OF THE INTERMODAL TRANSPORTATION SYSTEM FOR UNIT EQUIPMENT IS ALSO INCLUDED.

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THE ARMY'S USE OF CONTAINERIZATION FOR UNIT DEPLOYMENTS

by

Susan R. Sowers

A thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Science

University of Washington

1991

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CHAPTER 1:
INTRODUCTION

1.1: PURPOSE

The changing world political environment and domestic budgetary considerations have produced radical changes in American military strategy. The long-standing concept of "forward-defense," with a focus on the Soviet threat to Central Europe, has evolved into a strategy of limited "forward presence" and a reliance on the rapid movement of reinforcing units stationed in the continental United States. Rather than focusing on the European theater, the new strategy addresses potential threats in several distant regions of the world [Cardner, Army Staff, interview October 1991]. To meet the demanding deployment (overseas movement) requirements of this new strategy in a fiscally austere environment, the U.S. Army will have to rely on the use of both military and commercial airlift and sealift assets, to include existing container systems and the predominantly containerized U.S. flagged shipping fleet.

This thesis examines the sealift portion of deploying unit equipment during contingency operations in order to identify the benefits and disadvantages that would result from the Army's expanded use of both standard and specialized containers. While the military has shipped resupply type cargoes in containers for many years now, unit equipment consists primarily of outsized vehicles that are not readily containerizable. This document describes many of the challenges that impact the nation's ability to deploy units worldwide, such as the changing political environment, sealift shortfalls, lack of updated deployment doctrine, and various other resource inadequacies. While primarily addressing the topic of containerizing unit equipment for overseas deployment from a broad Army-wide policy viewpoint, this thesis also looks at unit level considerations. After examining the Army's current unit equipment containerization status, describing previous containership deployment research, and identifying container systems with potential military application, a methodology for unit level container selection is presented. The container selection methodology was intended to assist the Army in developing appropriate levels of containerization for each type of unit. This discussion and analysis will illustrate how, especially in a period of declining defense budgets, existing container systems and the U.S. commercial shipping fleet can serve as a truly practical, responsive and cost-effective means of assisting the Army in meeting the difficult deployment requirements dictated by the nation's military strategy.

1.2: BACKGROUND

As the world's principal superpower, the United States has unique global interests and responsibilities. The nation's military strategy, which is designed to protect American interests world-wide, clearly cannot be executed without a transportation system that is capable of deploying and sustaining forces over long distances.

America's transportation system is, therefore, a fundamental element of our national power. When the military is tasked to mobilize for war- the ability to move equipment to the ports depends almost exclusively on the commercial rail and trucking industries. Likewise, the United States has long relied on its Merchant Marine Fleet to assist in projecting power, or relocating forces, across the ocean in support of national political objectives. The commercial transportation industry and the U.S. government have formed a partnership that assists in the movement of military forces, and is known as the Defense Transportation System. This coalition of military and commercial assets is intended to allow the nation's leaders to muster all necessary transportation assets to meet the common goal of national security. As a result of the Department of Defense's (DOD) wartime reliance upon the commercial transportation system, the military should thoroughly examine the requirements for utilizing the commercial industry's existing intermodal (combined ocean/rail/truck) transportation network. If the analysis indicates that expanded containerization offers potential gains in the nation's deployment capabilities, then ensuring compatibility with that system will assist the military in capitalizing on these available commercial assets.

Terms commonly used to describe the nation's requirement to deploy and sustain military forces worldwide in support of national interests include: strategic mobility, force projection and power projection [NWP 80]. The Department of Defense has always had the mission of being able to deploy forces from the United States; but the term power projection, has taken on new meaning with recent worldwide events. As a result of many factors, especially the perception of a reduced Soviet threat, an ever broadening global scope of U.S. political concerns, and a declining defense budget- the United States is reducing the number of forward-deployed units in Europe and bringing them back to the continental United States (CONUS). With a smaller, more tailored military, power projection emphasizes the nation's ability to rapidly move units to crisis locations worldwide and to mass them quickly enough to overwhelm the enemy [Stone, 1991].

Since even the most combat ready forces cannot be employed without adequate 'lift', or transport, this becomes an important issue when evaluating national security. In most cases, the term lift is used when addressing <u>inter</u>theater transport, or strategic moves across the ocean- versus <u>intra</u>theater transport, which includes the tactical moves within a country or a confined geographical region. Lift includes both airlift and sealift. Airlift is the quickest method of response, and will ferry nearly all the required troops to their wartime area of operation. Airlift provides the capability to insert rapidly deployable forces into a theater of operations, to link soldiers with equipment deployed by sea, and to deliver time-sensitive priority cargo [Stone and Vuono, 1991]. Its greatest advantage is that it can deliver its cargo to the required location within hours of an alert notification. For contingencies where surprise and only small amounts of forces are required to be transported, airlift usually serves as the primary means of conveyance.

Sealift, however, has historically been the method of deploying the majority of equipment needed for <u>major</u> deployments. For example, in the Korean, Vietnam and recent Iraqi (1991) conflicts, sealift comprised 90-95 percent of all dry cargo, and 99 percent of all petroleum products transported [Johnson, "Managing Change," 1990]. Unlike airlift, sealift generally requires several days for loading, and anywhere from five to twenty days to steam across the ocean. While sealift is not as fast as airlift, it can carry far greater amounts of tonnage and is significantly cheaper. Strategic mobility planners for the military operate on the following rule of thumb: 90% of the equipment will go by sealift, and 10% will go by air. The costs, however, are the inverse; 90% of all lift dollars are spent on the 10% that was airlifted [Davis, TEA, interview March 1991].

The sealift portion of deployments fall into three categories: floating prepositioned storage of supplies/equipment (prepositioning); rapid initial overseas deployment of unit equipment and supplies (surge sealift); and long-term resupply of overseas forces (sustainment sealift) [NACOA, 1985]. As stated at the beginning of the document, this thesis examines only the use of containers for the movement of unit equipment, which falls into the surge phase of deployments. While containers already play an important role in the sustainment and prepositioning phases of deployment, their use in transporting unit equipment during the surge phase has not yet been fully exploited.

1.2.1: Current Deployment Conditions

Ever since the first overseas deployments of World War I, units have typically packed as much of their unit equipment as possible in plywood or cardboard boxes, and then nested them in the cargo space of their vehicles/trailers. These vehicles were then transported, either commercially or under their own power, to the port. Any equipment which did not fit in the back of their vehicles or trailers was then crated by a commercial transportation company and also moved to the port. Beginning with the Korean War, the Army began to supplement their unitization effort with intermediate-sized steel boxes called CONEXs (Container Express). These were used extensively in the Vietnam Conflict of the 1960's, as a method of transporting and securely storing both unit equipment and sustainment supplies [Neshiem, 1984]. During the 25 years since the Vietnam Conflict, however, the majority of the existing CONEXs have deteriorated to a nondeployable shipping condition [Brower, interview August 1991].

Within the past decade or so, several factors have made the packing, handling and shipping of unit equipment in ply-wood or cardboard boxes less efficient, and more time consuming and costly. The singularly most important factor that requires the Army to re-examine these traditional breakbulk-type deployment practices, was the advent of the commercial industry's intermodal container shipping practices. The term, 'breakbulk,' applies to the ocean shipping of goods that are lifted individually into large open ship holds, versus 'container' shipping, where the cargo items are unitized in standard boxes, resulting in fewer lifts and more efficient handling. The commercial industry's shift away from breakbulk ships, to the modern containerships which currently transports 80-90% of all dry cargo, underscores the potential requirement for the Army to shift their complete reliance in breakbulk shipping methods towards greater levels of containerization [NAVFAC P-1051, 1990].

Within recent years, rather than contracting a commercial shipping company to crate the extra equipment that a deploying unit could not carry in their own (organic) cargo space, the Army has started supplying 20-foot standard commercial containers to the deploying units. For the most part, these containers are used to carry a small portion of the unit's equipment, and must be returned to the transportation system once the unit is offloaded at the port of debarkation. The transportation managers within the theater of operations are then responsible to collect and move the equipment forward that was originally transported in containers. Further, these deployment containers are not shipped in the intermodal system aboard container vessels, but rather are transported as breakbulk cargo aboard Roll-On/ Roll-Off ships, barge carriers, or breakbulk ships.

While the Army has started taking those first steps toward supplementing unit moves with containers, this thesis illustrates that current usage is haphazard in its planning and inefficient in its application. The new Army container regulation (AR 56-4, September 1990) requires units to optimize the use of containers during deployments, but nearly all units are unaware of how many containers they would need- or how to load, document and handle containers should they receive them [Davis, Transportation Engineering Agency, interview July 1991]. This lack of container planning at the unit level impacts the installation's ability to properly predict the magnitude of container demand that a post will require in emergency situations [Allison, Fort Lewis' Installation Transportation Officer, interview March 1991]. Such information shortcomings forestall installation transportation officers (ITO) from adequately coordinating with leasing companies for no-notice container requirements, and could ultimately result in delaying the deployment schedules of their tenant units. In addition to the current lack of planning, containers are being used inefficiently when they are taken away from the unit at the port of debarkation. The benefit of being able to return containers back to the transportation system for other units to use, is that fewer containers will have to be leased by the military. But units that are unable to carry all their own equipment from home station to the port of embarkation will probably still need the transport and storage capability that containers offers throughout their entire deployment.

1.2.2: Desired Deployment Conditions

The current commercial intermodal transportation system is efficient, highly mechanized, automated, and integrated around a system of transporting standard size containers. This system is called, 'intermodal' because the cargo is shipped in standard size boxes that can be easily transferred from one mode of transport to another. Once the intermodal system was in place, it enabled cargo to be moved door-to-door under the control of a single carrier, rather than just terminal-to-terminal [MARAD, October 1990].

By expanding the use of containers for deploying unit equipment, the Army could potentially tap into the coordinated intermodal operations and logistics capabilities that the American shipping companies provide to their commercial customers on a daily basis. Using an integrated intermodal system could also provide the Army with a more timely and cost effective method of transport, rather than contracting independently for rail, ocean and truck services. [Hayashi, June 1991]

In addition to providing better compatibility with the commercial transportation industry, containers may enable units to maintain a higher readiness stance during peacetime. For example, units which carry a great deal of repair parts might be able to store the parts in the containers and work out of these containers while in garrison. These items would be constantly prepared for movement, should the unit be activated. Containers could also prove beneficial during unit deployments by providing a source of secure storage for units once they were deployed. The prospect of enabling containers to provide both a transport and storage facility helps fill a unit need that was previously met with the CONEX. Unlike CONEXs, however, by using the international dimensional standards required of the commercial container, the military could take advantage of the intermodal community's transportation network throughout the deployment process.

To expand the use of the intermodal network, agreement is necessary among policy makers at the highest levels of the Army on how units are to deploy in the future. If the Army is to continue its path towards increased containerization, then a detailed look at the various issues involved in using containers during the surge phase of a deployment must be addressed. These issues include:

1) Is unit equipment going to be deployed on containerships in future contingencies?
2) Are containers going to remain with a unit throughout the deployment? and,
3) What resources, such as material/container handling equipment, will be required for increased levels of containerization to be implemented smoothly?

These basic types of doctrinal shipping questions are examples of the various questions that must be resolved at the highest policy-making levels prior to implementing this major change in current deployment practices.

1.2.3: Additional Background Information

During the course of this paper, information on both the Transportation Operating Agencies and the 1991 war with Iraq will be referred to. This section serves to provide introductory background information on both of these areas. In addition, a brief deployment sequence is outlined for the reader who is unfamiliar with the typical flow of events during the surge phase of a deployment.

The Transportation Operating Agencies:

The Transportation Operating Agencies are key players in the deployment process. The U.S. Transportation Command (USTRANSCOM) is responsible for the three subordinate transportation operating agencies that coordinate and manage the transportation assets used to deploy forces abroad. These three agencies include: the Military Airlift Command (MAC), Military Sealift Command (MSC), and Military Traffic Management Command (MTMC). MAC, the component command operated by the U.S. Air Force, is responsible for the execution of strategic airlift. MSC, operated by the Navy, is responsible for acquiring the necessary sealift assets. And finally, MTMC, a major Army command, coordinates for the surface movement of forces from all branches of the military, and supervises all the port operations requirements [Dungan, 1991].

The 1991 War with Iraq:

In August 1990, Iraqi soldiers invaded and took control of Kuwait. After the capture of Kuwait, the Iraqi units established themselves in a potentially threatening stance toward the bordering country of Saudi Arabia. Two days later, the President of the United States ordered the deployment of the largest initial group of American Forces since World War II, into Saudi Arabia to defend both their Allied and American economic interests [DA DCSLOG Strategic Mobility Division, briefing charts, June 1991]. This deployment phase of the 1991 war against Iraq was called, 'Operation Desert Shield.' On 17 January 1991, the primary mission changed from deployment and establishment of defenses in Saudi Arabia, to the start of the coalition air war against Iraq. (Coalition air war, meaning that 33 countries were united in fighting against Iraq.) After the 17th of January, the war was referred to as 'Operation Desert Storm.' The air offensive was followed by the ground war, which began on 23 February and was concluded on 27 February with an unconditional surrender from Iraq's president [Flanagan, April 1991].

Military officials felt this recent large scale deployment provided an excellent test of the United States' ability to deploy troops on a no-notice basis [Johnson, October 1991]. While great levels of cooperation and hustle were provided from the Defense Transportation System, the deployment underscored the nation's transportation limitations in projecting power quickly half-way around the world [Henderson, Strategic Mobility DCSLOG, interview April 1991]. The unprecedented and extraordinary logistical effort ultimately resulted in a military victory, but the fact that it took six months to get all the units to the theater of operations has spurred interest in improving strategic mobility capabilities from the U.S. government.

Throughout the thesis, this war will be referenced to provide current empirical evidence on deployment requirements. 'Desert Shield' will be the terminology used if the information relates strictly to the initial deployment phase prior to any hostilities. The conflict will be referenced as 'Desert Storm' if the issue deals with a period of time that continued beyond the 17th of January 1991.

The Deployment Sequence:

This thesis is primarily a policy-oriented document and not intended to be a 'user's guide' on the procedures for employing containers during deployments. However, the relevant deployment issues may not be fully appreciated without first describing the typical Army deployment process. Figure 1.2.1 illustrates the important procedural steps taken during the deployment of unit equipment. (Field Manual 55-65, Strategic Deployment by Surface Transportation, provides the basis of the deployment procedures listed in the Figure.) [FM 55-65, May 1989]

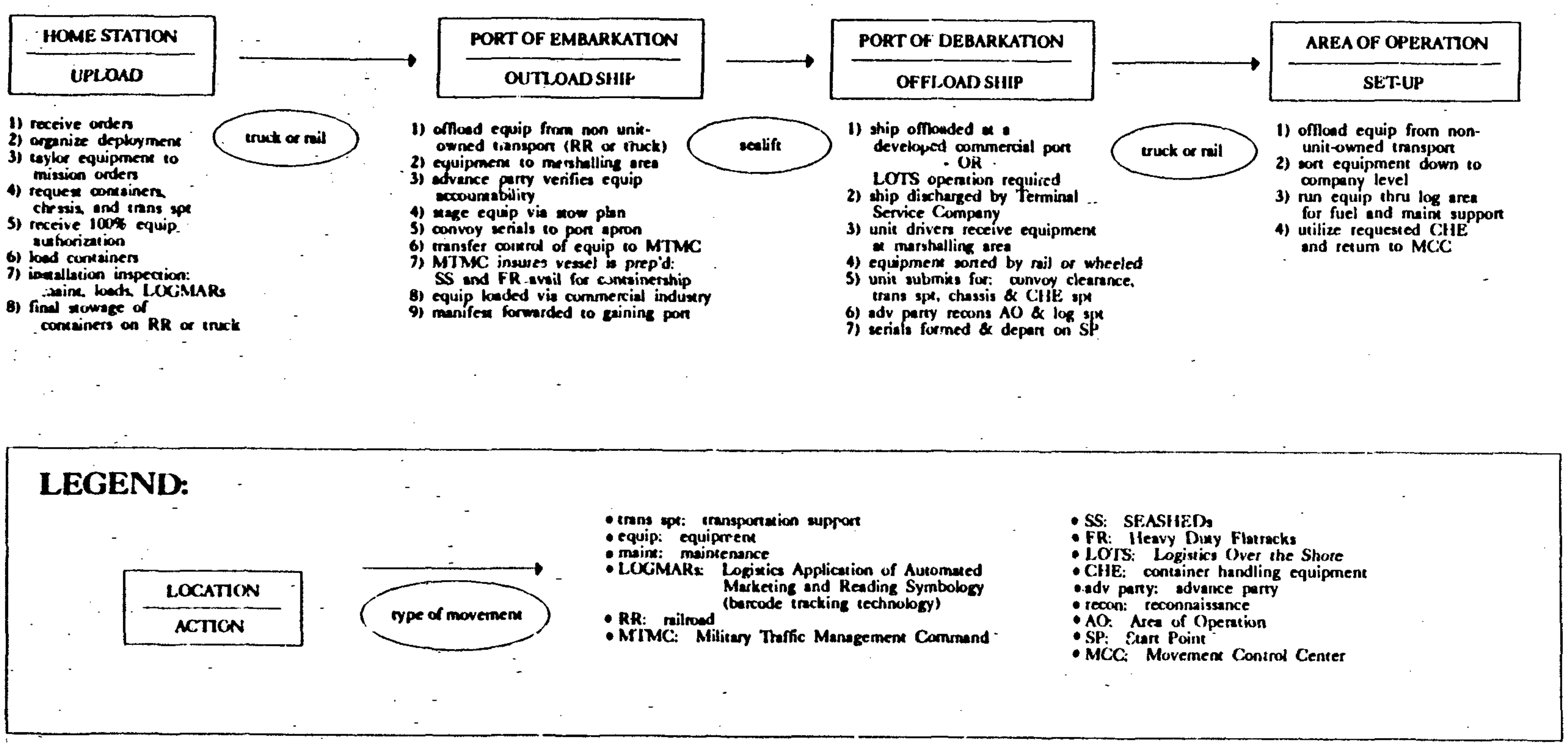


Figure 1.2.1 The Deployment Process

The Figure lists the key steps taken at each of the four transshipment points, or locations where unit equipment is transferred, loaded or unloaded. These four locations include:

1) the unit's place of origin;

2) the port of embarkation;

3) the port of debarkation; and

4) the unit's initial area of operation.

Within the Figure, the boxes at the top indicate these four locations and the primary action that occurs at each transshipment point along the deployment route. The arrows indicate some sort of movement. The type of movement is subsequently defined in the circle under the arrow. In an effort to condense all the information onto a single page. some as of yet unexplained military terminology is used. The legend provided at the bottom of the Figure should assist the reader in interpreting the abbreviations. The definitions of the military organizations and unfamiliar terms can be found in the Glossary and will also be discussed throughout the rest of the paper. While some units may experience slight variations to the deployment sequence illustrated in Figure 1.2.1, the outlined deployment scenario should provide the reader with a basic understanding of the various events that occur at each transshipment point along a unit's deployment process.

1.3: SCOPE AND LIMITATIONS

The scope of this thesis looks at broad Army-wide deployment concepts surrounding the use of containers for deploying unit equipment. It provides background on various deployment problems, and investigates the requirements for containerizing unit equipment in future contingencies. The recommendations offered in this thesis are primarily policy-type in nature and are oriented for an audience at the highest levels of the strategic mobility infrastructure.

Secondly, the recommendations in this document are focused specifically at the needs of the Army. While the Marines and the various land-based units in the other Service Branches may also benefit from the use of containers, addressing the deployment needs of the Army is the primary focus of this document.

Finally, the following areas, while germane to the discussion of deployments and involve the use of containers, are outside the scope of this thesis:

a) Logistics-Over-the-Shore (LOTS) operations. In times of combat, it is important that the military is able to discharge ships in an undeveloped or destroyed port area. There has been considerable amounts of research, development, and procurement conducted in this area [Woodman, April 1989]. This thesis only mentions the fact that these capabilities are available when needed.

b) The Palletized Loading System. This document does not address the new containerized <u>intra</u>theater resupply system because it is not a part of the unit deployment process. The Palletized Load System, is a type of container and truck system that is being developed primarily for ammunition resupply throughout the combat-zone. [Transportation Master Plan, December 1987]

c) Sealift and container requirements. This thesis does not provide the quantitative analysis to determine the amount of square footage, or number of containers required to move the entire Army. That study is currently being conducted by both the Army Staff and the DOD Joint Staff in their Defense Mobility Requirement Study (DMRS) [Henderson, April 1991] [Dungan, 1991].

1.4: ASSUMPTIONS

The basic character of this thesis is general enough to be understood by a broad audience. It is assumed, however, that the reader has a basic level of transportation knowledge and vocabulary. Since the basic premise of the paper is directed at making Army-wide policy changes at the highest levels, strategic mobility policy makers, those agencies dealing with military deployments, and the commercial carriers, would probably gain the greatest benefits from this study.

Secondly, since the Navy has their own ships to carry the preponderance of their sailors, and the Air Force deploys a great deal of their airmen on their own planes- it is assumed that the Army is the primary customer of sealift. The Army does not own or control any strategic deployment assets and must be either airlifted or sealifted to the location that they will fight. Along these same lines, it is assumed that the Army desires an active role in determining the types of sealift that will be selected for deployment purposes.

Perhaps most importantly- the thesis assumes that the military will not have enough money to buy all the strategic sealift required for large-scale deployments, and will therefore continue to be dependant upon U.S. Merchant Marine to augment the deployment of Army units and their equipment. In conjunction with the presupposition that the military will continue to rely on the U.S. Merchant Marine Fleet for sealift augmentation, this thesis also assumes that the commercial fleet will continue its trend toward using greater numbers of containerships.

1.5: METHODOLOGY

This thesis contains an accumulation of information on the military's use of containers for deploying unit equipment from sources that include:

1) A comprehensive review of published and unpublished military reports on containerization and national policy objectives;

2) A review of published literature on commercial containerization and intermodalism; and

3) Extensive personal interviews and telephone calls with agencies that include: the Transportation Engineering Agency (TEA) of Military Traffic Management Command (MTMC); The Army's Research, Development and Engineering Center (RD & E); Military Sealift Command (MSC); Sea-Land Services Inc. (to include a personal interview with the Vice-President of Government Sales); American President Lines (to include a telephone interview with the Vice-President of Processes and Systems); the office of the Deputy Chief-of-Staff of Logistics (DCSLOG); the U.S. Army Transportation Center and School; the U S. Army Quartermaster Center and School; the Maritime Administration (MARAD); selected members of the 864th Combat (Heavy) Engineer Battalion from Fort Lewis, Washington; and the U.S. Navy Civil Engineer Support Office (CESO). Refer to Appendix D for the specific list of people interviewed.

In a case study fashion, a Combat (Heavy) Engineer Battalion was used to illustrate how a particular unit's mission requirements and transport/material handling capabilities must be considered in determining the types and amounts of containers that are appropriate for that unit. In addition, MTMC's Transportability Analysis Reports Generator (TARGET) model was used to demonstrate a methodology for determining how many containers (of any size) are required to augment a unit's transportation requirements

1.6: ORGANIZATION

This information in this thesis is divided into eight chapters. Chapters 2, 3 and 4 provide the necessary background information on current Army unit deployment practices, roadblocks which stand in the way of expanding containerization, and the various issues that must be addressed before containerization can be fully embraced. Chapter 5 presents an overview of many types of container hardware that may be useful for unit deployments. Analysis of the hardware and guidelines for container selection is provided to assist the reader in choosing the appropriate containers for any battalion-type. The case study in Chapter 6 uses the information provided in the previous chapter to demonstrate how a military planner would determine the right container combination for an Engineer Battalion. Since the military is dependent upon the commercial transportation network to augment deployments, Chapter 7 presents the commercial carriers' perspective on containerizing DOD unit equipment for deployments. Finally, Chapter 8 summarizes the advantages and problems involved with expanding containers to deploy unit equipment, and subsequently presents the author's recommended actions to make this program work.

CHAPTER 2:
SEALIFT: THE BACKBONE OF DEPLOYMENT

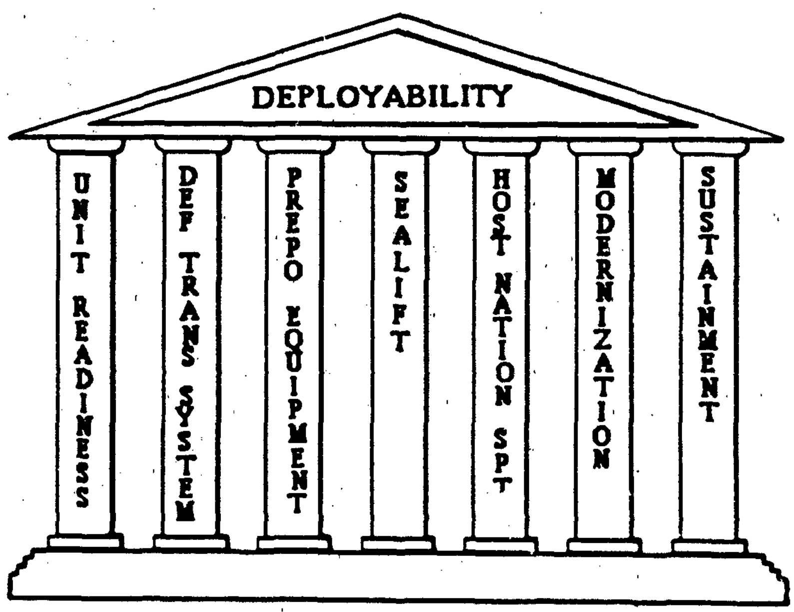
Since sealift is responsible for the movement of 90 - 95% of all equipment and supplies that are strategically transported during a large-scale war, this chapter focuses strictly on that key component of deployability. Determining the appropriate path to ensure there is adequate sealift to meet national defense requirements is a complicated problem with no clear cut solutions. This chapter does not provide a detailed accounting on the types and quantities of ships that the nation requires to deploy U.S. forces under the various regional and global threat scenarios. As stated previously, that type of study is beyond the scope of this thesis and is currently being researched in the 1991 Defense Mobility Requirements Study (DMRS). This chapter, however, is intended to familiarize the reader with the basic background surrounding the sealift issues affecting deployments, and then offer a somewhat different perspective for acquiring sealift than is currently being proposed by the Joint Staff. It challenges the cost effectiveness and reasonability of the current Army position to buy large numbers of military-owned and controlled strategic ships, versus expanded reliance upon the commercial maritime industry's assistance in unit deployments.

Operating under the assumption that the military will be unable to buy all the ships it may need for power projection purposes, this thesis postulates that the United States will continue to use commercial vessels for sealift augmentation in future wars. Under this premise, it is important that the military adapt their deployment methods to ensure compatibility with the commercial industry's ships. Even more so, if the U.S. intends to attain the flexibility to intercede militarily in foreign affairs, without allied support, it must begin to tap into the portion of the commercial fleet that has not been used for deploying unit equipment. The bottom line of this chapter purports that since 80% of the available shipping tonnage in the U.S. flagged merchant fleet consists of container vessels, the Army must capitalize on this available lift to unilaterally deploy adequate forces in acceptable timeframes.

2.1: DEPLOYABILITY AND SEALIFT

Deployability is a condition that is achieved by maintaining acceptable levels of performance from the various components which operate in support of power projection. It takes into account all the requirements for deployment, such as: the preparedness of a unit, the synchronized functioning of the U.S. defense transportation system (which enables units to get to the port), and having the proper weapons systems and equipment available to meet the mission assignment. When any of the major components necessary for making the military a world-wide deployable force are missing or constrained, then deployability breaks down. Strategic sealift is perhaps the most crucial component to achieving a state of deployability. Without this critical component, even the most combat ready force cannot be employed to deter aggression and conduct military operations in a desired region [Vuono and Stone, June 1991].

The diagram in Figure 2.1.1 is presented to assist in conceptualizing the concept of deployability and its dependence upon various other factors. In the Figure, the pediment of the building represents the goal of deployability; the



[Drawn by James D. Burns] [Source: General Glen Otis' testimony to the Senate Armed Services Committee, 12 April 1988]

FIGURE 2.1.1 Deployability and Its Components

columns represent the supporting components [Otis, 1988]. While this chapter focuses primarily on the component of sealift, the rest of the thesis addresses aspects within the components of modernization (containers versus breakbulk shipping) and the defense transportation system. While each column (component of deployability) in the structure is important in maintaining the conditions where deployability is possible, clearly, sealift is the backbone of deployment.

2.2: THE CHANGING FORCE STRUCTURE AND ITS IMPLICATIONS

Entering the 1990's with the recent end of the Cold War Era and the collapse of the Communist bloc, the nation's threat scenarios are undergoing a great deal of revision by military strategists throughout the Department of Defense. The shift in focus from a superpower conflict in Europe to worldwide regional contingencies will result in fewer forces forward deployed. Prior to the fall of the Berlin Wall in 1989, force planners were primarily concerned with the threat from the WARSAW Pact. They developed the strategic mobility requirement which stated that the U.S. must be able to deploy six CONUS-based divisions from U.S. installations and four forward-deployed divisions, within 10 days (called the 10-in-10 force). This requirement was in support of the NATO alliance, and planning factors included Allied sealift augmentation of 400 vessels to help deploy U.S. forces. It also included a program of prepositioned equipment (POMCUS) stored at sites throughout Western Europe, which relieved a portion of the sealift burden for such a contingency [Otis, 1988].

Currently, the requirement is being changed to the immediate and simultaneous lift of one light division (by air) and two heavy divisions, anywhere in the world, in 30 days. The 30 days includes the time required to cross the ocean, and does not assume prepositioned equipment, as was the case in Europe [Baker, 1991]. Light divisions are mobile units, such as Airborne /Air Assault forces. As their name implies, they have relatively few heavy or oversized vehicles, and may be airlifted to the area of concern. Heavy divisions denote an armor or mechanized unit whose equipment must be moved primarily by sea. The requirement to move two armored divisions would include approximately 600 tanks, a vast assortment of other wheeled/outsized equipment, and supplies for 35,000 soldiers [Matthews, 1991].

At the same time that the threat scenarios are changing, the force structure of the active military is being reduced. In 1991, budget constraints and the diminishing Soviet threat have encouraged the Bush administration to take advantage of peace initiatives by reducing the size and altering the geographic locations of U.S. forces. General Vuono, Army Chief of Staff, outlined the changes to Congress in March 1991, stating, "the smaller, CONUS-based force will be called the Contingency Corps, and will consist of only five divisions." [Henderson 1991] In addition to the Contingency Corps at home, this force will be supplemented by a much smaller 'forward presence' in vital areas around the world ["Forward Defense to Power Projection", April 1991]. By reducing the current size of the Army and withdrawing the number of forward-based divisions and prepositioned equipment, the difficulty in projecting power quickly and effectively is increased. The fact that the U.S. can no longer rely on major forward-deployed forces to initially contain the threat translates to CONUS-based units that will need to deploy with more equipment, at greater speeds, and perhaps more often.

This new strategic mobility requirement assumes that the wartime scenarios are changing towards regional conflicts that offer much shorter warning time, and that these conflict will be in areas with little or no infrastructure [Dungan, 1991]. In addition to deploying one light and two armored divisions in 30 days, there is the additional requirement to have the rest of the five division corps and its support units on the ground within 75 days [Smith, May 1991]. The new strategic mobility requirement is extremely challenging, and should encourage military strategists to exploit all possible sources of U.S. sealift.

When addressing the 45th Annual Transportation and Logistics Forum in September 1990, Vice Admiral Paul D. Butcher, Deputy Commander-in-Chief of U.S. Transportation Command (TRANSCOM) addressed this subject with concern and said; "as we withdraw our troops from overseas bases, it is essential for the security of our nation to find the funds necessary to increase our strategic lift capability." [Hogan, 90]. The ongoing requirement to withdraw military forces back to the United States clearly makes the availability of sealift even more critical than ever before.

2.3: THE MERCHANT MARINE

As the component of sealift becomes increasingly critical to national security requirements, the United States finds its merchant maritime industry in decline. The industry is not on the verge of collapse, but it is important for government officials who are making decisions that affect that industry to understand the vital role that it plays in deploying U.S. forces abroad. Using Desert Storm as an example of the merchant industry's role: two-thirds of the sealift vessels were commercial, every port of embarkation was commercial, and all the manpower and repair facilities to deploy the ships came from civilian ranks as well [Pouch, May 1991].

2.3.1: Merchant Marine Policy Background

Legislation which requires merchant vessels to augment the deployment of military equipment and supplies during times of national emergency has been in effect since the Merchant Marine Act of 1936. [Public Law 49-1985, Merchant Marine Act of 1936] This Act established several things. First, it set forth the principle that the United States will play an active role in international commerce, and will establish and maintain its own fleet of vessels (the merchant marine fleet) to achieve these goals. Secondly, it charters the merchant marine to serve as naval auxiliary in times of war or national emergency. This Act established the clear connection between the merchant marine and its role in the national defense of the United States. It has long been the policy of the United States to maintain the dual role of the commercial maritime base as a means of reducing the need for a large government owned or controlled fleet. The merchant marine has a long-standing and proud tradition in their role as the 'Fourth Arm of Defense' in times of war. Not only has it provided the majority of sealift in projecting forces abroad during all major U.S. conflicts, but it has served as the lifeline of logistical support to the soldiers once they have been deployed overseas. [Translog, July 1989]

2.3.2: Highlights of the Declining Merchant Marine

To appreciate the concerns of whether adequate strategic sealift is available, it is important to first understand the declining trends of the merchant marine. A good summary of the complex problems associated with the declining maritime industry and its impact on the nation was published in the four volume report by the Commission on Merchant Marine and Defense. [Denton, 1987] This five member commission was appointed by President Reagan on December 5,

1986. In the First Report's opening letter to the President, the chairman, Senator Jeremiah A. Denton, expressed the committee's concerns:

> The principle significance of the Commission's findings to date is that there is clear and growing danger to the national security in the deteriorating condition of America's maritime industries. The United States simply cannot continue to consider itself secure, much less retain leadership of the Free World, without reversing the decline of the maritime industrial base of this nation, a nation that would depend so heavily upon control and use of the oceans for concluding a protracted war on acceptable terms. Moreover, use of the seas would be essential for sustaining the civilian economy throughout the duration of the conflict.
> [Denton, 1987]

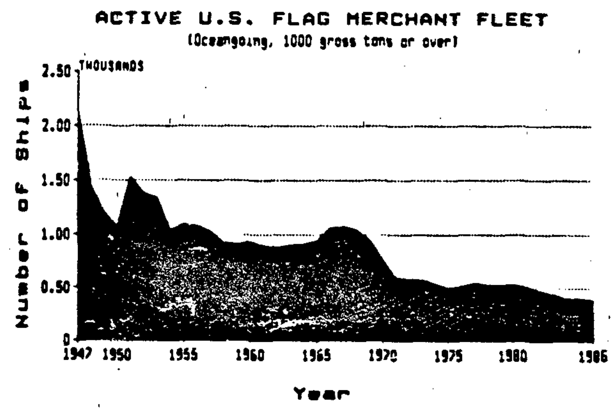
The commission's reports offers a great deal of detail as to why they believe that the maritime industry is in serious decline. They found severe problems in almost every aspect of the U.S. shipping industry, to include:

1) the declining size of the fleet,
2) the declining percent of U.S. cargo carried in U.S. ships,
3) the reduced availability of seamen, and
4) the declining shipbuilding industry.

The following information briefly outlines the problems within the shipping industry to enhance the reader's understanding of both the commercial shippers and military's perspective on the various sealift issues.

Size of the fleet: Since World War II, the decline in the U.S. Merchant Marine Fleet has been dramatic. The number of active U.S. flagged ships decreased from 2,114 in 1947 to 397 in 1990 [Margolius, 89] [Ship Register, 90]. Figure 2.3.1 illustrates the steady decline in the number of American shipping bottoms since the end of World War II, with a few peaks in the curve reflecting the sealift requirements of subsequent wars. This decline, even in the recent past, has been fairly rapid. In 1989 the U.S. merchant fleet lost about one million tons in shipping capacity, and about three-quarters of a million tons in 1990 [Pouch, 91]. The Commission on Merchant Marine and Defense added to these dismal statistics by reporting the following. In 1970, the U.S. had 18 major shipping companies. Each of these companies operated five or more ships, with a total of

430 ships in service. By 1989, however, there were only four major companies, with a total of 88 ships. [Trost, 1989]



[Source: Denton, 1987]

FIGURE 2.3.1: Decline of the U.S. Merchant Fleet

The primary reasons for the critically poor maritime status lie primarily in the economic factors affecting U.S. ships in international trade. These economic conditions include:

- a worldwide surplus of commercial cargo ships;
- a resultant depression in freight rates;
- U.S. operators are at a disadvantage when competing against the lower foreign costs of labor, ship building, and maintenance requirements; and
- some harmful U.S. government policies and practices.

[Denton, 1987]

Percent of U.S. cargo carried: In addition to the decline in the number of commercial vessels, there has also been a decline in the tonnage that American ships carry. In the 1950's the U.S. merchant fleet carried over 50% of the nation's international ocean-going trade [Dungan, 1991]. According to the Commission on Merchant Marine and Defense, only 4% of today's U.S. oceanborne commerce is carried on U.S. flagged ships; and this number is expected to drop to 1% by the year 2000.

Availability of seamen: The declining number of seamen in the merchant marine workforce is a major concern of those responsible for ensuring that the nation is capable of mobilizing forces for national defense purposes. Before the nation can utilize both the active and strategic reserve ships, there must be sufficient seamen to crew them. The Commission's report revealed that in 1970, a pool of 69,000 Americans were working in the 34,000 seagoing billets provided by the 800 active merchant ships. By 1987, however, there were fewer than 29,000 merchant seamen competing for the 11,000 billets in a fleet of only 400 ships [Denton, 1987]. In addition to the declining numbers, the average age of the merchant mariner continues to rise- and is currently at an average of 49 years old [MSC, interview April 91]. By the year 2000, less than a decade away, the average age of the mariners qualified to crew the older vessels found in the strategic reserve fleet (Ready Reserve Force) will be 65 years old.

The ship building industry: Just as the numbers of merchant ships and mariners is in decline, so too is the industry that supports it. Again, the Commission's report revealed that in the four years between 1982 and 1986, approximately 52,500 jobs were lost and over 140 ship yards and other facilities were closed [Denton, 1987]. The primary reason for the drastic decline of these maritime support facilities is directly attributable to the virtual cessation of commercial ship construction in the United States. In 1980 there were 69 ships being built in 15 different U.S. shipyards. By 1987 the number had dropped to zero! [Cassidy, 89] Only recently has there been any commercial ship construction begun again in U.S. shipyards. The Maritime Administration (MARAD) currently reports that there are three ships under construction: a containership and two small chemical carriers [Oates, interview with MARAD, April 1991].

2.3.3: Current Actions

The Merchant Marine plays a vital role in both the nation's economy and defense. In an effort to boost support and redirect government focus on the national importance of the merchant marine to the United States, President Bush approved the National Security Sealift Policy on October 5, 1989. The lead paragraph states the purpose of the policy and the resolve of the nation to ensure the survival of the merchant marine. It reads:

> Sealift is essential both to executing this country's forward defense strategy and to maintaining a wartime economy. The United States' national sealift

> objective is to ensure that sufficient military and civil maritime resources will be available to meet defense deployment, and essential economic requirements in support of our national security strategy. The broad purpose of the sealift policy is to ensure that the U.S. maintains the capability to meet sealift requirements in the event of crisis or war. ["Sealift", 1989]

This national policy is intended to be a 'first step' back to achieving a healthy merchant marine industry again. The challenges to reverse the years of decline will be long and hard, but most agree that it starts with the government's assistance in providing opportunities for the commercial industry to gain maximum access to U.S. cargoes. As was evident in Desert Storm, the merchant marine's role as naval augmentation is vital to sealift operations, and calls for national resolve to protect it from further decline.

2.4: PREFERRED SEALIFT FEATURES

Before this chapter can offer any analysis or recommendations on the use of sealift, it is important that the reader is provided with background on the preferred sealift features that the Army considers significant for deployments, and a brief outline of the sources of sealift. The next two sections provide this information. Once the background on the existing state-of-affairs has been presented, various reasons will be offered to show why the use of container vessels is an appropriate means of providing essential sealift during the deployment phase.

2.4.1: Generic Sealift Features

Understanding the features of a vessel that the military considers valuable for unit deployments is critical to making the determination as to which ships should be used for sealift purposes. Prior to the Vietnam conflict, most dry cargo vessels were breakbulk ships. Although these vessels were quite versatile, loading was time consuming and required longshoremen to arrange the cargo using lumber supports (dunnage) built specifically for each voyage. As a result, the commercial industry's breakbulk fleet of thirty years ago accommodated a civilian load just as easily as a military load. Today, however, there are some compatibility problems with military cargoes being transported in the commercial container vessels that are currently so prevalent. Changes in the merchant ships include: ships with cellularized holds; vessels that are dependant upon shore-based cranes; and larger, slower vessels to save on fuel.

Because of these drastic changes to the basic character of the commercial ships, strategic mobility planners of the early 1980's no longer had an accurate estimate of useable commercial vessels. In an effort to define existing sealift assets, a DOD Sealift Study was conducted in 1984. The study defined criteria for identifying militarily useful vessels. For ease of identification, they determined that ocean going vessels 1,000 gross tons or greater could generally be categorized as 'militarily useful.' Ideally, the vessels offering the greatest utility for defense sealift purposes were categorized as:

a. Medium-sized: so that the risk of cargo loss is reduced per target, yet still carries significant tonnage per lift.
b. Fast: vessels that can sail at 30 knots or greater are best.
c. Shallow-draft: enables increased flexibility of port selection.
d. Self-sustaining: so that each ship has the capability/flexibility to offload its own cargo at any designated port.

In addition to the above stated physical qualities, the concepts of availability (for loading), speed of loading, and the capability of carrying outsized heavy unit equipment were also important. Beyond listing the militarily useful vessels, the study also listed the types of ships that were <u>not</u> considered useful for military sealift purposes. These ships include: dry-bulk carriers, liquified natural gas/propane carriers, refrigerated ships, uncoated tankers and Ultra Large Crude Carriers [NACOA, 1985].

With these above stated desirable features, there are basically four types of dry cargo vessels that the military currently classifies as useful for deployment purposes. They include: Roll-on/Roll-off (Ro/Ro) ships, barge carriers, breakbulk ships and containerships. Without question, the Ro/Ro ships are favored because of their ability to provide the quickest loading of the military's wheeled and tracked vehicles. In the second category, there are two types of barge carriers; the "Lighter-Aboard-Ship" (LASH) and the Sea Barge Ship (SEABEE). These vessels are extremely useful during military deployments for much the same reasons as the Ro/Ro ship. They can also carry all the equipment in the Army's inventory and are self-sustaining. Next, breakbulk ships are capable of carrying all the Army's equipment for deployments, but these ships require a great deal of time and manpower to lift and brace each piece into the holds. In addition, they are typically older and slower vessels [Hanson, 1989]. Containerships, the most modern of the ship-types, are large vessels with cellularized holds to accommodate containerized cargo. Despite their enormous size, the container vessel can be loaded/unloaded in one day, while a smaller breakbulk ship requires four days [MTMCTEA PAM 700-2, 1989]. Containerships have not yet been used to deploy unit equipment during the surge phase of deployments. The primary reason it has been excluded from deploying unit equipment results from the ships inability to easily accommodate outsized equipment. For example, only 36% of a heavy mechanized division's unit equipment can be placed in standard containers. However, when containerships are modified with government-owned specialized containers (40-foot Flatracks and SEASHEDs), 92% of their equipment can be loaded [SEA-SHED, 80].

2.4.2: The Roll-on/Roll-off Feature

From the above stated desirable features, it is easy to see why the military views the Roll-on/Roll-off capability as so important. By using a Ro/Ro vessel, the majority of unit equipment, primarily wheeled and tracked vehicles, can be quickly driven onto the ship without the laborious task of lifting each piece one-at-a-time.

It is interesting to note that Ro/Ro ships were initially built in the 1970's to fill a special shipping requirement in the Middle East. With oil profits, many citizens of the Arab nations were willing to pay a high price for the various cargoes that were being shipped in containers elsewhere in the world. Since the Arab nations did not yet have ports capable of handling containerships, Ro/Ro ships were developed as another intermodal shipping method of transferring goods to the region. Once this area obtained container ports, however, the Ro/Ro ships could no longer compete for this service (capacity limitations). The commercial world currently views Ro/Ro ships as having minimal commercial shipping benefits, except in routes that have quick turnaround times. In the U.S., Totem Ocean Express, which runs from Seattle to Alaska, is an example of one of the few economically viable routes for Ro/Ro ships today [Corkrey, MARAD, interview July 1991].

As a result of the commercial industry's short-lived shipping requirement these ships were built, and have now proven to be tremendously valuable for the military. Seventeen Ro/Ro ships have already been purchased by the military and placed in the military's reserve fleet for any immediate strategic sealift requirements [Norton, 1991]. The seven U.S. flagged Ro/Ros that were chartered by MSC during Desert Shield proved to be tremendously valuable for both the military and the civilian owners, who received more than double their normal chartered rate [Warrens, 1991].

2.5: SOURCES OF SEALIFT

If the United States should need to deploy military forces abroad for national defense reasons, there are several sources from which sealift can be obtained. Military Sealift Command (MSC), the single manager of ocean transportation for DOD is responsible for obtaining the required sealift within the boundaries of established sealift acquisition procedures. Figure 2.5.1 illustrates the sources of sealift and the various controlling agencies. Although there is no strict requirement for acquiring sealift in the sequential order of the flowchart, typically, the sources are selected in sequence [NWP 80]. Depending upon the situation, the progressive steps in acquiring sealift are explained in detail in Appendix A.

In a brief summary, the first sealift source comes from the MSC Controlled Fleet. This pool of vessels encompasses the Nucleus Fleet (includes the Fast Sealift Ships), the Afloat Prepositioning Force (APF), and a few commercial ships on long-term charter with MSC. These ships are retained under the control of the Navy to ensure there is an immediate source of strategic sealift available within the first critical 48 hours of mobilization orders. If the MSC Controlled Fleet is not adequate to meet the sealift requirements, a request for chartered U.S. flagged ships goes out. If there is still a shortage, specific ships within the reserve fleet, called the Ready Reserve Force, are activated and crewed with merchant sailors. The National Command Authority (the President and the Secretary of Defense) does have the right to force U.S. flagged vessels to participate under the Sealift Readiness Program (SRP) or to requisition ships, however, this has not been done since World War II. The next source, depending upon the extent of allied support, would generally come from friendly foreign-flagged charter vessels. The last source of sealift would come from the oldest portion of the strategic reserve fleet, called the National Defense Readiness Fleet (NDRF). It is unlikely that these World War II vintage ships will ever be used, since it would require nearly one full year to prepare them for active duty [Warrens, 1991].

2.5.1: The Role of the Various Sealift Sources

MSC's Controlled Fleet fulfills a pivotal role in satisfying the strategic mobility planner's sealift requirements. Although the U.S. is dependant upon a strong merchant marine as a sealift source, the specifically tailored ships in the Nucleus Fleet and the Afloat Prepositioned Fleet are critical in answering the strategic sealift requirements that come after the initial alert. With the questionable availability time of the active commercial ships, the first sealift source must come from a fleet that has been reserved for serving the nation in a rapid response fashion.

The workhorse of the Nucleus Fleet, the Fast Sealift Ships (FSSs), serve to meet the deployment requirements of the all-important first days of a contingency. These eight former SL-7 class containerships were purchased from Sea-Land Corporation in 1981/1982, and were modified to incorporate many of the desirable military sealift features. The Navy purchased these ships primarily because of their exceptional speed (33 knots), and subsequently converted them to Ro/Ro vessels with Lift-on/Lift-off (Lo/Lo) self-sustaining capabilities [FC 55-50, 1987]. Out of the 200 plus ships used to deploy military cargo during Desert Storm, these eight ships delivered 14 percent of all unit equipment [Dungan, 1991].

The Ready Reserve Force (RRF) also serves a critical role in strategic mobility operations. This group of ships has been purchased from the commercial sector by the military because of their militarily useful features. They are placed in an inactive readiness posture that can be activated in five, ten or 20 days. With the declining state of the merchant marine industry, these ships were purchased to make up the difference in sealift requirements that the Nucleus Fleet and the merchant shipping industry cannot fulfil. Demonstrating their important role in contingencies, during Desert Storm, 78 of the 96 RRF ships were activated and were credited for delivering nearly one-third of all the dry cargo to the Persian Gulf region [Dungan, 1991].

For large-scale deployments, use of the merchant shipping industry is absolutely necessary. Again, during the most recent contingency, Desert Storm, commercial shippers transported 47% of all dry cargo. Such a high percentage of wartime supplies being transported on commercial vessels demonstrates the

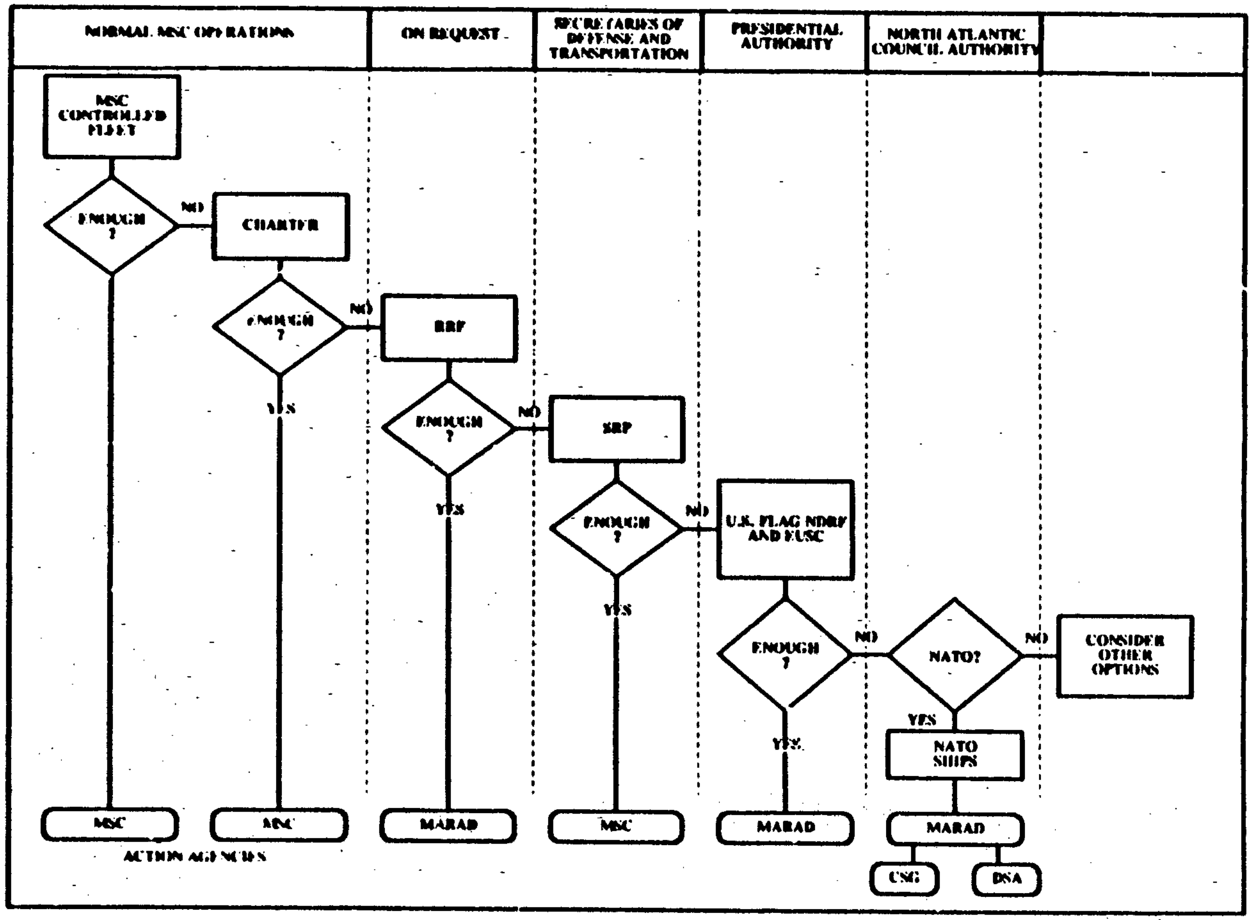


Figure 2.5.1 Sources of Sealift

nation's continued reliance upon the merchant fleet for naval augmentation. Without question, the commercial sector plays a critical role in deploying and resupplying the necessary fighting force within the limited timeframes [Dungan, 1991]. While the MSC Controlled Fleet serves to transport the first units across the ocean, the active merchant industry recalls vessels from their respective trade routes to transport the subsequent waves of deploying units. The Sealift Enhancement Features (SEF) (discussed in detail later in the chapter) permit modification of commercial ships to improve their carriage capabilities of military cargoes. This program serves to preserve compatibility, and enables a changing commercial fleet to continue their important role in sealift augmentation.

2.6: DETERMINING THE PROPER MIX OF SEALIFT

As mentioned previously, DOD is currently working on a Defense Mobility Requirements Study to determine the proper mix, by type and quantity, of sealift, airlift and prepositioning forces. Once the tonnage and square foot requirement for sealift has been determined, DOD policy makers must then decide upon the optimal mix of sealift sources that ensures national security, yet remains within a limited Defense Budget.

In an effort to achieve greater levels of compatibility with the changing merchant ships, DOD spent seven billion dollars in the 1980's to purchase: Fast Sealift Ships, prepositioning ships, crane ships, amphibious offloading equipment (such as floating cargo bridges), Sealift Enhancement Features (to increase the compatibility of containerships), and additional ships to the RRF [Dungan, 1991]. This investment in readiness proved its worth in Desert Storm. There is clearly an important role that only these specialized military-controlled ships can perform. But now that this large investment has been made to obtain these ships and enhancement features- how many more strategic sealift vessels must be procured to ensure power projection for future contingencies?

During Desert Storm, the United States chose to lean upon the assistance of allied sealift support. In the deployment phase, Operation Desert Shield, there were 213 vessels used to deploy unit equipment and supplies to the Persian Gulf region. Of the 213 ships that were used, 81 were owned by the U.S. government, 91 were foreign-flagged chartered vessels, and 41 were U.S. flagged chartered vessels [Duffy, 91]. The statistics speak for themselves. Two-thirds of the sealift used for deploying unit equipment were from the commercial sector; even more importantly, half of those ships were foreign-flagged. In spite of the all-out effort by the U.S. merchant marine and government agencies to meet the shipping requirements of Desert Storm, the war underscored the fact that U.S. sealift assets are not yet sufficient for large scale deployments [Roos, 1991].

After identifying these sealift shortages from Desert Storm, General Hansford Johnson, the Commander-in-Chief of U.S. Transportation Command, testified before the House Armed Service Subcommittee on the needed sealift reforms. He stated that the military needs the following to guarantee necessary power projection capabilities:

- Build eight to 10 new Strategic Sealift Ships (SSS). These ships would serve the same role as the FSSs, but would incorporate the diesel propulsion system and would travel at only 25 knots.
- Purchase 20 more modern Ro/Ro ships on the open market. These ships would be added to the RRF, and replace a comparable number of breakbulk ships.
- Purchase an unnamed number of Afloat Prepositioning Ships.
- Improve the readiness and maintenance level of the RRF.

[Thompson, 1991]

Not only is this request tremendously expensive, empirical evidence strongly suggests that the strategic mobility policy makers may have incorrectly interpreted the lesson to be gained from the U.S.'s dependence on foreign-flagged ships during the war with Iraq. A different perspective might indicate that the U.S. had not exhausted all its available sealift assets. Rather than buying more military-owned ships, perhaps the U.S. could meet its sealift requirements, without foreign assistance, if it used the largely untapped sealift source of the U.S. merchant containership fleet. Despite the fact that a large number of foreign ships were used, the tonnage carried was disproportionate to the number of vessels-transporting only 15% of the cargo [Norton, 1991]. If the U.S. sealift assets used during Desert Storm were capable of transporting the other 85%, then augmenting these ships with only a few containerships may be able make-up the shortfall that the foreign-flagged ships were asked to do.

The one uncontested lesson learned from the contingency is that-additional U.S. flagged sealift is required to ensure national security for future unilateral conflicts. There are many reasons why the government should consider budgeting money in a manner that expands the commercial maritime industry's participation in meeting our wartime sealift requirements, versus buying an entirely government-owned sealift fleet that requires no commercial augmentation. The reasons for including commercial containerships in the surge phase of deployments include: cost effectiveness, problems with the RRF, lack of seamen, and intermodal benefits.

Cost comparison: By illustrating the cost of various sealift alternatives, the reader can gain some appreciation of the tremendous expense required in maintaining reserve sealift assets. This simple cost comparison is not intended to equate dollars to their subsequent sealift tonnage gained. A much more detailed study would have to be conducted to compare all the important variables of each sealift option. Such a study would entail balancing costs, carrying capacity, flexibility, and the overriding factor of timeliness. When dealing with national defense, timeliness often outweighs costliness. The fact that a pool of military-controlled fast sealift should be dedicated to transporting the rapid deployment forces is not in contention. The key factor is finding the right balance of military-owned versus merchant owned.

Table 2.6.1 shows the approximate cost per vessel of the various approaches that are currently being debated on how to solve the sealift shortage. It does not include the sunk costs of the sealift purchases that have already been made. The quantity of each type of vessel was previously stated in this section, and can be found in the footnotes of the Table. The last approach deals with modifying commercial ships. The costs reflect the purchase of approximately 40 Flatracks per ship, to outfit 10 more containerships. Large quantities of SEASHEDs and Flatracks were previously procured to outfit approximately 25-30 containerships [NACOA, 1985].

From this simple comparison of costs, we can calculate that it will require $2.8 billion, just to purchase the 10 Strategic Sealift Ships and the 20 Ro/Ro ships for the RRF. Without doing a detailed study, it is hard to determine how many of these requested military-owned ships could be eliminated if a lesser amount of money was invested in trying to better utilize the merchant marine. From this initial look, modifying existing ships by purchasing more Flatracks at $14,000 apiece, may prove to be more cost effective if they can also provide the required sealift tonnage [NACOA, 1985] [Thompson, 1991].

TABLE 2.6.1 Cost Comparison of Sealift Approaches

Approach	Fleet	Acquisition, Construction, or Conversion Cost/Vessel	Annualized Operating Cost/Vessel
		-------Millions of Dollars-----	
Prepositioned	Afloat Prepositioning	184[1]	15[2]
Rapid Deployment	Strategic Sealift Ships	200[3]	4[4]
Government Reserve	Ready Reserve Force	40[5]	1.5[6]
Modified Commercial	Merchant Marine	.5[7]	minimal[8]

1 This cost was obtained by using the figure for the previously purchased Maritime Prepositioning Ships. This comparison is assuming that these ships will also be constructed and converted by private shipowners under the agreement that the vessels will be chartered for 25 years by MSC.
2 Annual operating costs paid by MSC through charters which includes a merchant crew.
3 This is the estimated cost of constructing each ship if built in US shipyards. Army is requesting 10 ships.
4 Annual operating cost for the FSSs in a reduced operating status. SSSs should be similar.
5 The cost of each Ro/Ro if purchased on the open market. The Army is requesting 20 more ships.
6 Average annual cost, considering activating the ships every 5 years is $1 million. An extra $.5 million is added per the military's request for more money to conduct additional maintenance.
7 This acquisition cost assumes 40 Flatracks per containership. Since a large number of SEASHEDs and Flatracks have already been purchased, it is estimated that enough Flatracks for 10 more vessels is sufficient.
8 No real maintenance is required on the Flatracks, and most container vessels do not need modification to carry.

[Sources from: NACOA, 1985 and Thompson, 1991]

Ready Reserve Force: There are several reasons for utilizing merchant ships for deployments rather than buying additional vessels and placing them in the reserve fleet. While placing ships in the RRF ensures that these vessels will be available to the military in emergency situations, many shipping experts argue that by allowing the militarily-useful ships (especially the 22 U.S. commercial Ro/Ro ships) to continue in the commercial trade, the military can avoid the cost of their purchase, inactivation and annual maintenance. In addition to these costs, Desert Storm highlighted the fact that activating the RRF ships can be very difficult. This was partially due to MARAD's reduced funding levels, which hindered the agency from providing the appropriate maintenance for these ships prior to the war [Norton, 1991].

Ship availability time is another rational that the military prefers to have a reserve sealift fleet versus waiting for commercial ships to be withdrawn from their trade routes. As stated previously, RRF vessels are in a five, ten or 20 day call-up status. The Vice President of SeaLand (largest U.S. shipping company), Jack Helton, estimates that this is approximately the same timeframe that would be required to pull pre-modified commercial containerships off of their normal trade routes [Helton, interview July 1991]. Again, by adapting active merchant vessels to military purposes, the benefits include: maintenance costs are borne by the operator during normal trade; the ships are continually providing training (and jobs) for U.S. mariners; and the vessels already have crews if called into service. These reasons offer evidence that there is operational efficiency and lower costs in maximizing the use of merchant ships, rather than building, acquiring or preserving an outmoded fleet.

Seamen: The steady decline in the number of trained merchant seamen is a pivotal issues that should be considered when the Department of Defense budgets their sealift funds. To crew the MSC Controlled Fleet and the RRF, the military is dependant upon the merchant industry for providing a pool of trained and qualified seamen [Norton, 1991]. The fact that reserve ships cannot be used without appropriately skilled merchant mariners to crew them, underscores the importance of maintaining the correct balance between active and reserve ships. If the balance swings too far to the reserve side for satisfying sealift requirements, then there may not be enough mariners to crew them when activated for war.

Intermodal Benefits: While unmodified container vessels cannot carry outsized equipment, a significant proportion of a unit's equipment is containerizable. If surge deployment practices were adjusted to include containerships, in conjunction with the expansion of containerizing unit equipment, then the Army could gain access to the industry's highly integrated, intermodal transportation network. Such changes in current deployment procedures would not only free-up some limited Ro/Ro space, but it would also enable the commercial industry to offer their transportation services in the intermodal environment which they are accustomed to operating in everyday, versus the older breakbulk methods. The complete list of benefits to be gained by the Army in transporting unit equipment through the intermodal network is discussed in Chapter 7.

2.7: COMPATIBILITY ISSUES ADDRESSED

For various reasons- economic, technical, political and military- the commonality of commercial and military shipping needs have declined over the last 30 years. The container and intermodal revolution that swept the commercial industry made the maritime fleet more commercially viable, but less militarily useful. Compatibility issues are part of the reason that the Navy has its own strategic sealift pool of militarily-useful vessels.

Prior to the container revolution, the self-sustaining breakbulk ships served equally well for both civilian and military cargoes. The non-self-sustaining containerships of today, however, reduce the military's flexibility of port selection. In addition, the rising cost of fuel in the 1970s caused shipping companies to use larger and slower vessels in order to achieve economies of scale, and increase fuel efficiency per ton of cargo [Hayuth, interview April 91]. Here again, economic reasons forced the commercial shipping industry to change their vessels in a way that was not ideally suited for national defense purposes.

2.7.1: The Containership Versus Outsized Equipment

The obvious problem with using containerships for unit deployment purposes lies in the fact that not all unit equipment fits into containers. While containerships serve as the optimal mode of carriage for the military's resupply missions, where 80% of the cargo is containerizable; only about 30% of unit equipment is containerizable during the initial deployment phase [Hanson,1989].

A great deal of work and money has already been expended in an effort to restore vessel commonality between the merchant fleet and the military's needs. As the executor of the program for the last 10 years, the Navy has made steady progress in the area of Sealift Enhancement Features (SEF). This program ensures that designated merchant vessels receive modifications, which may involve preparing the vessels so that they can be outfitted later for additional military capabilities. These capabilities include: secure (secret) communications, troopship "hotel" accommodations, and the ability to carry outsized equipment in container cells, refuel at sea, and offload at-anchor. This commercial ship modification approach of the SEF appears to be a cost-effective path to ensure compatibility requirements are met in the merchant fleet. The SEF improves the 'military readiness status' of the merchant fleet for the direct (and minimal) cost of reimbursing ship operators for lost revenue. This money is invested specifically on the desired ship modifications rather than providing the commercial shipping industry with a nondiscriminatory subsidy, or increasing the military's reserve fleets [NACOA, 1985].

Two innovative sealift enhancement features that have been developed to increase the military utility of the merchant ships are SEASHEDs and heavy-duty 40-foot Flatracks. A full description will be provided in Chapter 4, but in brief, SEASHEDs and Flatracks convert container holds into 'tween decks that enable outsized vehicles to be loaded onto containerships [SEA-SHED, 1980]. Figures 2.7.1 and 2.7.2 provide the reader with an introductory look at this SEF hardware.

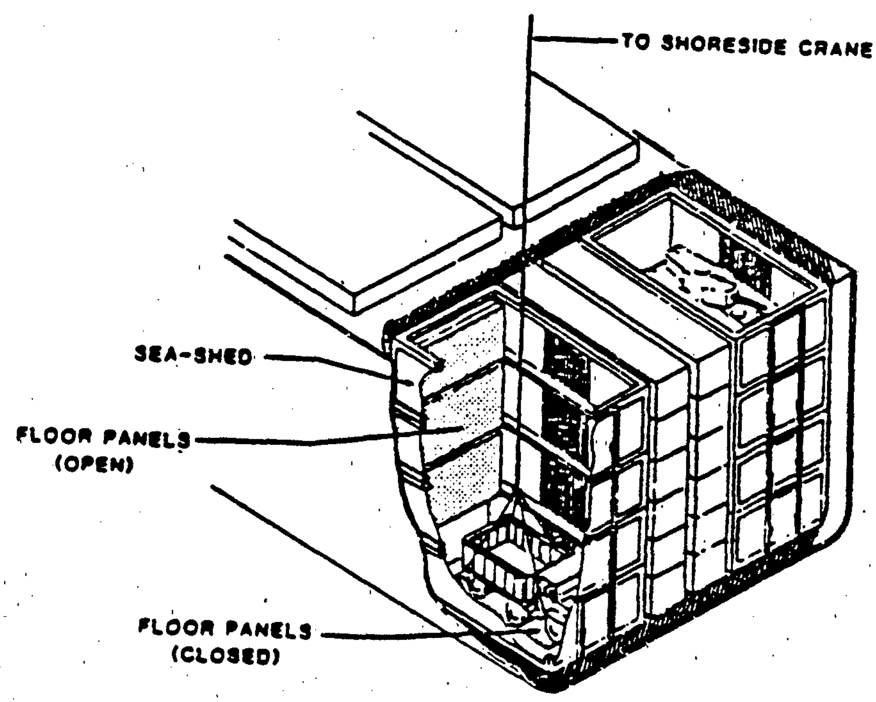
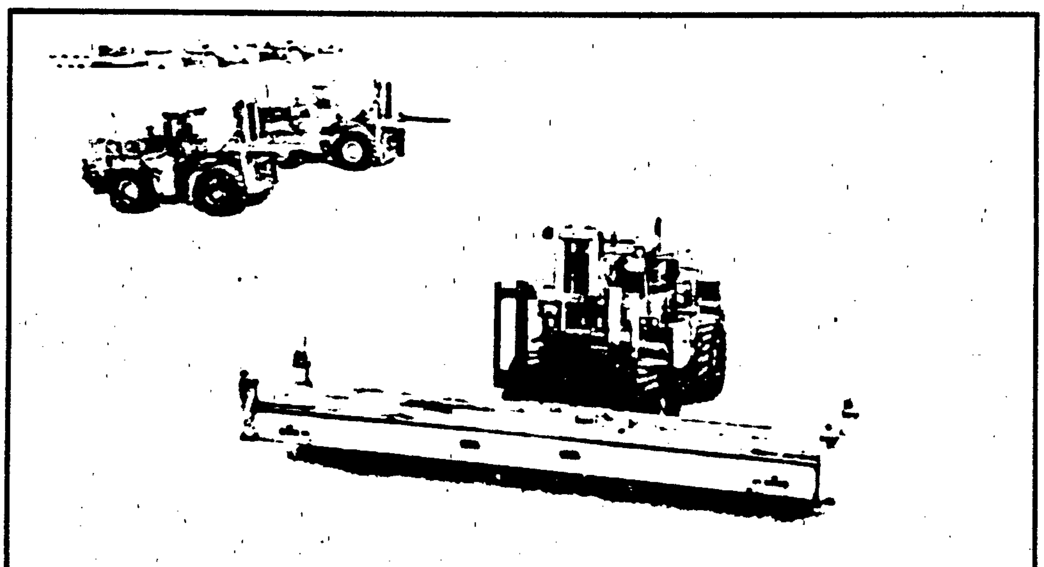


Figure II-3. (U) SEA SHED Being Loaded - Work-Through Floor Technique

[Source: Information Spectrum, Inc., June 1980]

FIGURE 2.7.1 Cross-Section of SEASHEDs in a Containership

Unfortunately, even after the development, procurement, and strategic national placement of the 1,500 SEASHEDs and 3,500 Flatracks, (at a cost of 40 million dollars) not a single containership was modified with this equipment in order to deploy outsized unit equipment during Desert Shield! The biggest reason for not using commercial containerships was the fact that the military could not afford to take the time to modify the ships after mobilization began. Had they performed the pre-modifications on containerships prior to the conflict, MSC would have been in a better position to locate a few of the modified vessels, and place the sheds and racks into them. Once the crisis had developed, however, ship repair facilities were unavailable to perform the required modifications in the time that could be allowed [Burns, MSC interview April 1991]. MSC did, however, charter a containership to experiment with the use of the SEASHEDs and Flatracks in the redeployment phase of Desert Storm. The results are reviewed later in Chapter 4. This experiment may encourage the government to perform the initial modifications (strengthen cell guides and reinforce the decking) on several containerships during peacetime, so that the SEASHEDs and Flatracks can be quickly inserted when needed in future contingencies [Corkrey, MARAD, interview July 1991].



[Source: MTMC-TEA, Display Determination 89 Afteraction Report, March 1990]

FIGURE 2.7.2 Flatrack Being Moved by a Container Handler

2.7.2: The Lack of Container Handling Equipment

Another hindrance in the military's use of containerships is the requirement for a developed port of debarkation- one that has the appropriate offloading equipment, and an area to sort and store containers. The commercial industry does not have this problem because the shipping lines limit their port-calls to load center ports which specialize in the handling of containers [Hershman,1988].

The military, on the other hand, has both 'strategic' and 'tactical' difficulties in handling containers. Strategically, U.S. forces can typically rely on embarkation from a developed commercial port. However, if the military equipment is on a non-self-sustaining containership, the transportation operating agency (MTMC) cannot always guarantee that there will be a port of debarkation capable of offloading the containers. Further, if the designated port area should become damaged by attack, or if an undeveloped port had to be selected, there are fewer options for the large non-self-sustaining ships to adapt to these wartime shipping situations.

As mentioned previously, however, MSC has a Nucleus Fleet of ships that serve an important role in augmenting the sealift that will be provided by the active merchant fleet. Currently, MSC controls 11 Auxiliary Crane Ships that could be used to assist in offloading of these non-self-sustaining ships. When used in combination with causeway ferries (floating bridge) and air-cushioned amphibious lighterage (small, shallow draft vessels), containerships can be offloaded in either an undeveloped or damaged port area [Margolius, 1989]. This type of operation escalates the discharge time dramatically, but would slow the discharge of all types of vessels equally. (For further information on the military's procedures for offloading containerships without a developed port, consult: "Mobile Crane Handbook for Expedient Cargo Handling Operations," written by the Naval Civil Engineering Laboratory, December 1983.)

Tactically, within the theater of operations, there are additional complications in the military's use of containers. The problem stems primarily from a lack of sufficient container-handling equipment. Even in the best-case scenario, where developed ports with gantry cranes are available, there may still be problems in obtaining the appropriate type and number of forklifts and rough terrain container handlers (RTCH). As was reaffirmed in Desert Storm, the military does not have the depth in quantity of materiel/container handling equipment (MHE)/(CHE) to easily facilitate the offloading and onward movement of containers beyond the port area [Smith, Desert Storm Lessons Learned Center, interview July 1991]. This problem is currently being addressed by the Army. With the potential trend of increased container use in any future conflict, the appropriate military agencies are now in the process of determining how much more materiel/container handling equipment is required. The extensive use of containers during Desert Storm for resupply purposes alone, has resulted in the allocation of additional money for the procurement of MHE and CHE [Brower, RD&E, interview August 1991]. If container usage is expanded to include the deployment of unit equipment, then the amount of CHE required throughout the theater of wartime operations is expected to increase even further.

Secondly, before units can be issued containers which stay with them throughout the entire deployment, it is important to first consider the unit's container handling capability. With the exception of a possible unit wrecker for vehicle-recovery, most battalion-sized combat units are not equipped with any materiel handling equipment. These types of units would require handling support from the Movement Control Center (MCC). (The MCC is a centralized unit that coordinates transportation requirements.) Some units, which are authorized their own tractors, may be able to shuttle containers with their organic assets. These units would probably need to be issued a chassis to carry the container, rather than waste a flatbed trailer that was authorized to that unit for some other purpose. In addition to supporting units with MHE and CHE requirements, the MCC is also responsible for transportation augmentation support within the theater of operations. So whether the unit needed help moving a container or the traditional loose pieces of equipment that can not be carried with their own transportation assets, this source of support is already in place.

2.8: SEALIFT SUMMARY

This chapter has provided the reader with a cursory look at the complicated environment surrounding the issue of obtaining the necessary sealift for deployment purposes. The type of sealift that DOD decides to use for future conflicts will greatly affect the level of containerization that is optimal for deploying unit equipment. Assuming that military policy makers decide to use containerships to deploy unit equipment in the future, the rest of this thesis may prove helpful in examining the many facets that should be considered prior to expanding the containerization of unit equipment.

CHAPTER 3:
BACKGROUND, POLICY AND ISSUES

The purpose of this chapter is to provide the reader with some background information on the Army's historical use of containers, its current containerization policy, and describe some important issues that surround the future use of containers- especially for unit deployment purposes. It begins by providing a brief history on the container and intermodal revolutions that have swept the commercial industry. This information is provided to assist the reader in understanding the environment of the commercial industry's state-of-the-art transportation network. Some productivity studies of container versus breakbulk operations are referenced, which attest to the improved efficiencies that have resulted. This chapter goes on to define the current military policy on containerization, and also discusses the primary issues concerning the expanded use of containers.

3.1: CONTAINERIZATION AND INTERMODALISM

This section is not intended to provide the complete historical background on the evolution of containerization, but rather, it offers the reader a flavor of the radical changes that have occurred in the transportation industry over the last 30 years. These changes have so transformed the commercial transportation industry, it behooves military planners concerned with power projection of military forces abroad to become familiar with the new system.

Technological developments throughout history have changed the course of transporting goods across the globe. Some of these developments include the introduction of the sail, the invention of the compass, and the development of steam propulsion and iron hulls. In the 1950's, however, a change of similar magnitude for transporting cargo began to evolve; creating a great change in the shipping infrastructure revolving around the container. The concept of containerization has since matured into a total distribution system, more precisely called intermodalism [Hayuth, 1987]. Most experts agree that these changes have revolutionized the shipping industry, and now dominate the way in which general dry cargo is transported in the international trade arena.

3.1.1: Containerization

The container is really nothing more than a reusable box that is too large for manual handling, and enables large quantities of loose cargo to be transported as one unit. This box has resulted in changing the demographics of the world's shipping fleet from predominantly breakbulk to a containership fleet. Containerization has also transformed the types of cargo handling equipment required, which in turn has changed a very labor intensive and time consuming port operation into one that is mechanized, automated, and very quick [Dowd, interview January 1991]. Port design is another area that has been vastly changed. The traditional finger piers and their adjacent transit sheds of breakbulk days have been replaced with 600-foot long terminals, dredged to at least 30 feet, and have approximately 20-25 acres of backup storage and marshalling space. [Chilcote, 1988]

The concept of reusable boxes to unitize cargo and decrease the loading time at ports has been tried as far back as the Roman Civilization. Metal boxes, wooden crates, barrels, pallets and sacks have been used throughout the centuries. But the concept of containerization is a modern development, involving transporting cargo from origin to destination, over various modes of transport, without having to rehandle the individual items inside the box.

Containerization's historical 'birth' is generally held to be April 1956, with the sailing of 58 loaded containers in Malcolm McLean's (President of McLean Trucking Company) partially converted T-2 tanker, the Ideal-X [Kendall,1986]. But it was not until 1967 that the International Standards Organization (ISO) agreed to a standard international dimension for containers, thereby allowing containerization to really take off. This agreement standardized the original container dimensions to eight feet wide, eight feet high, and 10, 20, 30 or 40 feet long. Corner lifting devices were also standardized [McKenzie, 1989]. This standardization resulted in a nearly overnight transformation of the world wide transportation system, with the container as the basic building block.

The containerization concept is fairly basic. Cargo is loaded into a container at its origin, is placed on some surface mode of transportation, usually a truck with a chassis or by rail, and is then hauled to the port. Each time the container is transferred from one mode to another, container handling equipment is required to lift the boxes. For an international shipment, the container is lifted off the marine terminal apron and onto a ship by a large gantry crane.

This sequence of operations is much more time efficient than the old breakbulk operations. The increased lifting capacity gained by containerizing cargo resulted in vast improvements of loading and unloading speeds. Various studies have been conducted to quantify the productivity gains in container operations versus breakbulk methods. While one SeaLand (Largest U.S. shipping company) study in 1979 showed that there was a productivity gain of 32 times, most studies have demonstrated a five to ten fold improvement.

In addition to improved loading/unloading times, containerization has also facilitated a dramatic increase in vessel productivity. Instead of vessels spending half of their time at a port under the older breakbulk operations, containerships now spend 80 -90 percent of their time in the profit-making mode, transporting cargo across the seas [Chilcote, 1988]. Another indication of the industry's conversion to containerization is evident in the terminology presently used to measure a terminal's productivity. Instead of using the amount of short tons transferred, a terminal's productivity is given in the number of containers moved across the terminal, or TEUs (Twenty-foot equivalent unit).

3.1.2: Intermodalism

As discussed above, the containerization of the 1960's and '70s brought about dramatic changes that revolutionized the infrastructure of the commercial transportation system. It was during this time period when most of the technological changes to the system took place. These technological changes include such things as: the development of container vessels with cellular holds; the development of container handling equipment; the shift from the railroads' boxcar operations to containers on flatcar; and the trucking industry's shift from hauling a van-like trailer to hauling a chassis with container combination. By 1980, a new phase of change called intermodalism began to evolve. Intermodalism altered the organizational methodology, and is characterized by the synchronization of the transportation network into an almost seamless distribution system. Containers could now be transported across several modes of carriage under a single document for its entire journey. Intermodalism was a shift from hardware development to one of cooperation and even mergers of transportation companies between the various modes. A great deal of these organizational changes were also directly attributable to the deregulation of the transportation industry in the 1980's [Hayuth, 1987].

These changes were extremely advantageous for the shipper. Instead of a multi-rate billing structure, caused by container transfer from one mode of transport to another, intermodalism provided a single rate with a through bill of lading. As a result of this new systems-approach to transportation, container shipments were no longer a series of disconnected moves between a rail company, a trucking company, and a shipping company. Shipments were now coordinated between the different modes, and resulted in more time- and cost-efficient movements. Perhaps the most accurate and succinct definition of intermodalism is provided by Dr. Yehuda Hayuth, a Senior Lecturer at the University of Haifa, Israel, and author of Intermodality: Concept and Practice. He states:

> Intermodality is simply defined as the movement of cargo from shipper to consignee by at least two different modes of transport under a single rate, through-billing, and through-liability. The objective of intermodal transportation is to transfer goods in a continuous flow through the entire transport chain, from origin to destination, in the most cost- and time-efficient way.
>
> [Hayuth, 1987]

3.1.3: Advantages and Disadvantages of Containerization

Perhaps more important than knowing the history behind containerization, the military shipper should be familiar with the commercial industry's perspective of the advantages and disadvantages of containerization. By understanding the appropriate uses of containers, the Army can make better decisions on their proper employment in a wartime environment. The majority of the following list of advantages are summarized from Alan Branch's, Elements of Shipping, 1981.

1) Containerization permits door-to-door service without intermediate handling of the contents at transshipment points (where a container is transferred from one mode to another). This advantage is lost if containers are stuffed at one port, only to be unstuffed at the destination port. One of the biggest advantages of containers is that they can alleviate port congestion; because of their capacity of being able to be transferred off the ship and onto a truck in a single lift, and then immediately hauled away.

2) The absence of having to handle the individual contents inside the container throughout the movement reduces the risk of cargo damage and/or pilferage. The shift from breakbulk operations to containerization has resulted in fewer claims against the carrier for damaged or stolen goods during transport.

3) The mechanization required to handle containers, combined with the tremendous amounts of cargo that are moved in a single lift, reduces the number of workers required to load and unload cargo. This enables substantial labour savings to be realized, especially for the industrial countries that must pay their workers at high rates.

4) Generally, less packaging is required for containerized shipments. In the use of specialized containers, this is especially true. For example, bulk liquid tank containers provide a substantial cost savings for the transport of liquids, versus the traditional 55-gallon drum breakbulk operation. Also, it generally requires less dunnage to secure loads inside a container versus building crates or pallets, as is used for breakbulk operations.

5) Transit time for cargo has been reduced by half over conventional breakbulk methods. This is achieved through a combination of faster vessels, a reduced number of ports that are called upon, and substantially quicker cargo handling methods.

6) Containerization has permitted fleet reduction. On the average, one container vessel has displaced six smaller and slower breakbulk ships. (Not necessarily an advantage for the military shipper. Each ship sunk by the enemy would mean a larger amount of cargo lost.)

7) Containerships offer improved utilization, or space-efficiency, as compared to breakbulk ships. Even though the box configuration 'wastes' some space below deck, a containership gains space-efficiency in its ability to stack containers high above the weather deck.

8) Intermodalism continues to improve the customer service benefits of the shipper (user) by offering:

- a through bill of lading (a single shipping document),
- a through rate that covers both maritime and surface transportation costs,
- greater reliability of delivery over loose shipments, and
- intransit visibility (ability to track cargo anywhere along its route through the transportation network) is available through electronic data interchange

(EDI), and various other technological developments, such as automatic equipment identification (AEI). Breakbulk cargo can also be tracked, but that service is not a part of its normal transport rates.

It is just as important for the military user of containers to be aware of the disadvantages of commercial containerization. In general, these disadvantages apply equally to the military.

1) Containerization is capital-intensive. The required investments range from large inventories of containers, containerships, container handling equipment, chassis, large developed terminals, and automated inventory systems.

2) Not all items to be shipped can fit into a container. While there are various specialized containers which can carry outsized, bulk or liquid commodities, these types of containers are not always readily available. (This point applies directly to deploying unit equipment, which has a great deal of outsized items.)

3) A container is typically a high capacity carrying unit, and therefore may provide limited service to the shipper who does not have enough cargo to fill the box. Customers with less than container load (LTL) traffic are unable to take full advantage of the economical through-rate. In addition, their cargo is slowed at a consolidation point while other compatible cargo to a similar destination is found to fill the remaining space inside the container.

4) Some trade routes are imbalanced with more imports than exports. Empty containers must then be transported back to origin without profitable trade goods. (If space on a commercial containership has been chartered to haul cargo to a war zone, it is unlikely that there will be much return cargo during the deployment phase. Some compensation to the carrier for the empty backhaul may have to be made by the military user.)

5) There is a limited supply of containers. Container lessors cannot afford to buy excess containers that are not gainfully employed under normal market demands. (Without careful planning and coordination, the military may not be able to procure the amount they need during military emergencies.) The container owning company has the difficult task of ensuring that it gets maximum utilization of its equipment. Strict control over containers as they go through the intermodal system requires coordination with various parties, and fairly elaborate tracking mechanisms.

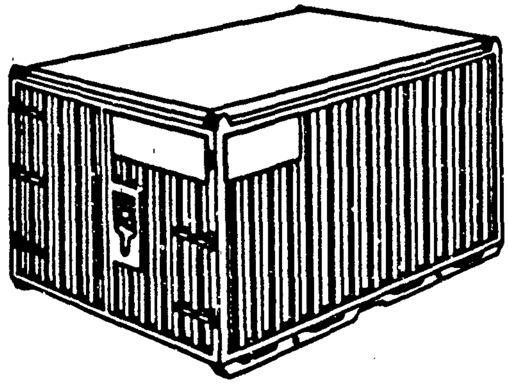
6) The intermodal system must be 100% intact. The intermodal advantage of moving large quantities of equipment quickly between locations can be quickly lost if there is a weak link in the system. For example, if container handling equipment is not available at a transshipment point to transfer a container from one mode to another, that cargo will be stopped along its path.

3.1.4: The Military's First Container Efforts

In many ways, the military should receive credit for having the first widespread use of a container transport type operation. During World War II, the damage and pilferage losses sustained by military cargo was so great that a study was directed to 'fix' the problem. As a result of this study, a metal box called the CONEX (Container Express) was developed. This box was designed to consolidate cargo, protect it during shipment, and to relieve congestion at the ports by speeding up the loading/unloading process [Neshiem, 1984].

The CONEXs came in two sizes: 6'3" W x 6'10" H x 4'3" L, and 6'3" W x 6'10" H x 8'6" L. The two different sizes contribute to their versatile features. CONEXs were used for many purposes, such as: transporting unit equipment, storing unit equipment throughout the deployment, and transporting sustainment supplies. These reusable metal shipping boxes were mounted on forkliftable skids and had recessed lifting eyes at the top four corners to assist in handling [FM 55-15, 1986]. Additionally, they could be stacked, and were somewhat 'intermodal', in that they could be easily lifted from one mode of transport to another. Figure 3.1.1 provides a diagram of the larger CONEX.

The first CONEXs were used in the Korean War, starting in 1952. By 1965, the Army and Air Force owned 100,000 CONEX boxes. They were considered to be the backbone of logistics support for the Vietnam conflict and carried most of the cargo that was sent to the region. As the war escalated, the number of Army-owned CONEXs doubled.



	Type 1 (Half Size)*	Type 2 (Standard)
Inside		
Length	3' 10 5/8"	8' 1 5/8"
Width	5' 11 3/4"	5' 11 3/4"
Height	6' 3/8"	6' 3/8"
Outside		
Length	4' 3"	8' 6"
Width	6' 3"	6' 3"
Height	6' 10 1/2"	6' 10 1/2"
Cargo Capacity	9,000 lb	9,000 lb
Empty Weight	900 lb	1,800 lb

*For cargoes with overall density exceeding 45 pounds per cubic foot.

[Source: FM 55-65, 10 May 1989]

FIGURE 3.1.1 CONEX Characteristics

These unitized shipments proved so successful that full containership service using 20-foot containers were also introduced to assist in the resupply mission of Vietnam. Between 1968 and 1969 the military procured 6,700 military containers, called MILVANs. These containers, however, were truly intermodal since they met the ISO dimensional standards (8' x 8' x 20') and could be transported via a commercial container vessel. The MILVANs were purchased with chassis so that units had the capability of moving the containers [Neshiem, 1984]. Of the total number purchased, 4,500 of the MILVANs had built-in restraint systems for the transport of ammunition [1991 Container System Hardware, 1991]. In this way, the military purchased specialized containers that met this unique military requirement, and depended upon the commercial industry to supply the majority of standard dry cargo containers that were needed for non-ammunition type shipments.

Many of these original CONEXs and MILVANs are still in the Army system, and are located at installations all over the world. The MILVANs with restraint systems are still maintained and controlled by the Joint Container Control Office in Bayonne, New Jersey. The wear and tear of the years on CONEXs, however, has made them generally nondeployable. As will be discussed later in this chapter, large numbers of 20-foot containers are currently being purchased to supplement standard size container requirements. But the CONEX, which served a critical role in the Vietnam and Korean conflicts, are not generally available for deployments today. As these boxes become too damaged and rusted for use, a suitable replacement is needed to fill that unit requirement.

3.2: THE MILITARY'S CONTAINERIZATION POLICY

Recognizing that the commercial transportation network is built on a highly efficient intermodal system that centers on containerized modules to transport cargo, the military has established a policy to assist in employing such a system. The current Department of Defense containerization policy is outlined in DOD Directive 4500.37, "Management of DOD Intermodal Container System" [DODD 4500.37, 1987]. The policy is aimed at establishing containerized shipments as the preferred method of transporting military equipment, vehicles and supplies. The policy is stated in three parts, and reads:

1. It is DOD policy that DOD Components attain and maintain a container-oriented distribution system of sufficient capability to meet DOD-established mobilization and deployment goals while ensuring commonality and interchangeability of modal containers, hardware, and equipment between Military Services and commercial industry, which collectively constitute the DOD container-oriented distribution system. The container-oriented distribution system must interface with and complement the movement and control of all other noncontainerized DOD cargo.
2. The DOD policy is to rely on the use of intermodal container resources and services furnished by the commercial transportation industry when doing so is responsive to military requirements.
3. Containerized shipment shall be the preferred method, unless cost effectiveness or peculiar shipment requirements are an overriding factor.

It is important to note that the policy does not recommend the procurement of a complete intermodal system for the deployment and resupply of military cargoes, but rather, recommends a cooperative effort with the commercial transportation industry ["The Potential Military Application of Commercial Intermodal Equipment Advances," 1990]. This underlying theme of utilizing commercial assets for military assistance during national emergencies is reminiscent of the previously discussed Merchant Marine Act of 1936, which charters the commercial shipping industry to serve as naval augmentation. Both of these policies, however, are caveated with the requirement for responsive support. If these assets cannot be obtained quickly, the military must procure enough of its own containers to satisfy the initial transportation requirements of a no-notice deployment.

As outlined in the above stated policy, the DOD containerization objective is to utilize the existing commercial transportation network, supplemented with DOD assets, to meet deployment requirements. A great deal of the transportation industry's common intermodal equipment such as dry cargo 20-foot and 40-foot containers, flatracks, terminal equipment, and line-haul assets are well suited to moving non-vehicular military equipment and supplies. The DOD policy states that intermodal assets should primarily be purchased to fulfill unique military requirements and would entail keeping the container for an extended period of time. These unique requirements requiring the military to purchase their own containers might include:

1) The need for an immediate stock of containers readily available for rapid deployment units.
2) The need for a transport and storage type container that is to remain at unit level throughout a unit's deployment. or,
3) The need for nonstandard containers that are not readily available in the commercial inventories.

To meet these unique transportation requirements, each branch of Service (Army, Navy, Air Force and Marines) must develop equipment requirements and justification for the procurement of these types of specialized containers. Currently, these requests are then approved by the appropriate hierarchy in each branch of service [Fuchs, DA DCSLOG, interview July 1991].

3.3: GENERAL REQUIREMENTS FOR MILITARY CONTAINERS

There is no manual that outlines the engineering specifications for developing and procuring military containers. This section, however, is a compilation of information that was taken from Army Regulation 56-4 "Management of Army Intermodal Container Systems," various government reports, and interviews with the Army's Research Development and Engineering Agency, at Fort Belvoir, Virginia.

3.3.1: ISO/ANSI Dimensions

As a general rule, leasing commercial container assets is preferred to purchasing military-owned assets. However, where special purpose military containers are required, DOD prefers that the purchased container and its components be International Organization for Standardization (ISO) and American National Standards Institute (ANSI) compatible. This requirement stipulates that the ISO/ANSI dimensional and weight characteristics, corner fittings, and stacking strengths are adhered to ["The Potential Military Application...", 1990]. By adopting the same specifications as the commercial industry, the military is attempting to ensure higher levels of compatibility with the intermodal transportation network. An example of a military specialized container that meets the ISO/ANSI containerization standards is the TRICON. The TRICON is composed of three box units that are connected at the corner posts to form the equivalent of a 20-foot container. When connected in its 20-foot "foot print," the corner fittings meet the dimensional requirements of a 20-foot container spreader bar.

3.3.2: Threat Considerations

The fact that containers used in deployment scenarios are intended for a war zone dictates that this potentially dangerous environment be considered in the design. These boxes offer little protection to any kind from direct fire, but survivability is greatly enhanced when concealed from enemy detection. As a result of the varying levels of hostility within the war zone, different size containers are better for certain missions than others. Resupplying warehouses in the theater rear is well suited to the use of large 40-foot containers. This region of the war zone is well removed from the front lines, and can take advantage of a more mature infrastructure and a reduced threat environment. These larger containers are typically transported over good roads between the port and a distribution point (warehouse), with a source of dedicated trucks to haul them. Units with operational missions further forward on the battlefield, however, must consider the signature that a large container would cause. Container usage forward of the theater rear is better suited to 20-foot or smaller containers which are more difficult for the enemy to detect [DODD 4500.37, 1987]. As a result, containers that are procured or leased for unit deployment purposes are typically 20-foot dry cargo containers versus the 40-foot unit.

3.3.3: Container Handling Equipment

When selecting containers to be used for transport and/or storage of unit equipment, consideration should be given of the users capability to handle this large box. Most Combat and Combat Support units (warfighting units located closest to the front lines) have limited amounts of materiel handling equipment (MHE), such as forklifts, large trucks with the capability of hauling a container chassis, or container handling equipment, to easily accommodate the use of standard 20-foot containers. The larger logistics units in the rear, own the majority of the MHE and can more easily benefit from the 20-foot container filling both a transport and storage role for their equipment. But combat units must also find some form of transport and storage facility for their loose items of unit equipment. (These items include things such as tents, stoves, tools and various reference manuals.) Because of their lack of MHE, they may require a smaller container size, like the old CONEX, that can be either man-handled or moved with a 10-ton unit wrecker. The ability of the user to transport and handle containers on the battlefield is an overriding consideration on determining which units should use containers, and the appropriate size of the containers that should be issued.

3.4: STEPS TAKEN TOWARDS CONTAINERIZATION

As discussed previously, DOD has acknowledged its shift in policy from breakbulk methods of transporting military goods towards containerization. The evidence that this shift is more than just words in a DOD policy paper is beginning to manifest itself in the movement of military cargo. For example, the peacetime resupply cargo shipped to forward-based units around the world, has been containerized for nearly a decade [Carlyle, MTMC Pacific Northwest Outport, interview October 1990]. This section highlights the Army's progress toward containerizing unit deployments, in both the policy and procurement arena.

3.4.1: Army Policy

While the Department of Defense has had an intermodal policy since 1987, the Army came on line with its own supporting policy in September 1990. Army Regulation 56-4, "Management of Army Intermodal Container Systems," serves as the first clear evidence that the Army intends to use containers and the intermodal system during unit deployments. The policy states that the Army's first principle in making strategic transportation moves will be to: "Optimize the containerization of Army Unit Equipment (UE) to reduce force closure time, to meet the needs of the supported theater commander-in-chief, and to reduce the transportation costs." [AR 56-4, 1990] The complete policy is only one page long and has been enclosed in its entirety in Appendix B.

AR 56-4 is still very young and was not even published until September 1990, after the U.S. deployment to Desert Shield was already under way. Unfortunately, the policy is broad in nature and sweeps over the problems of defining how, or to what extent units are to containerize for deployments. At this point, it is difficult to determine the impact this policy may have on future deployments, but the fact that the Army has stated its intent to start maximizing the use of containers during deployments should begin to influence current military shipping practices. Now that the path to move toward containerization has been selected, much work is needed (such as developing doctrine on container usage, and training units on how to obtain containers, how to pack unit equipment into them, and how to maneuver with containers in the field) to ensure that the executors of this policy (units and transportation operating agencies) can successfully effectuate containerized deployments during future conflicts.

3.4.2: Container Procurement

In brief summary, DOD has many agencies that have been involved with the military use of containers since 1970 [Weisflog, Transportation School, interview March 1991]. Currently, however, there is no central agency for the development and procurement of military containers. After 1975, when the position of DOD Project Manager for containerization was eliminated, the services went to a more decentralized, lead-service approach [Woodman, 1989].

The following paragraph outlines the various Army agencies and their role in the life-cycle of the current container procurement process. The Deputy Chief of Staff for Logistics (DCSLOG) is responsible for overall policy issues on the Army's use of containers. The Transportation School has been given the responsibility to develop the Army-in-the-field's requirements and doctrine for ISO standard-type containers, called strategic containers. Likewise, the Quartermaster School is the proponent for the unit-owned, smaller containers, called mobility containers. (The different roles of the strategic versus unit-owned containers are discussed later in this chapter.) Once the branch schools have developed a requirements document, it is then sent to the materiel developer at the Army's Research Development and Engineering Center (RD&E). RD&E translates the school's requirements document into performance-type specifications that a commercial container manufacturer can use. The manufacturer is then contracted to fill the requirement with a commercial container, or designs a specialized container to meet the specifications. Once the designs are approved by the requesting branch school, procurement is made and issued to the appropriate units [Bower, RD & E, interview August 1991].

The inventory of Army-owned containers has been relatively low throughout the last 25 years. The inventory of CONEXs (which are not ISO containers) and the 6,700 MILVANs, purchased in the late 1960's, has declined over the years as a result of aging, weathering, use and lack of unit preventive maintenance. Prior to Desert Storm, the number of MILVANs registered with the Joint Container Control Office, MTMC's agent for tracking containers, included 4,324 restraint MILVANs and 979 general cargo MILVANs [Kinslow, MTMC interview, August 91].

With the updated container requirements identified from Desert Storm, a new interest has been generated at the highest levels of the Army to procure additional containers. An example of this new support for logistics requirements is evident in the monies provided for the purchase of containers during the redeployment of Desert Storm. The Department of Defense approved a $40 million budget for the purchase of commercial containers to retrograde (return shipment) the unused ammunition from South West Asia. These containers will be procured by the end of September 1991. The proposed breakdown of containers is listed below in Table 3.4.1 [Bower, RD & E briefing slides, July 1991].

It is still too soon after the war to have collected all the information, but MTMC's Joint Container Control Office estimates that in addition to the containers purchased for the retrograde of ammunition, the Army acquired 10,000 containers during the conflict. These additional containers were the commercial containers that were leased during the war. As a result of the detention time running over 180 days, the Army had the option to purchase the container for the same price as the lease [Kinslow, MTMC interview August 1991]. Such appropriations seem to indicate the Army's intentions of continuing the trend towards using containers to deploy forces abroad.

TABLE 3.4.1 Army Containers to be Purchased in 1991

TYPE CNTR	DIMENSIONS	# TO BUY
End-opening	8' x 8.5' x 20'	4,000
Side-opening	8' x 8.5' x 20'	1,500
Half-high	8' x 4.2' x 20'	1,500
Load & Roll Pallets		400 - 600
TOTAL		**~ 7,500**

3.4.3: Transportability in Design

Another indication that the Army is making progress towards the use of containerization is seen in the transportability 'check' that is done on all military equipment prior to procurement. Since the DOD policy is to containerize unit equipment to the greatest extent possible, newly designed military equipment must now attempt to meet containerized transport dimensions. Obviously design requirements are guided primarily around the combat mission of the vehicle, but a transportability review is mandatory in the developmental process of new military equipment [Davis, TEA, interview July 1991].

The smaller administrative tactical vehicles (such as the CUCV and HMMWV, which replaced jeeps), are examples of military vehicles that were designed to have dimensions compatible with containerization. The Army's M-1 tank, on the other hand, illustrates that mission requirements making the tank too wide and heavy for containerization outweigh the advantages of designing a tank that will fit into a 'box.'

3.4.4: Containership Modification Devices

As mentioned previously, Sealift Enhancement Features (SEF), such as SEASHEDs and Flatracks have been procured to ensure that outsized vehicles, such as M-1 tanks, can be transported on containerships if necessary. As stated in Chapter 2, Ro/Ro ships are the preferred method of moving wheeled/tracked vehicles, but their limited number may require units to deploy on the numerically superior containerships fleet. The procurement of these relatively expensive specialized containers illustrates the serious intentions of the policy makers to increase the use of containers in future contingencies.

3.5: PERCENT CONTAINERIZABLE

Before looking at a detailed analysis on the advantages and disadvantages to containerizing a unit for deployment, it is helpful to first look at the overall percentage of unit equipment that is containerizable in the various types of divisions in the Army. These percentages offer the reader a better idea of the proportion of unit equipment that does not fit into standard commercial containers, and thereby provides an appreciation of the transportability challenge.

Each unit has a mix of cargoes that generally fall into one of three categories:

- equipment (e.g. tents and stoves) that can be containerized,
- equipment (e.g. M-1 tanks) that cannot be containerized, and
- equipment (e.g. small wheeled vehicles) that is difficult to containerize.

Various studies and simulations conducted by the Army's Transportation Engineering Agency (TEA) (an agency that evaluates transportability problems for the military) have determined the percentage of Army type Divisions deployable via containership [MTMCTEA Pamphlet 700-2, 1989]. The results of this study, shown in Table 3.5.1, illustrate the varying degree of containerization that can be accommodated by using the standard 20-foot and 40-foot containers versus the percentage when Flatracks and SEASHEDs are available.

As evident in the chart, the percentage of all divisions that can be transported on containerships is greatly improved when government-owned Heavy-Duty Flatracks and SEASHEDs are available for loading outsized equipment. The light divisions, which include the Air Assault, Airborne, and Light Infantry Divisions, have a much higher degree of containerization in standard commercial containers than the heavy divisions (Armored and Mechanized). The difference reflects the fact that a large number of vehicles in the light divisions can be driven into a container, while the majority of the armored equipment in a heavy division is too wide and heavy to fit into a container.

The comparison of a Light Infantry Division, at 40% and 48%, to an Armored Division, at 8% and 8% containerizable in standard 20 and 40-foot containers, illustrates the substantial difference in the shipping requirements of different units. The increase in carrying capability is quite dramatic for both of these units when Heavy -Duty Flatracks are available. These specialized containers bring both units up to nearly 100% deployable on a containership.

Table 3.5.1 Percent Of Army Type Divisions Deployable Via Containership

Type Division	Unmodified				Modified
	Containers		Flatracks		
	20-Ft	40-Ft	Commercial	Heavy-Duty	Seasheds
Air Assault Division	31	38	87	94	91
Airborne Division	39	49	93	97	96
Air Cavalry Regt	18	19	64	95	91
Armored Division (RC-NG)	8	8	50	98	94
Light Infantry Division	40	48	91	97	97
Infantry Division (Mechanized)	9	9	51	99	97

SOURCE: MTMCTEA Study OA 88-5c-18 , Analysis of Containerization on Unit Strategic Deployment (As of November 1988)

The different carrying capacity between the commercial flatracks and the Heavy-Duty government-owned Flatracks is best illustrated in the Armored Division. The Table shows that the Heavy-Duty Flatracks nearly doubles the unit's ability to load their equipment onto a containership. As shown below the two types of flatracks vary greatly in their cargo weight capacity and height restrictions:

Flatracks	Weight	Height
Commercial	26 - 40 long tons	8 feet
Heavy-Duty	60 long tons	13 feet

As indicated on Table 3.5.1, the increased capability of the Heavy-Duty Flatracks enables an Armored Division to jump from 50% to 98% of unit equipment that can be loaded onto a containership. The bottom line to be gained from this study, is that the government-owned Flatracks and SEASHEDs must be made available if a the military desires to maintain unit integrity by loading entire units onto the same containership.

3.6: ISSUES ON PROPER EMPLOYMENT

Even though the new Army policy on containerization, states that the Army will optimize its use of containerization for the strategic moves of unit equipment, there is still a great deal of disagreement on many of the specific issues surrounding their use. This section highlights three of the primary issues, and presents options on how those issues can be resolved. These issues also highlight the fact that there is no detailed doctrine outlining the standard operating procedures on how containerization will be employed. Despite the fact that the Army has recently published a one page policy (AR 56-4) requiring units to optimize the use of containers, there is no follow-on guidance as to how these containers will actually be employed by the operators: the unit commander and the transportation operating agencies such a as MSC and MTMC. By addressing these issues the Army can expand their use of the intermodal network and improve the nation's deployment capabilities.

3.6.1: Appropriate Missions for Containers

The first unresolved issue focuses around identifying the appropriate purposes of containers during the various phases of deployments. This issue is a major problem to be addressed by this thesis: should containers be used to deploy unit equipment during the surge phase of mobilization? Even though the recent Army policy encourages the use of containers during every phase of a strategic move, there is a great deal of disagreement on their feasibility during the initial phase of deploying unit equipment [Woodman, 1989].

Containerization during the sustainment phase:

During the sustainment phase transportation planners have generally agreed that optimizing the containerization of resupply cargoes is the quickest and most space efficient means of transport. Especially after Desert Storm, there seems to be little doubt that containerization is an appropriate and, in fact, preferred method of shipping sustainment supplies and equipment. The number of containers used to transport sustainment cargoes during Desert Shield exceeded

37,000. Since approximately 7,000 containers were used to transport unit equipment, approximately 94% of all containers were used for sustainment purposes ["Guns 'n Boxes," August 1991].

The breakdown on types of containers used during the entire conflict is provided in Table 3.6.1. It is interesting to note that 89.3 % of the containers used were 40-foot containers, and 2.5% of the containers consisted of refrigerator vans. These types of containers are used exclusively for resupply-type missions. [Military Traffic Management Command (International Cargo) briefing slides, dtd 8 July 1991]

TABLE 3.5.1 Breakdown of Container Equipment

TYPE CONTRS	NO. CONTRS	PERCENTAGE
20' DRY	2,240	5.8%
40' DRY	34,250	89.3%
FLATRACKS	913	2.4%
REEFERS	972	2.5%
TOTAL	**38,375**	**100%**

The real proof that containers are beneficial in resupply can be seen in the sheer tonnage of cargo that was moved in a short amount of time. The efficiency of moving containerized supplies on containerships is especially evident when the tonnage, moved over time, is compared to the tonnage moved on the predominant breakbulk ships of previous conflicts. For Operation Desert Shield, the tonnage of Army equipment and supplies shipped to Saudi Arabia in the first six months was 2,280,000 tons (2,105,000 tons by sea and 175,000 tons by air). This tonnage exceeded the rates for both the Korean and Vietnam conflicts. During the first six months of the Korean War, 1,388,062 tons were deployed. And likewise, during Vietnam, only 1, 376,384 tons were transported during the entire year of 1965 [DA DCSLOG, Strategic Mobility Division briefing slides, dtd 19 June 1991]. This impressive transportation accomplishment was achieved through the military's use of U.S. commercial carriers during the sustainment phase of Desert Storm. Without question, this success solidifies the role of containers during the sustainment phase for any future conflicts.

Containerization during the surge phase:

While there is now agreement on the doctrinal role of containers during deployments, there is still controversy over the use of containers during the initial deployment phase. Major General Elam, the Assistant Deputy Chief of Staff for Logistics, Department of the Army, testified to the House Armed Services Committee on 16 April 1991, that:

> ...80% of the sustainment supplies for Desert Shield were shipped in containers. The problem was unit equipment. However, we are making efforts to work on containerizing unit equipment. Next year we were planning a Joint Logistics Over the Shore Exercise to learn more about containerizing unit gear.
>
> [Brown, Congressional Hearing Summary, April 16, 1991]

Expanding the use of containerization during the surge phase is not a simple problem with obvious answers. It is one, however, that needs to be wrestled with, producing clear direction to go with containers or not, and then offered as deployment guidance for all unit-level commanders.

3.6.2: Concept of Unit Integrity

The second issue that needs to be resolved in the area of deploying unit equipment, centers around the idea of splitting a unit's equipment into various ships versus trying to ship everything on the same ship. The Army's preference to keep unit equipment as consolidated as possible is reflected in the last of the four Army containerization objectives in AR 56-4. It states: "Maintain unit integrity by keeping a unit's equipment together in the same container or the same ship" [AR 56-4, 1990]. Army commanders are reluctant to separate 'unit integrity' of their equipment into different ships. They are concerned that they will be unable to pick up all their equipment at the port of debarkation (at the same time and place) if their shipment is split. Another school of thought proposes that units ship their containerizable equipment in containerships and their outsized equipment onto the next available Ro/Ro ship. Military Sealift Command, the agency responsible for obtaining sealift for the Army, states that this type of 'sorting' of the cargo would greatly enhance their capability in obtaining adequate sealift capacity [Lynch, MSC, interview July 1991].

The fact is, the requirement to maintain 100% unit integrity is not really applied in actual practice. During Desert Storm, for example, the 24th Infantry

Division was deployed in 12 ships. Some battalion-level unit integrity was able to be maintained, but no brigade-sized unit could be placed into a single ship. Dictating how the transportation agencies will move unit equipment, begs the question: 'Does the Army want the transportation services, or do they want the ship?' [Burns, MSC, interview July 1991]. By reserving certain ships for only a certain unit's cargo, there is a great deal of lost capacity in the remaining space that the unit does not use. This trend of lost shipping capacity is compounded, and becomes increasingly critical, if the practice of reserving ships for single units is tolerated for a large number of units.

With a shortage of shipping bottoms in the U.S. fleet, it is important to maximize the existing shipping capacity. This is best accomplished by placing the right type of cargo into the appropriate ships. MSC, the transportation agency responsible for acquiring sealift during deployments, maintains that greater shipping efficiency could be achieved if containers were shipped on containerships and outsized wheeled/tracked equipment took advantage of the quick loading/unloading capabilities of the Ro/Ro ships. While this practice violates the axiom of 'unit integrity,' the problem of reassembling units at the port of debarkation cannot be avoided by merely transporting individual units on the same ship. Regardless of how unit equipment gets to the port of debarkation, there must be a good method of sorting and staging same-unit equipment once it is offloaded from a ship. At this point in time, it is somewhat understandable that Army commanders do not have confidence in the transportation agencies' ability to locate unit equipment that is shipped in different vessels and marrying them together in a port staging area. This sorting problem primarily stems from the military's immature system of tracking equipment as it is shipped through the transportation system [VNTSC, draft white paper, August 1991].

To examine the Army's current problems associated with sorting containers at the port of debarkation, it is helpful to look at the empirical data gathered on the sustainment containers during Desert Storm. By shipping the sustainment cargoes intermodally, the supplies arrived in theater very quickly, but breakdowns in system discipline and manifest errors resulted in thousands of containers piling up at the port of debarkation with unknown destinations. Because of the unprecedented volumes of cargo to be moved, military organizations rushed the packing the of resupply containers and shipped much it as generic "N.O.S." (Not

Otherwise Specified) cargo. At one time, the back up of unidentified containers was so great that the port had to be shut down for 11 days while all the containers were opened to find out what was in them and where they were supposed to go [APL's white paper, May 1991]. Clearly a better way of accounting for containers must be developed before unit equipment can be comfortably separated during the overseas portion of a deployment.

One solution for such a problem would be for the military to adopt a commercially available equipment identification technology. Accurate equipment tracking would provide the military positive control over their equipments' location at all times. A radio frequency technology called Automatic Equipment Identification (AEI) is capable of gathering identification numbers off of 'tagged' stationary or moving objects and then transferring the data to a centralized computer management system. The Army is currently looking at this technology and testing its operational efficiency on a truck battalion in Germany [Doornink, Bn Cdr, interview September 1991].

This tracking problem is an important hurdle that must be resolved before shippers can safely abandon the practice of maintaining unit integrity during the overseas portion of a deployment. Once a good tracking system is in place and port sorting procedures are finetuned, MSC and MTMC will have greater flexibility in shipping unit equipment in vessels appropriate for the cargo's configuration.

3.6.3: Strategic Versus Unit-Owned Containers

The last of the container associated doctrinal issues that has been identified in the research of this thesis relates to the very purpose of containers. Should containers be used as a transport platform only, or should they to be used as both a transport and storage facility of a particular unit's equipment throughout the deployment? Within the various Army agencies that are associated with containers, there are some very fixed opinions on this issue. For example, the proponent responsible for ISO containers is the Transportation School, and they view containers in the more traditional role as strategic platforms only [Weisflog, Transportation School, interview March 1991]. The Quartermaster School, however, sees a role for containers that remain with the unit throughout the deployment process [Fleming, Quartermaster School, interview June 1991]. The key to resolving this container usage disagreement will be to define the issue, and to find common ground for all the players involved in policy or procurement actions of containers. The ability of Army logisticians to understand and agree on the intended purpose of containers is critical to the logical progression of container usage in the military.

The term strategic container, indicates that a container is merely a carrier of military cargo that is constantly recycled back into the transportation system after offloading its cargo at the destination. Strategic containers are viewed as transportation platforms only. The single written guidance on this subject was found in an outdated Army Field Manual, FM 54-11. It supports the concept of strategic container usage by stating, "The container is a permanent article of transport equipment designed for repeated use." [FM 54-11, Container Movement and Handling, 1981] Similar to the function of a sealift ship, a strategic container carries military cargo from one place to another, is offloaded, and is then ready to transport cargo for a different customer. These containers are not owned by a unit, but rather belong to the 'system.' That system could mean it was leased from the commercial intermodal community, or was an Army-owned asset.

A unit-owned container, on the other hand, remains with a single unit from home station, throughout its wartime mission, and then redeploys with that same unit. Unit-owned containers have two functions:

1) they serve a strategic transport role in carrying the unit's equipment abroad; and
2) they serve as storage facilities that can move tactically around the battlefield with its unit.

The reason it is so important to have some doctrinal direction on this issue relates to the infrastructure required to support the two different container purposes. If containers are to be strategic transport assets only, then units are subject to the dilemma of receiving all their equipment, but having no place to put it. And if that unit gets relocated (as nearly all units do in a combat zone) then they have no internal assets to move the equipment that was delivered to them in a container. On the other hand, if the Army allows containers to stay with a particular unit, they must have the ability to transport containers, and lift them. Many units do not have the capability to handle a 20-foot container with their current equipment authorization. If unit-owned containers is the path that the Army chooses, then additional materiel handling equipment and trucks/chassis must be purchased and distributed to units [Mamer, MCC Desert Storm, interview July 1991].

To understand the argument completely, it is helpful to look at the advantages and disadvantages of each concept for container usage. The biggest advantage of using containers for strategic purposes only, can be seen in the monetary savings. If containers are recycled and shared between all Army units, then reduced numbers of containers have to be either purchased or leased. Their role as strategic transportation platforms also eliminates the cost of equipping units to handle, maintain and transport containers. On the other side of the argument, the biggest advantage of unit-owned containers is the fact that they fill a critical mobile storage requirement for the unit. In the Korean and Vietnam wars, CONEXs filled this role, but now, they have deteriorated to the point that they are not suitable for movement, nor are they ISO/ANSI compatible.

Clearly there are benefits and disadvantages to each of these systems. Rather than choosing one option or the other, perhaps both have their place in the current Airland Battle Operations Doctrine (Army warfighting doctrine). The containers used in sustainment missions, for example, are strategic-type containers. A typical cycle would resemble the following:

1) The leased 40-foot containers are loaded at a large supply depot in the United States.
2) Commercial transportation assets (truck or rail) haul them to a port.
3) The containers are loaded onto a commercial containership and transported across the ocean.
4) The containers are offloaded at a port and delivered to a warehouse in the theater operations.
5) The containers are collected again after allowing the customer 48 hours to offload his cargo. and,
6) The containers are then returned to the system for a retrograde load.

These types of resupply missions have no relationship to the application of containers for unit deployments. Unfortunately, people within the military agencies that deal with container policy have not all made the distinction in the different mission requirements of sustainment versus unit-deployments. Certainly, the great majority of containers used in large conflicts will be for sustainment purposes, and those containers will be strategic transportation assets. But if the

Army has shifted its containerization policy, as stated in AR 56-4 to include containerization for unit equipment, as well as sustainment cargoes- then the unit need for both a transport and storage facility of their miscellaneous equipment should be answered.

The U.S. Army Quartermaster School is making headway in addressing this unit need for a transport and storage facility in a program called the Mobility Container (MOBCON) System. The School is requesting the materiel developers to either design or find a series of containers that are lightweight, durable, transportable in all modes of transportation, and smaller than the standard 20-foot container [Fleming, 1991]. Such a system would greatly assist the units by providing them a mobile storage facility small and light enough to handle without any modification to most unit authorized equipment tables.

But what about the standard 20-foot containers filling the unit-owned container role? Many units, especially the larger logistics units positioned towards the rear of the battlefield, have both the need and the capability to handle the large standard containers. A 20-foot container with chassis is larger and more space-efficient than a MOBCON, and is easily transported from one location to another if the unit has a suitable truck. The advantage of using a standard 20-foot container is twofold:

1) they are compatible with the intermodal transportation network, and
2) they can be easily obtained in the commercial market if a unit must be issued one.

Except for the fact that it may be cheaper in the long-run to buy the container for the unit, rather than charter a long-term lease, the actual permanent ownership of the container is really inconsequential to the concept of 'unit-owned.' The intent is that some doctrinal agreement is made to allow capable units the opportunity to retain containers issued at home station throughout their entire deployment. Certainly there are deployment-training benefits that are more readily available to a unit if they 'own' the container during peacetime, but actual ownership is not the critical issue in the debate of how containers ought to be employed.

3.6.4: Summary:

In summary, doctrinal guidance on these three issues from the Department of the Army (or the Training and Doctrine Command, as appropriate) would greatly assist both the transportation agencies and the units that are involved with container usage. There are a few other ancillary issues that need to be included in the Army-wide guidance, but unlike the three issues previously discussed in this chapter, they are not vital to the basic concepts of container employment. For example, some of these other topics might include:

1) The topic of preferred stuffing locations should be addressed. Should containers be stuffed at home station or at the port? Also, if small vehicles are to be containerized, should they be stuffed at the port while the rest of the containerizable equipment is stuffed at home station? and,

2) A determination should be made of the appropriate stockage level of Army-owned containers versus the amount of containers that can reasonably be expected to be leased from the commercial sector on short notice. With all the containers purchased during Desert Shield/Storm, some decisions need to be made as to which units should be issued containers and which units are expected to lease containers. By specifically identifying units that will have to lease containers for any future contingency, these units and their respective installations can develop contingency contracts with container lessors to ensure rapid response to the unit's request.

Once the doctrine explaining the appropriate missions and concepts of employment is published, it will become easier to determine if there are weak links in the Army's intermodal movement sequence that must be corrected. By providing all the responsible agencies with the current 'rules of the game,' continuity between these agencies will be added for future decisions surrounding containers.

CHAPTER 4:
DEPLOYMENTS USING CONTAINERSHIPS

Chapter 2 presented the argument that additional sealift is required to move U.S. forces in future defense contingencies. Since a large-scale deployment would require more sealift than is currently available from the government-controlled strategic sealift fleet, the U.S. continues to rely on the merchant marine fleet to augment these sealift requirements. While the military prefers Ro/Ro vessels to move unit equipment, which is predominantly wheeled and tracked cargoes, the number of available Ro/Ros (and even breakbulk ships) continues to dwindle as the percentage of containerships rises. This trend of merchant shipping towards containerization is worldwide, and impacts equally on the shipping fleet characteristics of our allies. Even more so, since U.S. access to the Ro/Ro ships of other nations is not always certain, policy makers should be made aware of the effects of augmenting the surge phase of deployments with containerships. Before policy makers can decide on the role of containerships in relieving the nation's sealift shortages, they must first be given all available information.

This chapter provides information on SEASHEDs and Flatracks, and their capabilities of modifying container vessels for the transport of unit equipment. This information is followed by a brief summary of the germane studies, both completed and ongoing, that evaluate the use of containerships as a method of transporting U.S. military forces abroad in support of national defense objectives. Five types of containership 'evaluations' are discussed in this chapter. The bottom line of these studies show, that containerships can be used to transport unit equipment, and in fact, can significantly improve force closure times.

4.1: SEASHEDS AND FLATRACKS

This section describes and analyses the hardware that has been purchased as part of the Sealift Enhancement Program, to ensure that container vessels can carry outsized military equipment. After presenting the capabilities of SEASHED and Flatrack hardware, a brief analysis of their reported performance will then be provided.

4.1.1: SEASHEDs

As mentioned previously, SEASHEDs are inserted into the holds of containerships resulting in 'tween-deck conversion systems. These temporary decks in a container vessel provide for the transport of outsized military equipment, such as tanks bulldozers that cannot be containerized. Each shed occupies three adjacent 40-foot container cells in width, and has an overall height of $1^1/_2$ containers. These large open-top structures, measure 40 feet long by 25 feet wide by 12 feet 6 inches high. Their tare weight (empty) is 75,000 pounds, with a maximum gross weight of 147 short tons [Information Spectrum, Inc., 1984].

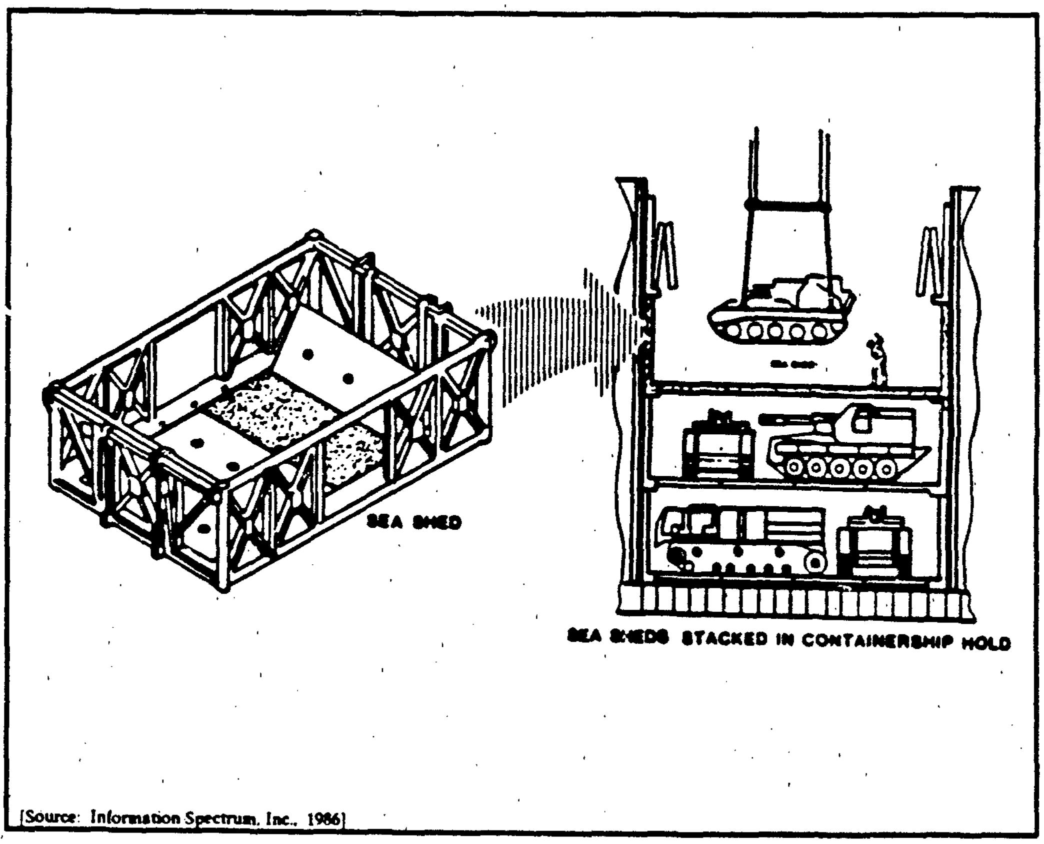
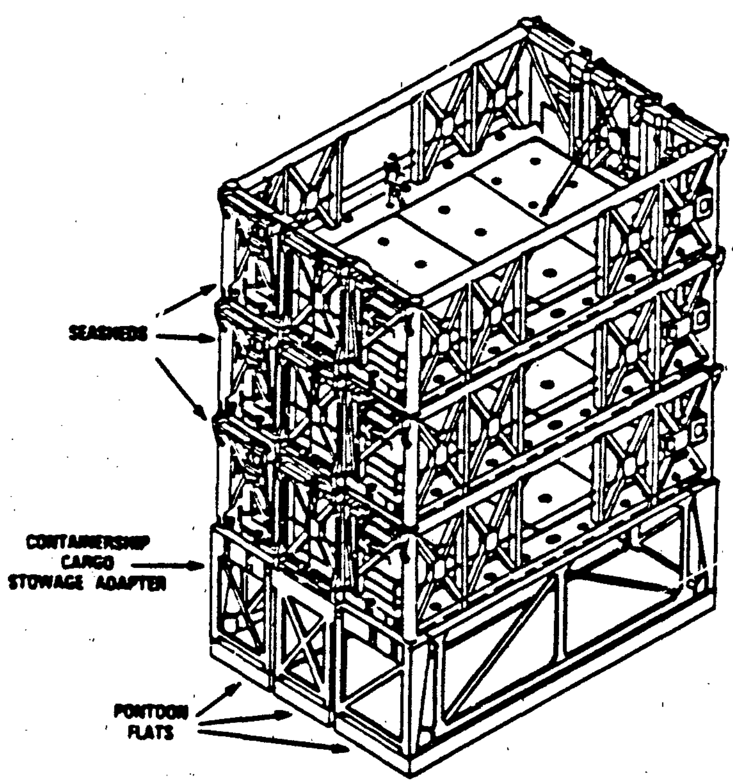


FIGURE 4.1.1 SEASHED Stowage

The biparting floors provide a 'work-through' capability, enabling cargo to be loaded onto the bottom shed, in a stack of SEASHEDs. Figure 4.1.1 demonstrates how cargo is lowered through the open doors of the higher SEASHEDs. A self-contained electromechanical winch actuates the floor section.

Floors can also be opened with an emergency rigging system connected to an external crane [Information Spectrum, INC., 1984]. The 'work-through' floors restrict some access into the sheds, and therefore only accommodate cargo up to 30' x 18' [Naval Sea Systems Command, 1989].

SEASHEDs can be stacked up to three high, and must be placed on a Containership Cargo Stowage Adapter (CCSA). The CCSAs are large open frame structures, similar to SEASHEDs, except that they have no flooring [Burns, MSC interview, July 1991]. See Figure 4.1.2 for the placement of the CCSAs.



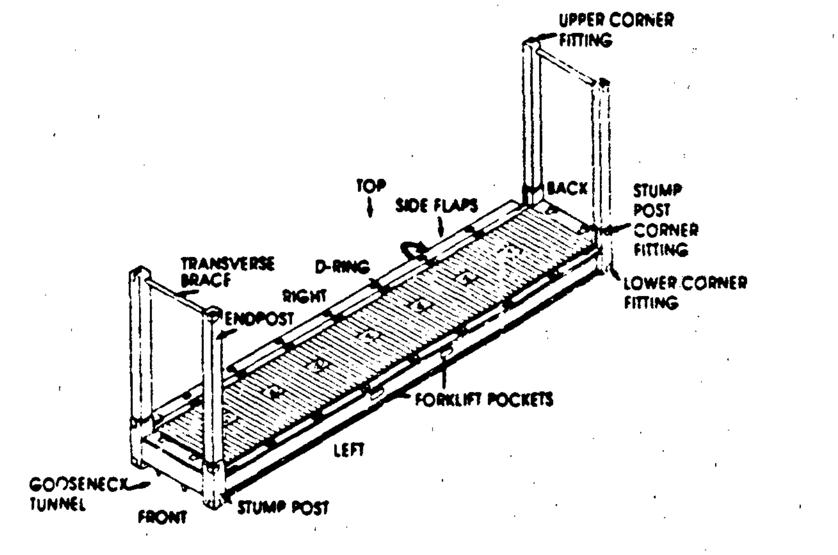
[Source: Naval Sea Systems Command, 1989]

FIGURE 4.1.2 The SEASHED System With CCSA

As of December 1990, 939 SEASHEDs and 359 CCSAs were delivered to Military Sealift Command. Approximately 100 more SEASHEDs remain to be delivered off the 1989 contract [Burns, MSC, interview July 1991]. The inventory is strategically located off the three coasts: Bayonne, NJ; Charleston, SC; and Port Hueneme, CA. [1991 Container System Hardware, 1991]

4.6.1: Heavy-Duty Flatracks

Like SEASHEDs, the 40-foot Heavy Duty Flatracks were developed under the Sealift Enhancement Program to provide a breakbulk capability to container vessels for the carriage of heavy or outsized military cargo. Flatracks are intermodal, open-topped, open-sided units which fit into existing container cell guides. Figure 4.1.3 illustrates the components of the Heavy Duty Flatrack.



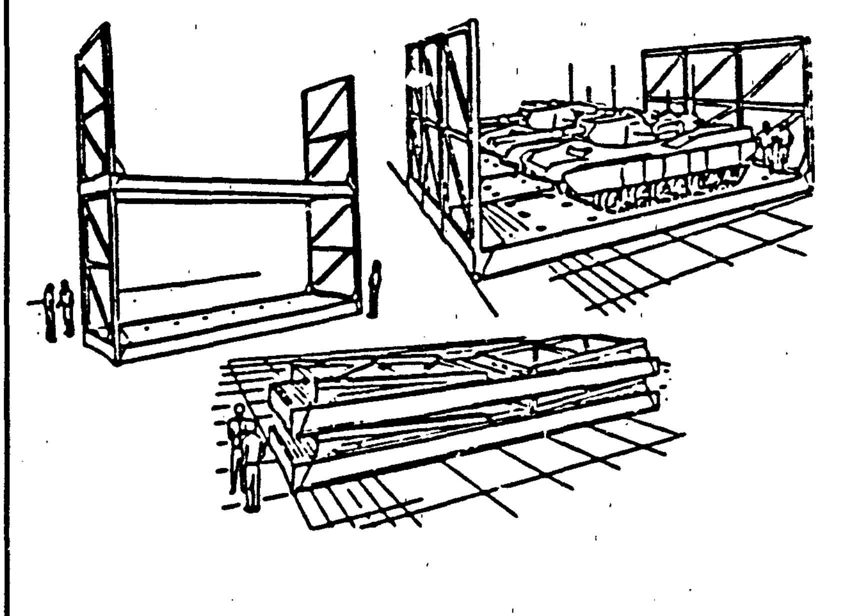
[Source: 1991 Container System Hardware, 1991]

FIGURE 4.1.3 Heavy Duty Flatrack

Flatracks may be used individually or combined horizontally in sets. When used as 'decking' and placed side-by-side, small portable ramps must be placed between the Flatracks so that vehicles can cross from one to another. Preloaded Flatracks may be inserted or removed from the container cells if their gross weight does not exceed the spreaderbar capacity of 67,200 pounds [Naval Sea System Command, 1989]. If the combined weight does exceed the spreaderbar limitations, then the cargo would have to be lifted separately from the Flatrack.

The military version of the flatrack was designed specifically to handle the heaviest pieces of equipment in the Army inventory. For example, the commercial flatrack has a 30 long-ton cargo capacity, while the Heavy Duty Flatrack can carry

60 long-tons [Woodman, 1989]. In addition, the corner posts on the military version are higher than the commercial types to allow greater loading flexibility. The telescoping corner posts of the government-owned Flatracks range from 8.5 feet to 13 feet high. In addition, these ends fold down to facilitate stacking and storage [1991 Container System Hardware, 1991].



[Source: Naval Sea Systems Command, 1989]

FIGURE 4.1.4 Various Flatrack Configurations

Figure 4.1.4 offers three separate views of a Flatrack's capabilities. They can be stacked with the posts up or down, and they can carry equipment that straddles the Flatracks. In this illustration, the decking capability is demonstrated by showing three Flatracks carrying two tanks.

As of 1 April 1991, 2,011 Flatracks had been delivered to the Military Sealift Command from the contractor. Another 349 are still projected for delivery. They are being stored at the same three strategic locations as the SEASHEDs [Burns, MSC interview July 1991].

4.1.3: Analysis of the SEASHEDs and Flatracks

This section provides the military transportation planner and the actual user with some practical information about the SEASHED and Flatrack hardware.

A great deal of research has already been conducted on the application of these Sealift Enhancement Features. A study by MARAD in 1985 identified, by containership, the number of SEASHEDs required and their appropriate placement into each U.S. flagged merchant containership [Strategic Sealift Program, Survey of Large Containerships, 1985]. In 1983, the Transportation Engineering Agency (TEA) conducted a study to determine the benefits and proper uses of SEASHEDs and Flatracks [A Comparative Analysis of The SEASHED and Flatrack Systems, October 1983]. It is from this study and personal interviews with Military Sealift Command, that most of the following information was compiled.

SEASHED Advantages:

1) The work-through floors allow equipment to be lifted on and off through the deck levels of the vessel. Such a benefit eliminates the time loss associated with hatch removal and any double handling of the SEASHEDs.

2) The load/discharge times in port may be faster if SEASHEDs are used rather than multiple levels of Flatracks, since the SEASHEDs are already installed in the ship, and therefore, requires fewer lifts at the port. (only the cargo has to premodified vessel is recalled for SEASHED installation, the procedure will impact on the ship's available response time and will necessitate occupying the berth space for a longer period of time in the already congested port situation.

2) The SEASHED is unable to stow all the equipment in a Division's inventory. (e.g. 90.3% of a Mechanized Infantry Division) Side-by-side Flatracks, on the other hand, can stow 100% of a Mbe loaded, rather than the Flatrack decking and then the cargo)

SEASHED Disadvantages:

1) A costly (approximately $1,000,000) one-time ship modification is required if a container vessel is to be prepared for future SEASHEDs installation. Afterwards, if this echanized Infantry Division's gear, and approximately 95% of the other divisions' equipment.

3) The installation of SEASHEDs greatly reduces container back-loading capability of the container vessel. In a wartime theater of operations, the backload requirement for containers will become more critical as the duration of the operation increases, and pier and intransit storage space become scarce.

4) Initially moving the SEASHEDs from one of their three stockpile locations to a designated port is a challenging logistical operation. The fact that these platforms are so heavy, oversized, and bulky makes them extremely difficult to move across country [Driver, MTMC-EUR, interview September 1991].

5) Presently, SEASHEDs have no existing commercial application, and are not intermodal platforms [Dias, TRANSCOM, interview March 1991].

Flatrack Advantages:

1) Triple Flatracks offer 14% more usable cargo stowage area than a single SEASHED (its container cell equivalent). Triple Flatracks offer 912 square feet for cargo stowage versus the SEASHED, which offers 783.2 square feet.

2) Flatracks are intermodal (can be transferred from one mode to another) and are compatible with the standard ISO 40-foot container handling equipment. This ensures compatibility with host nation assets to offload the Flatracks and backload containers simultaneously.

3) Single-loaded Flatracks (Flatracks with a load that are lifted as any other container with load) can be discharged with the same efficiencies as containers. Since 56% of a typical division's equipment is single Flatrack eligible, their use could decrease discharge time and increase vessel turnaround time.

4) Flatracks allow for a mixture of breakbulk/container operations aboard the same vessel. The conversion of a ship from a 'false deck' breakbulk configuration, back to container configuration is easily accomplished since both Flatracks and containers are handled identically. This enables the containership to return carrying the necessary mix of containers versus Flatrack loads. The Flatracks that are not required on the return voyage can be collapsed in an effort to maximize container cell capacity.

Flatrack Disadvantages:

1) Flatracks require some double handling when configured as false decks (versus single loaded Flatracks). In this configuration, several Flatracks must be removed to gain access to cargo below decks.

2) When discharged as a single-loaded Flatrack, some congestion may occur at the port area while separating (offloading) the vehicles and equipment from the Flatracks. Since these government-owned Flatracks are limited assets purchased to augment containership deployments, they must then be returned to the vessel for its subsequent voyage. In short, single-loaded Flatracks can be

handled with intermodal CHE, but they loose their intermodal advantage because the Flatrack must stay with the ship or in the port area.

Summary:

Together, SEASHEDs and Flatracks offer both breakbulk (false decking) and container cargo alternatives to a container vessel. Once installed, the SEASHEDs' work-through floors provide some efficiency advantages for cargoes that must be lifted onto the ship. In most instances, however, the Flatracks generally offer more advantages. The ability to adjust the 'mix' of container versus breakbulk operations according to the changing situation provides added flexibility in maximizing sealift capacity. Flatracks also offer interoperability with the host nation's cargo handling equipment, and do not require any ship modifications for use. Although Flatracks offer greater advantages, their limited numbers may require the use of both SEASHEDs and Flatracks to convert enough container vessels in the deployment of a large military force. The current SEASHED and Flatrack inventory has the potential to convert 25-30 containerships to breakbulk configuration.

4.2: THE MECHANIZED DIVISION SIMULATION STUDY

The first of the studies relating to containership deployments was conducted by Information Spectrum, Inc. for the Maritime Administration, and was called, The Use of Containerships to Transport a U.S. Army Mechanized Division [June 1980]. This study utilized simulation models to investigate the viability of using SEASHEDs in conjunction with containers and weather deck space to transport the equipment and supplies of a Mechanized Infantry Division. (The upcoming 1986 Table of Equipment was used for the study, and is still current today.) Within the deployment calculations, they also included the requirement to ship 30 days of supplies [Information Spectrum, Inc., 1980].

The study defined the capacities of a hypothetical containership (notional) after evaluating the storage facilities of the existing containerships in the 1979 U.S. fleet. Of the 105 existing containerships, 50 of those ships were capable of carrying an average of 23 SEASHEDs, and 30 of these ships could carry an average of 30 SEASHEDs. Since these ships were believed to be the most likely candidates for early modification to accept SEASHEDs, the following notional containership capacities were selected:

- Average TEU below deck before SEASHED installation:	594/ship
- Average SEASHEDs:	30/ship
- Average TEU below deck after SEASHED installation:	324/ship
- Deck area:	23,400 sq. ft./ship

This was really the first study that offered some quantitative analysis to the idea that specialized containers, like SEASHEDs, could enhance the United States' capability to use containerships for unit deployment purposes. The study determined that 23 notional containerships, using 660 SEASHEDs, 4,927 containers (TEUs), and 489,739 square feet of weather deck space could deploy 100% of a U.S. Army Mechanized Division. It also determined that 36% of the equipment was containerizable in ISO containers, and that 92% of the equipment could be loaded below deck in either ISO containers or SEASHEDs (while the remaining 8% could be loaded on the weather deck). With this baseline of empirical data, the actual execution of modifying a containership to test whether unit equipment could actually be deployed was not attempted until nine years later.

4.3: DISPLAY DETERMINATION '89

From 13 August - 15 September 1989, the Joint Chiefs of Staff directed an exercise to test the use of a commercial non-self-sustaining containership (NSSC) in deploying military unit equipment. The name of the exercise was Display Determination '89. The test consisted of a single containership, the *Sea-Land Consumer,* which was modified with SEASHEDs and Flatracks to carry 477 pieces of military equipment [Cooper, 1989]. The two primary objectives of the exercise were to:

1) Evaluate the feasibility of using commercial sealift assets previously held to be inappropriate for the transport of unit equipment. and,
2) To test the feasibility of containerizing unit equipment for strategic deployment purposes [MTMC-TEA, March 1990].

Display Determination '89 was conducted in five operational phases: ship modification, SEASHED installation, cargo preparation, loadout and discharge. During the modification phase, the ship's container cell guides were strengthened with additional crossmembers and back plates to carry the SEASHEDs. The Adapter frames (CCSAs) were also placed onto the ship during this phase. The entire process took five days, but could have been done in two or three if the holds had been modified concurrently (rather than one at a time) [Cooper, 1989].

The SEASHED installation phase required two days to complete. It involved adjusting the CCSAs to the width of the cell guides, and bolting them to the ship's structure. These adjustments required four to six hours per container hold. A total of 11 container holds were used, each providing four false decks. Once the 33 SEASHEDs were positioned on the terminal apron, the placement of the sheds into the container cells was as easy as moving normal containers. On the average, it required only two to three minutes per lift cycle. Despite the fact that each SEASHED weighed 76,000 pounds, most modern commercial cranes and their 40-foot spreader bars are capable of handling these loads [Cooper, 1989].

The cargo preparation phase took another four days. This involved pre-loading approximately 150 40-foot Heavy Duty Flatracks, and driving utility vehicles (e.g. CUCVs) into 90 of the 20-foot and 40-foot ISO containers. Precut blocking and bracing materials were nailed to the wooden container floors to stabilize the vehicles for the ocean voyage [MTMC-TEA, March 1990].

The initial loadout phase was conducted at the Port of Baltimore with two cranes. One crane was loading the ISO 20-foot containers while the other loaded the pre-loaded 40-foot Flatracks. This process went very quickly, again requiring only two to three minutes per lift. As these were being loaded onto the ship, the slow process of opening the SEASHED floors was started. Since SEASHEDs have their own controls, the floors had to be raised individually in each hold. Once completed, the breakbulk-type loading operation began of the outsized vehicles. The first pieces were placed on the very bottom level of a hold, and once full, the floor of the adjacent SEASHED was lowered to create another false deck. Flatracks were also loaded empty to be used as false deck stowage space. They found that the Flatracks provided more usable stowage space than the SEASHEDs, and could be loaded more quickly.

The ship was loaded in less than one day with the 285 pieces that would come out of Baltimore. It then proceeded to Livorno, Spain for an additional 192 pieces of equipment. The loadout in Livorno took longer (two and one-half days), because some of the equipment had to be restowed to accommodate the additional cargo [Cooper, 1989].

Finally, the discharge was conducted in Bandirma, Turkey. It was conducted using mobile cranes of 330-ton and 230-ton capacities. These cranes were much slower than the gantry cranes of the loadout, and required approximately 15 minutes to lift-off each piece. Also, unlike the procedure used during the loadout, the cargo stowed on the Flatracks was unlashed on board ship, and the cargoes were lifted off separately from the Flatracks. The vehicles that were stowed in the containers were unstuffed at the port and the empty containers were placed back on the ship. During this phase, they found that none of the vehicles had been damaged inside the containers. Overall, the Lift-on/Lift-off (Lo/Lo) operation of the discharge took 6 days. If modern gantry cranes had been available, it is estimated that the time could have been cut by approximately two-thirds [Cooper, 1989].

This exercise has been very important in demonstrating that deployments using non-self-sustaining containerships are possible. Many valuable lessons were learned, and serve to provide the subsequent exercises with a baseline of information to avoid some of the time-consuming mistakes, such as having to restow the load at the second port of embarkation. This exercise also verified the results from the previous simulation study that said that Flatracks are more space efficient and less time-consuming during the loading phase. Display Determination '89 also showed that small vehicles could be successfully loaded into ISO containers without damage during sealift [USTRANSCOM, May 1991]. Finally, this exercise may have shown that containerships, modified to carry outsized equipment, can offer a great deal of unit integrity during transport. The fact that there are more containerships than the preferred Ro/Ro and breakbulk ships, and that modified, they can accommodate all sizes of unit equipment, makes the containership a viable alternative to those commanders who insist on unit integrity during the sealift phase of deployment.

4.4: THE MALLORY LYKES

The most recent test using containerships to deploy unit equipment was conducted during the redeployment phase of Desert Storm. While enroute to the Persian Gulf, from the East coast of the United States and Rota, Spain, the *Mallory Lykes*, a self-sustaining containership, was loaded with six SEASHEDs, three containership cargo stowage adapters (CCSAs), and 34 40-foot Heavy Duty Flatracks. The ship arrived on 1 June 1990, was loaded with the equipment of two Army companies, and departed on 5 June. A total of 335 pieces of cargo (40,440 square feet) were loaded [Cahill, Formal Memorandum to MSC, 10 June 1991]. Because the containership was equipped with SEASHEDs and Flatracks, unit integrity was maintained, allowing for all pieces of equipment from both units to be loaded on the same ship [Lynch, MSC Administrative message, 14 July 1991].

Even though this was only a small sample of transporting unit equipment, it provides additional information for future deployments using the Sealift Enhancement Features on commercial container vessels. The following comments were provided from the Military Sealift Command's observers at the port in Dammam, Saudi Arabia.

1) The size of the *Mallory Lykes*, listed as 51,000 square foot capacity, was thought to be too big for a company-size unit, but not big enough for a Battalion. They recommend that a larger containership is used in the future to allow more flexibility in unit selection and in cargo operations [Cahill, Formal Memorandum, 10 June 1991].

2) The SEASHEDs and Heavy Duty Flatracks were in good mechanical shape and had no hardware problems.

3) The Flatracks required additional handling and delayed the loading time. The additional handling involved rearranging Flatracks to make false decking. The SEASHEDs, on the other hand, were already installed so they did not cause preparation delays.

4) The SEASHEDs easily handled the outsized engineer equipment, such as the large portable cranes and earthmovers. The considerable size of these pieces, however, gave them a high broken stowage factor. (The shape did not allow for the full capacity of the SEASHEDs to be utilized.)

4.5: IMPACT ON FORCE CLOSURE

In 1989, MTMC's Transportation Engineering Agency conducted a study called, "Analysis on Containerization of Unit Equipment in Strategic Deployment." This study utilized simulation models to determine the effect of using various types of sealift, and its impact on unit closure times. Unit closure refers to the time required to move an entire unit from CONUS to the port of debarkation. Obviously, in a military emergency, decreasing the time it takes for military units to arrive at the theater of operations is an important aspect of a successful deployment. The units evaluated were notional units of each division type: . Air Assault Division, an Airborne Division, an Armored Division, a Light Infantry Division, and a Mechanized Division.

r their simulation parameters, they assumed that Ro/Ro ships, breakb ships and containerships would be used to deploy unit equipment as they became available. The first iteration, however, ran the models through a 'base case scenario,' where units are deployed as they have been in the past, using the first available Ro/Ro and breakbulk ships only. The next iteration assumed that units would containerize their breakbulk-type items in 20-foot containers. These containers, would then be loaded on the first available containership, while the unit's wheeled vehicles were loaded on the first available Ro/Ro or breakbulk ship. Table 4.5.1 shows the force closure results for the various types of divisions, under these conditions. While the actual days required for force closure is classified, the unclassified results revealed that final unit closure times would improve moderately with maximum containerization.

TABLE 4.5.1 Closure Improvements When Unit Containerizes

UNIT	% UNITS CLOSED/#DAYS EARLY	PORT CLOSURE
AASLT	29% CLOSED 6 DAYS EARLIER	1 DAY EARLIER
ABN	40 % CLOSED 7 DAYS EARLIER	SAME DAY
ARMD	27% CLOSED 4 DAYS EARLIER	4 DAYS EARLIER
LIGHT	17% CLOSED 4 DAYS EARLIER	SAME DAY
MECH	NO EFFECT	SAME DAY

[Source: MTMC-TEA, "Analysis on Containerization of UE in Strategic Deployment," 1989]

The next iteration of their simulation compared the 'base case scenario' to time closure improvements if containerships were outfitted with Flatracks and SEASHEDs. In this scenario, outsized unit equipment was loaded onto containerships if no Ro/Ro or breakbulk ship were available. Table 4.5.2 summarizes the results. They determined that unit closure times could be improved significantly when containerships were converted to accept outsized equipment.

TABLE 4.5.2 Closure Improvements With Modified Containerships

UNIT	% UNITS CLOSED / # DAYS EARLY	PORT CLOSURE
AASLT	50% CLOSED 4 DAYS EARLIER	2 DAYS EARLIER
ABN	40% CLOSED 8 DAYS EARLIER	2 DAYS EARLIER
ARMD	90% CLOSED 8 DAYS EARLIER	4 DAYS EARLIER
LIGHT	28% CLOSED 4 DAYS EARLIER	10 DAYS EARLIER
MECH	67% CLOSED 6 DAYS EARLIER	1 DAY EARLIER

[Source: MTMC-TEA, "Analysis on Containerization of UE in Strategic Deployment," 1989]

4.6: JUITI

Of all the studies and exercises investigating the use of containerships for moving unit equipment, the most comprehensive of these studies is currently in the planning phase. The Joint Unit Intermodal Transportation Initiative (JUITI), scheduled for execution in 1993, will resolve many of the procedural questions that still exist. The purpose of JUITI is to evaluate the use of containerships and the commercial intermodal system that transports military units from their home station to overseas locations. While the previous studies have demonstrated that outsized equipment can be carried on containerships using SEASHEDs and Flatracks, this study will expand beyond the scope of the sealift leg, by addressing performance at additional system links and nodes. To date, actual equipment moved on modified containerships has been tested at a small scale. JUITI will be the first test to evaluate the movement of an entire battalion-sized unit. See Joint Unit Intermodal Transportation Initiative Joint Test and Evaluation Feasibility Study, May 1991 for additional details on the exercise and its objectives.

4.7: SUMMARY OF STUDIES

The studies that have been conducted on the use of containerships for deploying unit equipment have all shown that these vessels provide a viable source of sealift. Because the shortfalls in sealift were highlighted during Desert Storm, there is added emphasis in utilizing all available sealift sources. While the strategic sealift fleet and Ro/Ro ships are the most militarily useful ship types, their scarcity makes the use of containerships to supplement the total sealift mix, an option that policy makers should consider using for future large-scale deployments.

CHAPTER 5:
CONTAINER HARDWARE

This chapter presents the various types of containers that the Army should consider using for unit deployment purposes, and subsequently provides a methodology for container selection. To date, no published report can be found which documents the advantages and disadvantages of employing different types of containers. This comparison type information is essential in order for someone to select the appropriate containers necessary to meet a particular unit's equipment configurations and mission requirements. The annual, Container System Hardware Status Report, published by the Research, Development & Engineering Center at Fort Belvoir, Virginia, is currently the most useful document in describing container hardware suitable for military application. This document, however, only describes dimensional information and current procurement status of container systems already in use by DOD. In an effort to supplement that report's dimensional description of containers, this chapter also describes each container's advantages and disadvantages to the user, and thereby provides a single-source document for unit container selection.

5.1: GENERAL INFORMATION

The generalized advantages and disadvantages of containerization were presented in Chapter 3. This first section will define some of the specific characteristics of International Standards Organization (ISO) containers, which are formally referred to as, 'freight containers.'

5.1.1: Definition

As mentioned in the previous chapter, the term 'container,' has been used for centuries to denote any type of receptacle used to ship cargo. The term, 'containerize,' however, is distinguished in the American Heritage Dictionary, as: "To package (cargo) in large, **standardized** containers to facilitate shipping and handling." It is the ISO dimensional standards which enable the process of containerization to take on its modern-day intermodal advantages [MARAD, 1982].

The ISO definition states that containers are, "an article of transport," that does the following things:

- Is built strong enough for repeated use.
- Is designed to facilitate the transfer of goods, by more than one mode of transportation, without intermediate reloading.
- Is fitted with hardware to allow easy handling.
- Is designed for easy filling and emptying (stuffing/unstuffing).
- Has an internal volume greater than one cubic meter. [McKenzie, 1989]

5.2: DRY-CARGO CONTAINERS

Within these above stated specifications, there are a variety of container types which are available to meet the shippers needs. ISO containers of all types fit into two broad categories: Dry-cargo (sometimes called general-purpose) containers, and specific cargo containers. As indicated by the names, dry-cargo containers carry a wide assortment of nonliquid cargoes, while specific cargo containers are intended for goods that require additional features, such as temperature control, for dry bulk solids, liquids, automobiles, or livestock [McKenzie, 1989].

Without question, the most commonly used freight containers are the dry-cargo units. They carry approximately 83 percent of all cargo that is moved in containers [DOT,MARAD, 1982]. General-purpose containers are completely enclosed, and must be loaded/unloaded by hand or forklift truck. These units are specifically designed to protect cargo from weather, pilferage, and excessive handling of the individual cargo items.

5.2.1: Dimensions

Dry-cargo containers vary in size, to include 20, 24, 35, 40, 45, 48, or 53 feet in length. By far, the most typical lengths are the 20 and 40 foot containers. These containers are often called '20-footers' or '40-footers' by people in the shipping business. In terms of accounting for containers, the boxes are typically equated to twenty-foot equivalents (TEUs), but with the 40-foot container now dominating the commercial carriers shipments, forty-foot equivalents (FEUs) are also used [Dowd, Professor UW interview January 1991]. In the U.S. container fleet alone, there are approximately 2.4 million TEUs in the 1990 inventory [DOT, MARAD, 1990].

The ISO standard does not restrict the height of containers, but typically, they are designed to be 8 feet, 8 feet 6 inches, or 9 feet 6 inches. The width of all

ISO containers is always 8 feet. If this width standard was changed, as some in the European community want it to, all the current container handling equipment would require major modification [Hayuth, interview April 1991].

5.2.2: Statistical Summary

The following information provides the military container user with a 'big picture' overview of the types and quantities of containers that are available in the U.S. commercial intermodal shipping market. For a complete breakdown of the nation's intermodal distribution, see MARAD's annual report, Inventory of American Intermodal Equipment - 1990.

1) The U.S. container fleet has over 1.6 million containers (2.4 million TEUs), with 87 percent of the containers owned by intermodal equipment leasing companies (lessors) and 13 percent owned by the shipping companies (carriers).
2) The combination of the 20-foot and 40-foot containers, make up 98 percent of the entire U.S. container inventory. Of the total number of containers, 56 percent are 20-footers, and 42 percent are 40-footers.
3) The U.S.-flagged carriers prefer the 40-foot containers, and own four times as many 40-footers as 20-footers. The lessors, on the other hand, are stocked primarily with 20-foot containers, which comprise 67 percent of their fleet. [DOT, MARAD, 1990]

5.2.3: Construction Aspects

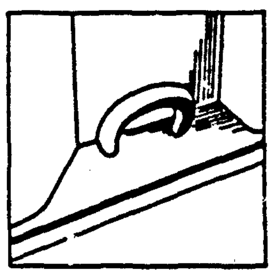
Base Materials for Construction: To ensure the proper container is selected for the intended shipping requirements, it is important to have a basic knowledge of their construction differences. The user should also have a general understanding of the structural strength members of a container, so that they can apply that information to the stowage of items within the container.

There are three primary base materials used to fabricate dry-cargo containers: 1) steel; 2) aluminum; and 3) plywood fiberglass.

1) The Steel Container is the strongest, but it is also the heaviest and corrodes faster than the other two types. The walls may be flat or corrugated, and the flooring may be steel or covered with plywood. Some have cargo lashing strips that run the length of the container along the inside walls.

2) The Aluminum Container is relatively lightweight, which is an important consideration for movement over-the-road. Aluminum has improved insulation properties (over steel), is high-impact resistant, and does not corrode as quickly as the steel containers. Normally the inside walls and flooring are covered with plywood for protection against shifting cargo. The plywood along the side walls should not be used to lash down cargo by driving nails through them.
3) The Plywood Fiberglass Containers are constructed with two different materials: Fiberglass Reinforced Plywood (FRP) or Glass Reinforced Plastic (GRP). Both types are easy to maintain, do not corrode, but also, do not have the strength of the aluminum or steel containers.

Most dry-cargo containers have built-in tie-down devices (Bull rings/ D-rings) to secure cargo. The bull-rings are typically recessed into the floor, and D-rings are normally located along the sides of the container. Figure 5.2.1 is a sketch of a container D-ring.



[Drawn by James D. Burns]

FIGURE 5.2.1 Container D-Ring

Major Components:

The following component description and corresponding figure (Figure 5.2.2) provide the reader with the basic engineering background on a typical end-opening container's construction [DOT, MARAD, 1982].

Corner Posts:

These are the vertical frame components, forming the corners of the container. Structurally, these members are critical to the stacking capacity of the container. In addition, they are integral with the corner fittings and connecting the roof and floor structures.

Corner Fittings:

These are the standardized fittings located at the eight corners. They provide the means for lifting, handling, stacking and securing the container. These castings protrude higher than the walls of the container and therefore, carry the weight of the box in conjunction with the corner posts.

Front-End Frame:

The structure at the front end of the container (opposite the door end). It is made up of the top and bottom end rails, which are attached to the front corner posts and to the corner fittings.

Roof Side Rails and Bottom Side Rails:

Longitudinal structural members at the top and bottom edges on either side of the container.

Floor:

The floor may consist of soft or hard laminated wood, plywood, or planks.

Header:

The horizontal members that are perpendicular to the longitudinal axis of the container. The headers are found on the top of the container and form part of the frame for the roof.

Sill:

Horizontal members that are perpendicular to the longitudinal axis of the container. They are found at the bottom of the frame, opposite the headers of the roof.

Doors:

Doors are either plymetal (plywood core with steel and/or aluminum facings), corrugated / flat steel, or fiberglass reinforced plywood with steel hardware, locking devices and hinges. Doors are lined (plastic, rubber or synthetic rubber gasket) to seal against water leakage. They are generally designed with a door locking rod and handle to secure the door.

DRY CARGO VAN

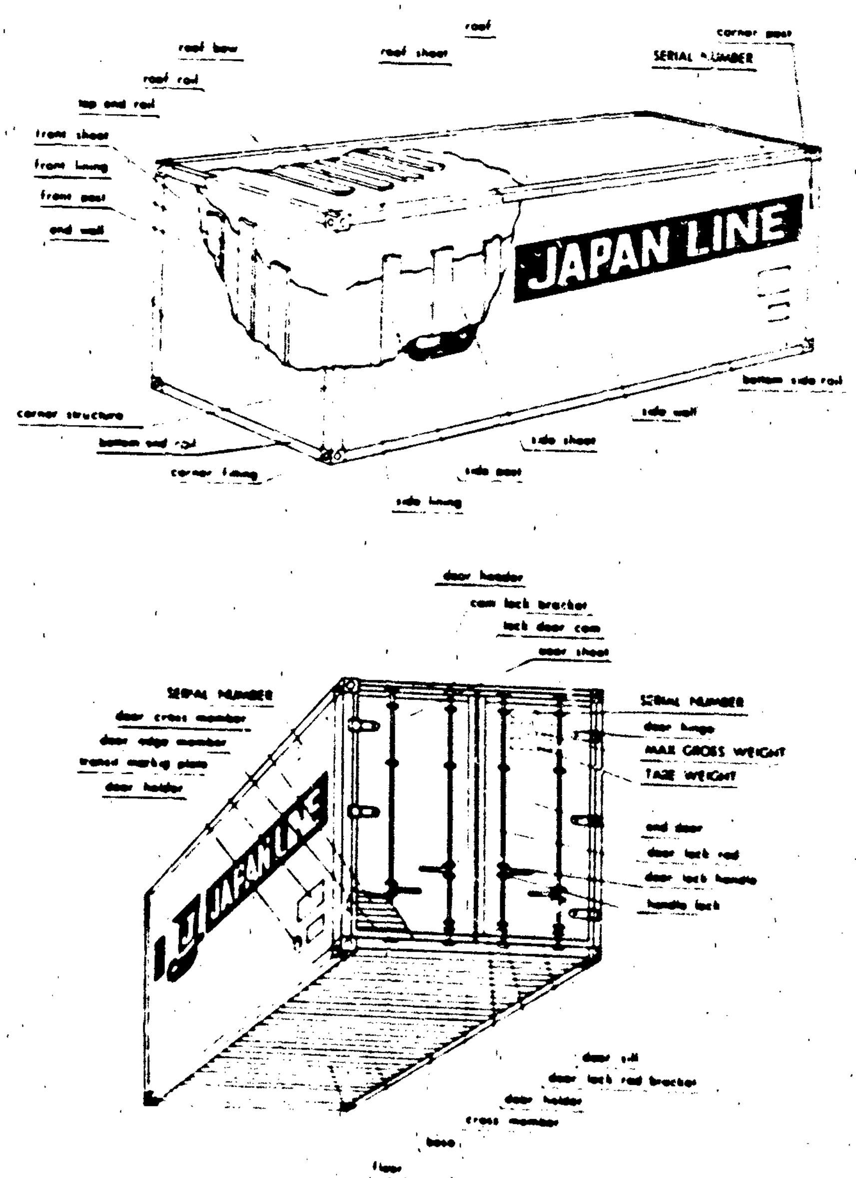


FIGURE 5.2.2 Major Components of a Dry-Cargo Container

Roof and Roof Bows:
Roof bows are the undermost structure of the roof and are typically placed every 18 -24 inches apart. Steel containers may have corrugated or flat steel sheet roofs welded to the frame members. Aluminum containers generally have a flat aluminum sheet bonded with adhesive to the roof bows and riveted to the top rails and headers. The FRP containers will have fiberglass reinforced plywood panels fastened to the rails and headers. It is important for the user to be aware that the roof is the most vulnerable part of the container to damage.

Sides and Fronts:
The sides and front of steel containers are made of corrugated steel sheets. Aluminum containers have flat sidings attached to posts, which are bolted to the top and bottom rails, as well as to the header and sill in front. These posts may be placed to the inside or outside of the aluminum sidings. The FRP of GRP containers do not use posts to support their reinforced plywood panels.

5.2.4: Container Selection

While the outside of most 20 and 40 foot containers look very similar, interior cargo capabilities and features may be quite different from one container to another. For military purposes, the container's manufacturing specifications can make a great deal of difference in the types of commodities that can be carried.

The Army's MILVAN illustrates this point well. It has the exterior dimensions of a standard 20-foot ISO container, but it was designed to carry much greater loads than a standard commercial container. These 20-foot containers were manufactured with the added requirement of hardwood flooring and all interior walls lined with plywood. These added military performance specifications 'cost' five cubic feet of internal storage capability, but gained 4,800 pounds of carrying capacity. (The MILVAN has an internal volume of 1,060 cubic feet and has a weight capacity of 44,800 pounds.) Even more to the point, the majority of MILVANs were manufactured to have ammunition restraint hardware. The restraint system consists of eight slotted steel rails permanently installed on each wall and 25 adjustable cross bars that fit into the rails. While the ammunition MILVAN has normal ISO dimensions on the outside, its modifications make it a much better transportation platform for ammunition than a standard commercial container [Container System Hardware, 1991].

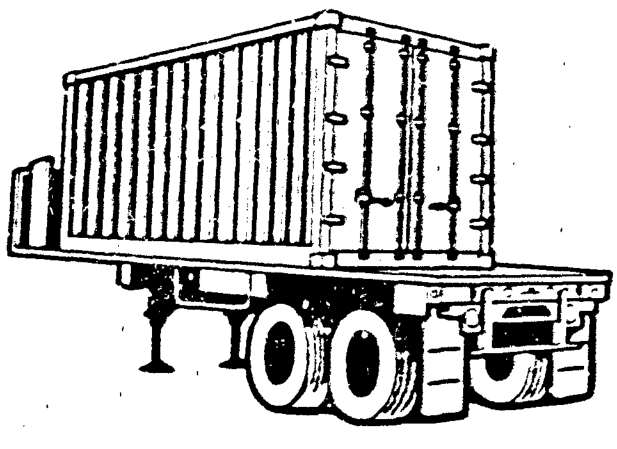
External dimensions are also important considerations when selecting a container. Some items that will not fit into an 8 foot high container will easily fit into a 8 foot 6 inch high container [DOT, MARAD, 1982]. These added inches can make the difference in shipping a partially loaded container, with lost shipping capacity and the potential for cargo shifting, versus a full container with a tight load. It is also important to recognize the restrictions that may be incurred when using a 9 foot 6 inch high container. When placed on a chassis, they can generally move over the road in the United States, but they exceed height restrictions in many foreign countries [Hayuth, interview, April 1991]. If these containers were used by the Army for deployments, it is very possible that the container would not be able to move inland from the port of debarkation. Such a potential reduction in flexibility is a good reason for the military to avoid using 9 foot 6 inch high containers as unit-owned containers.

External dimensions should also be considered when selecting container lengths. Just because a 40 foot container is twice as long as a 20-foot container, that does not mean that it can carry twice as much cargo. While the volume increases two fold, the weight capacity goes from approximately 40,000 pounds for a typical commercial 20-footer (8' x 8' x 20') to 50,000 pounds for a 40-footer (8' x 8' x 40') [DOT, MARAD 1991].

Additionally, because longer containers provide the greatest benefits to shippers with low density and voluminous cargo, 40-foot containers are typically not as well suited for unit equipment. The nature of most unit equipment, such as tents and camouflage netting, is very heavy and dense. Generally, unit equipment would 'weigh-out' a 40-foot container before it 'cubed-out' [Dowd, interview May 1991].

As mentioned in the previous chapter, consideration should be given to the mission and location of units in a war zone. Some units that are in the rear and have been authorized many pieces of large equipment, may be able to accommodate a 20- or 40-foot container without jeopardizing their location. Their location is already apparent to enemy air reconnaissance because of their other large items. Units located more forward, however, may need to conceal their location, and therefore prefer smaller containers which are easier to camouflage or conceal with overhead cover, such as trees.

Another important aspect about the length of the container, is its impact on compatibility of transport throughout the entire system. There are several reasons why the Army should select only 20 or 40 foot containers (or smaller subdivisions of this length), versus the other 24, 35, 45, 48 or 53 foot varieties. First, the Army's Rough Terrain Container Handler (RTCH) is equip with spreader bars to handle 20, 35, and 40 foot containers [Brower, interview March 1991]. Second, U.S.-flagged container vessels can only carry 20 and 40 foot containers in their holds. While some carriers accept the other 'odd' size containers (typically 45-footers), these are restricted to weather deck loading only [Helton, VP SeaLand, interview July 1991]. Next, compatibility consideration must be given to the inventory of Army trailers which are capable of hauling containers. Primarily this includes the M872 series (40-foot) and the M871 series (30-foot) semitrailers [1991 Container Systems Hardware, 1991]. Both of these semitrailers were designed with container



FIGUBZ 5.2.4 M871 Semitrailer with a 20-Foot Container

locks every five feet to handle various size containers. This means that containers falling within the 'footprint' of a 20 or 40 foot container maximize the available space on the semitrailer. Figure 5.2.4 illustrates an M871 semitrailer carrying a 20-foot container. Lastly, since 98% of all containers in the current inventory are either 20 or 40-footers, these will be the easiest for the Army to obtain. This is especially true if containers must be leased on short notice, as was the case for Desert Shield.

5.3: COMMERCIALLY AVAILABLE ISO CONTAINERS

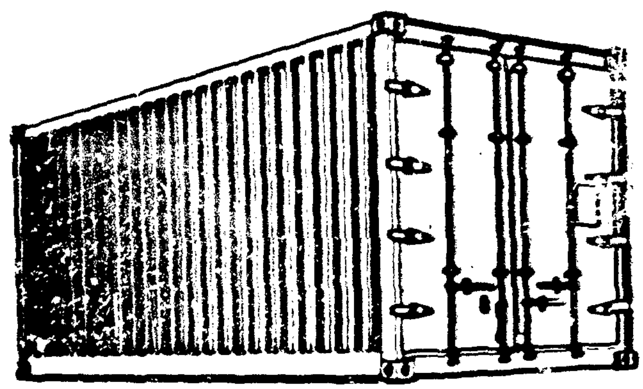
The next three sections present a wide variety of containers that may be appropriate for the purpose of transporting (and storing, in some cases) Army unit equipment during deployments. Afterwards, guidelines for container selection are presented to assist military planners in choosing containers appropriate for their particular unit's needs from the previously described hardware. The tools presented in this chapter should enable the military-user compare the benefits of various containers, weigh the particular advantages to their cargo requirements, and make an educated selection on the best mix of containers for their unit.

As stated at the beginning of this chapter, there are no published reports that compare the advantages/disadvantages of one container to another. As a result, much of this information is a collection of ideas gathered from people who work with containers. This first hardware section describes the ISO containers that are available on the commercial market, or can be procured with higher military specifications.

5.3.1: Dry-Cargo General Purpose (End-Opener)

The commercial transportation industry uses many types of containers to transport different types of cargo, but the 20 and 40 foot dry-cargo general purpose vans are what most people envision when discussing freight containers. As stated earlier, they come in a variety of height dimensions, with the best height for unit deployment purposes being either 8 feet or 8.5 feet. Figure 5.3.1 illustrates to 20-foot dry-cargo container with the doors on one end, typically called 'end-openers.' This name distinguishes this type of container from side-opening dry-cargo containers of the same dimensions. The approximate cost of an end-opening 20-foot container is $3,500.

Advantages: End-openers are the most readily available type container for either procurement or leasing by the Army. While the MILVANs were manufactured to a higher performance standard than the standard commercial container, the added weight capacity may not be worth the cost [Browers, RD & E interview, August 1991]. Particularly for unit deployment purposes, the standard ISO/ANSI container works just as well. The interior plywood reinforced walls of the MILVAN may offer some longevity to the container, but the additional cost of specially manufactured containers may not prove to be cost-effective in the long run. The second advantage of using commercially available end-openers lies in the reduced chance of forklift trucks damaging the doors, since containers are lifted from the side [Barickman, RD & E interview, August 1991]. Last, when being loaded from the ground, the 'curb' of the container entrance is low enough that a forklift can enter and exit without a ramp.



[Source: FM 55-65, [illegible]]

FIGURE 5.3.1 Dry-Cargo General Purpose (End-Opener)

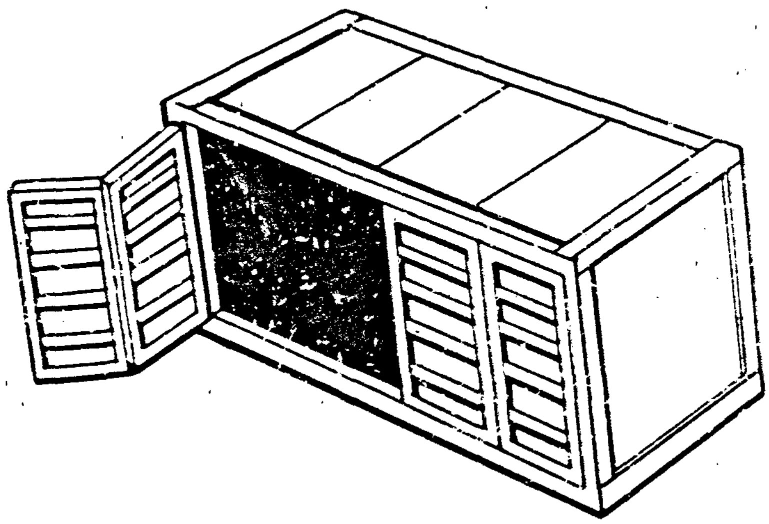
Disadvantages: The primary disadvantage of the end-opener is the fact that there is little access to the cargo in the front part of a full container. If an item must be retrieved from the front of the container, the entire van must be discharged first.

5.3.2: Dry-Cargo General Purpose (Side-Opener)

This container has the same general appearance as the ISO end-opener, except with the door on the side and they come in only 20 or 40 foot lengths [FM 55-15, 1986]. The Air Force uses these extensively to store and transport ammunition in Europe. These ISO containers were constructed primarily to provide access to cargo the entire length of the container [Container System Hardware, 1991].

Side-openers have several door configurations. Most are built with doors that open the full length of the container on one side. Others have both the end-opening doors and the side-opening doors. Another kind has smaller side-opening doors, approximately the same size as the end-opening doors (providing only partial access to the length of the container). There is even a variation that has side doors on both sides, and an end door. The structural integrity of this particular variation is reduced because of the many doors.

For unit deployment purposes, the version that the Air Force is using, with the full access along one side, is recommended with the following advantages and disadvantages. See Figure 5.3.2 for sketch.



[Source: Drawn by [illegible]]

FIGURE 5.3.2 Dry-Cargo General Purpose (Side-Opener)

Advantages: Unlike the end-opener, this dry-cargo container's primary advantage is the ease of access provided to the contents of the container. In addition to allowing easy access items near the front of the container, the large working area provided by opening both doors increases the speed of loading and unloading. With this type of container, two forklift trucks can work in tandem to on/offload the cargo.

Disadvantages: When placed on the ground, the floor of the container is approximately 10 to 12 inches higher. Because the floor is so far off the ground a forklift truck would require a ramp to run in and out of the container and maintain a steady load. (The 'curb' at the entrance is approximately six inches higher off the ground than the end-opening doorway.) Without entering the container, a 4,000-

Pound Rough Terrain Forklift Truck (4K RTFLT) does not have the tine reach to pick-up items toward the back side of the container. If a ramp was not available to assist the forklift truck to get inside, a 6,000-pound variable reach forklift truck would be required [Browers, RD&E, August 1991].

The second concern with these containers is the anticipated maintenance requirements, over the end-opener. There will be more wear and tear on the doors because of the proximity of the forklift pockets along the side. Also, these larger double doors have more hardware and gaskets that will require repairs. This container meets all the ISO standards and is structurally sound [Browers, August 1991]. However, because of the large openings created by the doors, it may be more susceptible to racking (or twisting) than an end-opening container [Barickman, RD&E August 1991]. As with all containers, they should be placed on hard flat surfaces to avoid racking.

5.3.3: Platform Containers (Flatracks)

Platform containers, most commonly called flatracks, generally come in 20 and 40 foot lengths. These are used to carry outsized or odd shaped cargo that cannot easily fit into an enclosed container. (Government-owned Heavy Duty Flatracks will be discussed later in the chapter.) Just like any other ISO container, it has the standard base and corner fittings at the tops of the two end wall frames, for intermodal handling. See Figure 5.3.3 for a picture of a flatrack which is loaded, and a second view of several flatracks that have their ends folded down and are stacked for storage. Not all flatracks, however, come with collapsible end walls. The benefit of using collapsible walls is in their ability to be reduced in size, stacked, and locked together into modules of standard ISO dimensions. This feature can save space when no cargo is available for them on the return trip.

For unit deployment purposes, only a few units could benefit from having flatracks issued to them as part of their unit-owned container set. An engineer battalion headquarters is an example of a unit that could benefit from having a flatrack remain with them throughout the deployment. For carrying lumber, piping or other construction materials, it would generally serve the unit better than an enclosed box.

Most other units would only benefit from the flatracks' function as a transportation platform on containerships during the strategic move across the ocean. Movement control personnel may choose to use flatracks to intermodally transport a unit's smaller vehicles or odd shaped equipment from home station to the unit's final destination. Once the unit's items were delivered, the flatracks would return to the transportation system.

Advantages: Commercial flatracks are used fairly extensively in the intermodal transportation industry. U.S. lessors of the major container companies have an inventory of 6,362 40-foot flatracks and 12,974 20-foot flatracks [DOT, MARAD, 1990]. Such quantities indicate that the military will be able to lease a portion of their requirement for deployments. The military currently owns approximately 3,500 Heavy Duty Flatracks for immediate deployment needs.

In addition to being available on the commercial market, flatracks provide a useful transport and storage alternative for a few specific units. The fact that large, cumbersome items, such as lumber, can be easily loaded/offloaded from the open sides, will assist in speeding mission requirements.

As indicated earlier, much of the unit deployment benefits gained from flatracks will be in their function as strategic intermodal platforms, versus as containers 'owned' by units to carry and store their unit equipment and supplies. In this mode, force deployers will be able to best utilize the transportation system, and move units quicker to their final destinations.

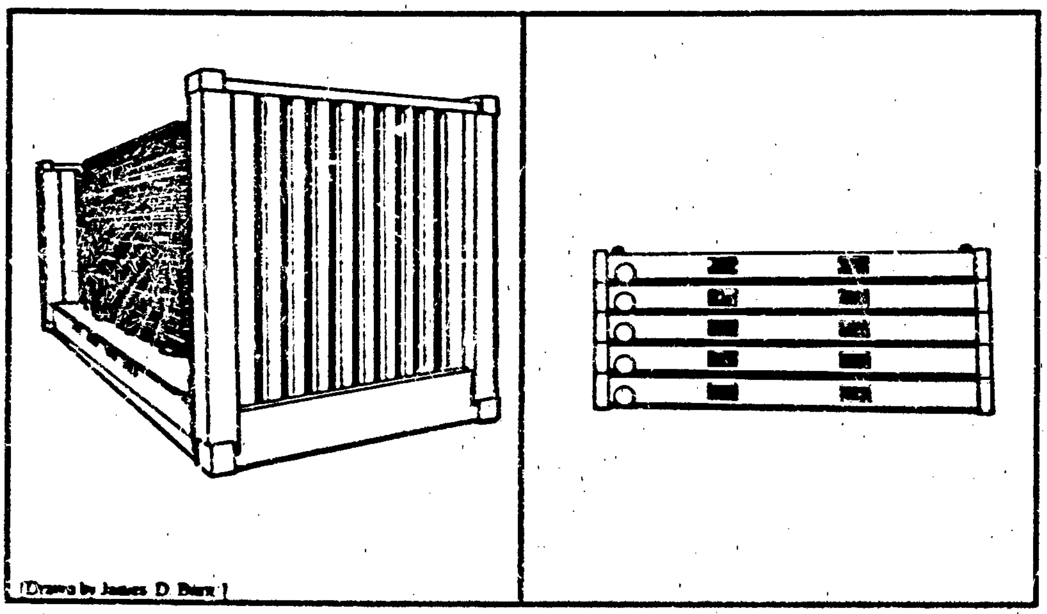


FIGURE 5.3.3 Flatracks, Loaded and Stacked

Disadvantages: For those few units that could benefit from flatracks as unit-owned containers, they must ensure that their 'awkward' items are properly loaded. Since the container does not have sides or a roof, it will be easy for unsecured items to fall off. Secondly, flatracks do not offer protection from the weather like the enclosed containers. Items such as lumber will have to be covered in plastic. This also means that while flatracks serve as transport and storage facilities, the storage portion is temporary, typically until the transported materials are expended.

5.4: MODULAR ISO CONTAINERS

This section will present information about various intermediate-sized containers that will meet the units' transport and storage needs, and serve as replacements to the old CONEX. These modular containers can be arrayed in sets which handle and store like an ANSI/ISO 20-foot dry-cargo container. While the following containers differ is size, one is not viewed as better than the other. Some units may prefer a modular container of one dimension versus another due to the size of the particular items they need loaded.

5.4.1: Quadruple Container (QUADCON)

The first of the modular ISO containers is the QUADCON. The Marine Corps developed this general purpose shipping container as a part of their family of small containers for their Expeditionary Forces. The QUADCON is an 82-inch by 57.5-inch by 96-inch lockable, reusable, weatherproof container with a cargo capacity of 7,435 pounds. (See Figure 5.4.1) When arrayed in sets of four, they have nearly the equivalent volume of a standard 8' x 8' x 20' container, and are compatible with the 20-foot cells in a container vessel [Craig, 1989]. The frame is constructed of steel, and the top, sides and door panels are plywood coated with plastic laminate. The floor is high-density plywood covered on both sides with sheet steel. These containers also have the structural strength to be stacked six high. They have ISO corner fittings for lifting and coupling the QUADCONs together. In addition, they have a tineway base to allow four-way forklift entry [Container System Hardware, 1991].

Each QUADCON has through doors, to allow access from both ends of the container. These containers can also be purchased with shelves and removable drawers. (See Figure 5.4.2) The drawers have individual covers so items cannot be jolted out of them during shipment. The approximate price of each QUADCON is $4,000 [Brower, RD&E, interview August 1991].

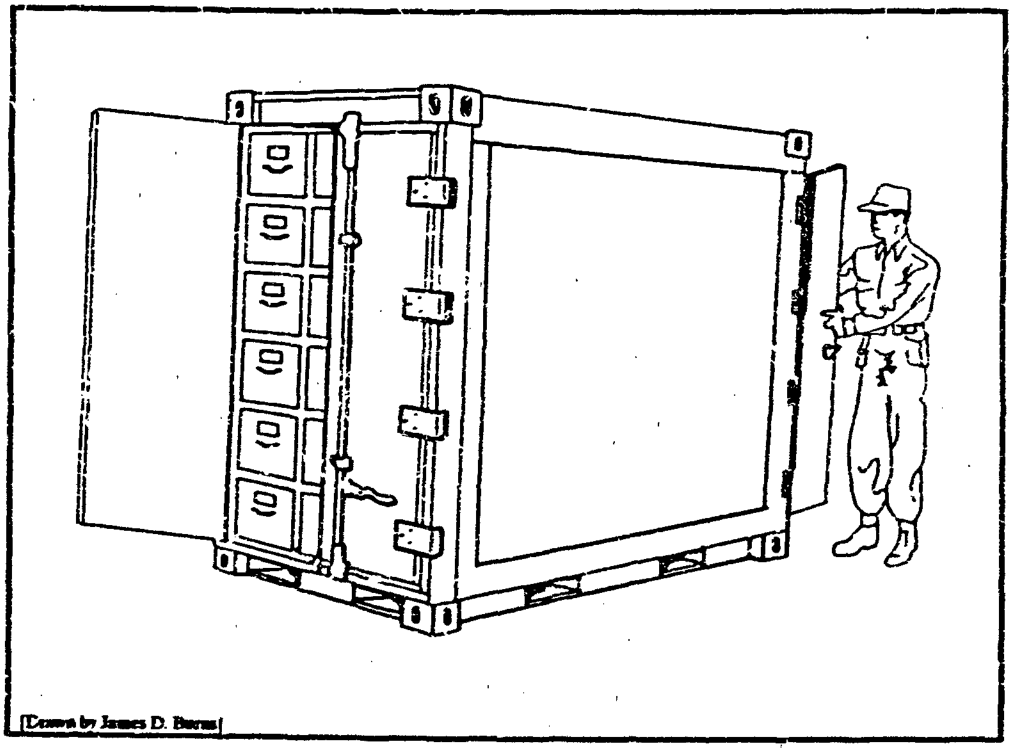
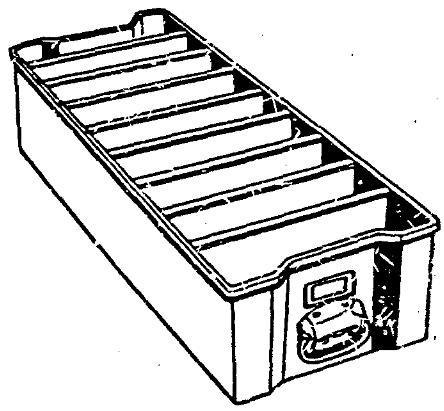


FIGURE 5.4.1 The Quadruple Container (QUADCON)

Advantages: There are many benefits that units can gain from having these smaller intermediate-size containers. First, all battalions in the Army, including the combat-arms units that are forward on the battlefield, own unit-level wreckers that have the capacity to pick-up these loaded containers and move them. The container's fourway forklift capability enables units, with a 10,000-pound forklift or greater, to handle them as well.

One of the greatest advantages of these containers over the standard 20-foot containers, is the ability of companies, or even sections, to completely fill a box, and not loose accountability of their own equipment. This enables the QUADCONs of the various sections within a company to be connected together during shipment, and then broken apart as the unit begins to set-up their mission site in the area of operation [American Defense Preparedness Association, 1983].

Each section can then take their QUADCON with them and not have to sort equipment before sections depart for separate locations.



[Drawn by James D. Burns]

FIGURE 5.4.2 The Drawers Within the QUADCON

Another benefits that the QUADCON will enable combat support (CS) and combat service support (CSS) units to maintain their repair parts (PLL/ASL) in an uploaded posture all the time. During peacetime, these containers can be located (and worked out of) in their maintenance workshops with all the repair parts stored in the appropriate bins. When called to mobilize for war, these uploaded QUADCONs are immediately ready for loading onto trucks. Not only do they improve strategic mobility time requirements, but they ensure rapid tactical deployment within the combat zone as well [Fleming, 1991].

The fact that these containers can be transported in so many different modes, adds to the unit's movement flexibility. As stated before, they can be locked together in the 'footprint' of an ISO 20-footer for commercial intermodal (ship, truck, rail) movement. When separated apart as single QUADCONs, they can be locked down into the 5-ton truck or onto the M871 and M872 semitrailer. Unlike the 20-foot container, these can be transported externally in Army helicopters [Brower, interview March 1991]. For units forward on the battlefield, the ability to slingload equipment to them from a helicopter may be important.

This type of container also provides rapid deployment forces, such as the 82d Airborne Division and the 101st Air Assault Division, the ability to deploy by air in accordance with their deployment plans.

QUADCONs can be opened from both ends (through access), which allows ease of access to almost anything within the box. Since it can be loaded from both sides simultaneously, this container can be loaded twice as fast. Finally, having the option to choose between the shelf/bin configuration or the open box provides the user with the flexibility to store many small loose items, or larger items, such as tires, tents, meals-ready-to-eat (MREs) or stoves.

Disadvantages: The biggest disadvantage of the QUADCON is experienced by unit that use them inappropriately. If a unit has the capability to handle a standard 20-foot container, and has the type of cargo to fill it, then the use of four QUADCONs instead will result in lost storage capacity. Also, some unit equipment that should be stored and transported in the protected environment of a container, may be too large for a QUADCON. Another factor to consider when choosing between the intermediate-sized container versus the standard dry-cargo is the additional requirement of time, manpower, and 12 connectors to link the four QUADCONs together into the 20-foot footprint.

5.4.2: The TRICON

The TRICON is currently being used by the Naval Mobile Construction Battalions (NMCB) (SEABEEs) to assist in the storage of unit equipment, and to increase their rapid mobility capabilities. Like the QUADCON, the TRICON can be arrayed in sets to meet the ANSI/ISO intermodal dimensions. As the name implies, the TRICON is a bit larger than the QUADCON, and only requires three containers to meet the 20-foot equivalent footprint [NAVFAC P-1051, September 1990].

The TRICON is 8 feet high, 8 feet wide, and 6.5 feet long. It is a lockable, watertight, reusable container that is constructed of all steel. For handling purposes, it has ISO corner fittings and threeway forklift pockets. TRICONs have been procured in two styles: Bulk (empty, general-purpose containers) or Configured. Configured containers have either steel drawers, shelves or rifle racks welded to the inside walls. For more detail on the configured variations, see the 1991 Container System Hardware Status Report.

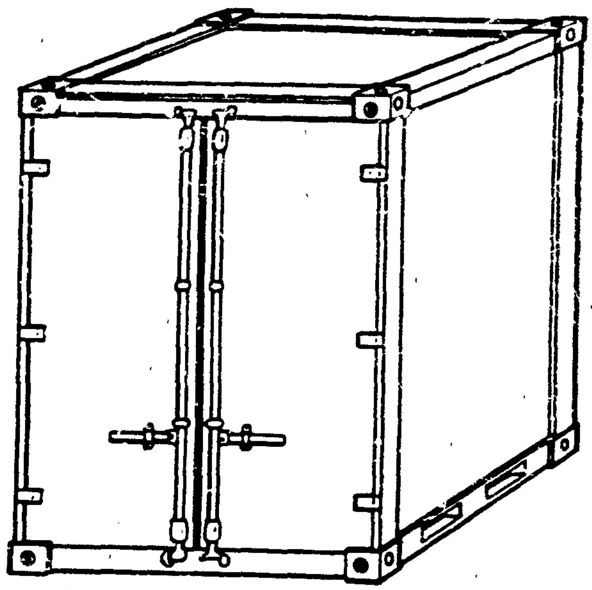

[Source: NAVFAC P-10?1, 1990]

FIGURE 5.4.3 The TRICON

Advantages: The same benefits that were given for QUADCONs, apply to TRICONs as well. The only exceptions will be discussed in the 'Disadvantages' paragraph below.

The fact that a TRICON is larger (longer in length and height) than a QUADCON, may prove to be an advantage to some units. This added space may enable a unit to load things that were too big for the QUADCON. The second advantage over QUADCONs, is in the stability of their 20-foot equivalent footprint. The more 'boxes' that are connected together, the greater opportunity in creating an insecure connection at one of the corner fittings.

Disadvantages: The TRICON has basically the same disadvantages that were identified for the QUADCON. Unlike the QUADCON, however, the TRICON does not have through access, since it only has doors at one end of each box. Secondly, the steel drawers and cabinets of the Configured TRICON are welded to the inside of the walls, and cannot be removed for easy loading and unloading. Finally, and perhaps more importantly, purchasing additional TRICONs will be more difficult than procuring QUADCONs. The Marines (and perhaps the Army) are currently in the process of procuring QUADCONs, while the contract for the NMCB's TRICONs has been fulfilled.

5.5: MODULAR SPECIALIZED CONTAINERS

The containers presented in this section were selected because of their potential benefits to units as transport and storage facilities. These containers are not constructed to ANSI/ISO standards, and are therefore, not compatible with the commercial industry's transportation assets. They can, however, be easily transported on various modes, to include: transported as secondary loads on the back of trucks, loaded internally or slung externally from a cargo helicopter, or loaded in a military aircraft.

5.5.1: The Pallet-Size Container (PALCON)

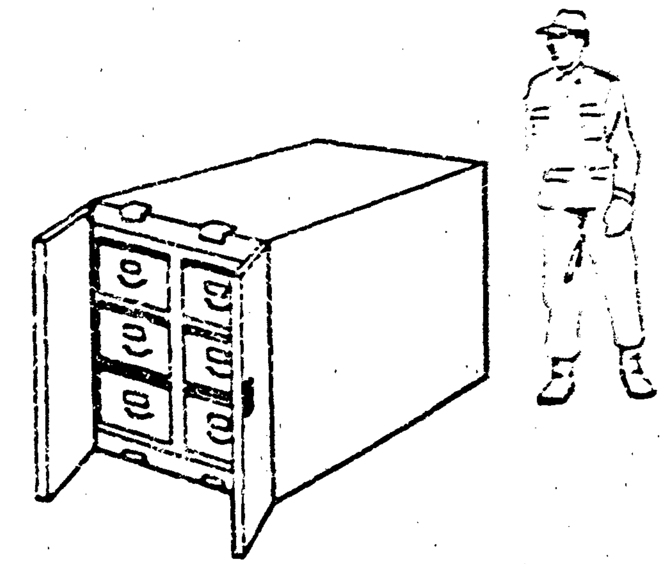
The PALCON is a pallet-sized container that has fourway forklift capability, lockable doors, fittings for a helicopter or crane sling, and a gross weight of 2,000 pounds. Its dimensions are 41 inches high, by 40 inches wide, by 48 inches long [Lennon, MTMC-TEA interview, July 1991]. The PALCON is currently in use by the Marine Corps to augment company-level requirements for storage of small organic equipment or consumable supplies, such as organizational clothing, administrative supplies, and repair parts [ROC No. Log 41.1, 1991].

Interior racks can be added to support up to six insert drawers. While the PALCON cannot be locked together in a structurally secure 8' x 8' x 20' ISO envelope (it would require 22 units), it can be interconnected in a 2 x 2 x 2 array, with a gross weight of 10,000 pounds. This array can be handled by the 10-pound rough terrain forklift [American Defense Preparedness Association, 1983]. (See Figure 5.5.1)

Advantages: Since the PALCON is less than a quarter of the size of a QUADCON, it is small and transportable enough to be part of the combat forces maneuverable equipment. It would be employed in lieu of the wooden boxes that units are currently constructing to carry small loose items. Wooden boxes are inefficient, since they have a relatively short service-life, are difficult to access, and do not provide the weatherproof environment of the PALCON.

Secondly, the fact that they weigh a maximum of 2,000 pounds, means that they can be easily maneuvered with a 4,000 pound rough terrain forklift truck. For strategic intermodal transport, these containers could be loaded into an ISO dry-cargo container. If loaded as container inserts they could be loaded two high, two across, and up to five rows deep. In all practicality, however, most of these small containers would be loaded singly or in pairs, as secondary loads, on the back of the section's truck that is responsible for that equipment.

Lastly, these containers meet a unit requirement to carry small loose items of equipment, similar to the QUADCON. PALCONs can carry small section-level equipment, maintaining section-level integrity, without intermingling their gear with other sections'



Drawn by James O'Rourke

FIGURE 5.5.1 The PALCON

Disadvantages: Clearly the disadvantage to these containers is the fact that they do not meet the interchangeability criteria of the intermodal transportation system. Just as the smallness of the PALCONs size can be an advantage for some equipment, on the other hand, its size limits what it can carry.

5.5.2: Action Containers (ISU-Series)

For some units, an appropriate intermediate-sized container, may be the ISU-series containers. AAR Brooks & Perkins, a container manufacturer, targets the military market niche with their ISU-series Action Containers. They build various sizes of containers which are made of lightweight composite materials, and have military certifications for: Air Force fixed-wing air transportability, external air transportability for helicopter slingloading, and are certified to carry various hazardous materials [AAR Brooks & Perkins "Action Containers" brochure].

The Army is considering purchasing these containers for specific units, and will call them Unit Deployment Containers-Airmobile (UDC-A). When Operation Desert Shield began, 417 of these Action Containers were purchased directly from the contractor by individual units. This shows the need at unit level to have some sort of transport and storage facility for deployments [Pettit, Project Engineer, interview July 1991].

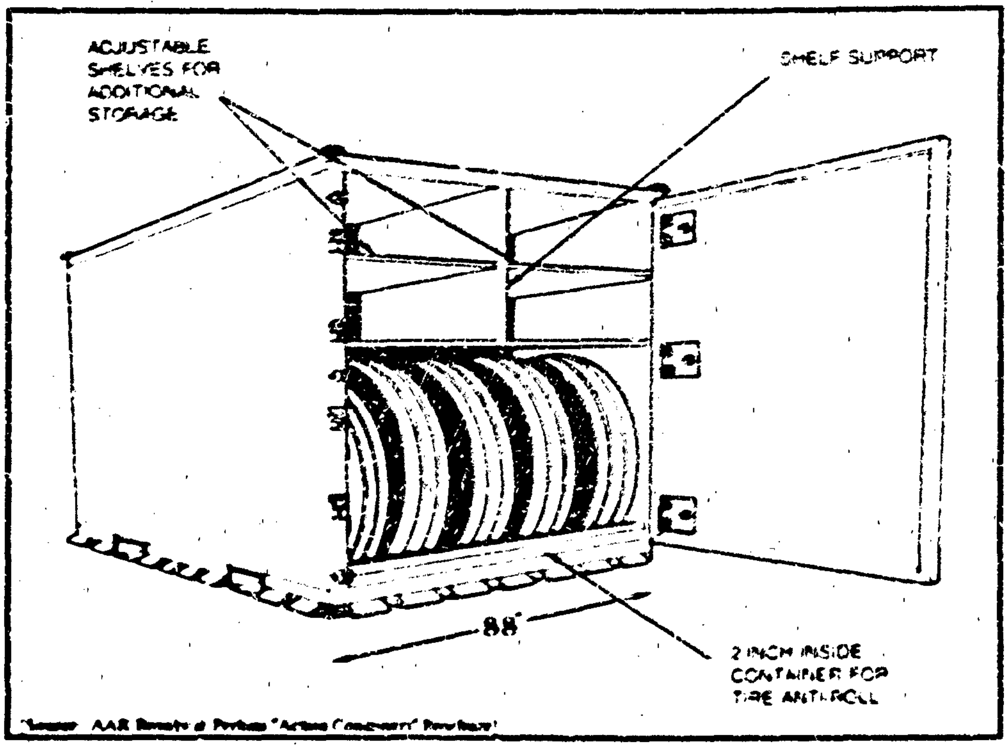


FIGURE 5.5.2 Action Container with Pallet-Base

The base of the Action Containers is the one feature that makes these containers unique from any other container. These containers are basically boxes that have been built on top of 463L pallets (Air Force pallets). 463L pallets are designed specifically for loading cargo on Air Force fixed-wing cargo planes (C-

130's, C-141's, and C-5's). These pallets are rolled into the cargo plane and quickly locked down for take off. Before cargo is loaded onto these planes, it must be netted down onto the 463L pallet. Since the Action Containers are designed with this pallet-base, there is no requirement to 'build a pallet' (tie-down cargo with cargo netting onto the 463L pallet). Such features save loading time and could ultimately speed unit deployments. See Figure 5.5.2 for an illustration of the Action Container and its pallet-base.

The various Action Containers listed below offer the reader an idea of the sizes and weight capabilities that are available to assist in unit deployments. All models are listed as weatherproof, forkliftable with a 10,000 pound forklift, and sea transportable on commercial flatracks [AAR Brooks & Perkins, "Action Containers" brochure].

MODEL #	SIZE (INCHES)	WT CAPACITY (LBS)
ISU-90	108L x 88W x 90H	10,000
ISU-60	108L x 88W x 60H	10,000
ISU-60.5	108L x 48W x 60H	5,000
ISU-60 EO	108H x 88W x 60H	10,000
(doors open both 88" sides)		

Advantages: Because of their specific adaptability to Air Force cargo planes, these modular containers would greatly benefit the rapid deployment type units that are going to be airlifted to their deployment sight versus sealifted. The smaller models, such as the ISU-60, which can be transported both internally and externally in the Army cargo helicopter (CH-47), may also be helpful for aviation maintenance units. These specialized air transportable containers would provide aviation maintenance units an airborne tactical capability to meet up with downed helicopters, fix them on site, and leave. Figure 5.5.3 shows an ISU-90 as an external helicopter slingload.

Disadvantages: For the majority of Army units, this is <u>not</u> the ideal unit deployment container. The fact that they cannot be interconnected to form an ISO container footprint presents numerous problems in handling the ISU-series containers. Unlike the PALCONs, which are small containers that easily fit in the back of any size truck, these Action Containers are quite large and would require their own dedicated source of transportation. With the exception of the rapid deployment units and the aviation maintenance units, that receive both strategic and tactical airlift, the modular ISO containers offer greater flexibility and cargo handling opportunities.

It should also be noted that these specialized modular containers are expensive when compared to the other intermediate-sized containers. For example, the price of one ISU-90 is approximately $9,000. This is nearly triple the cost of an ISO 20-foot container, and more than double the cost of a QUADCON.

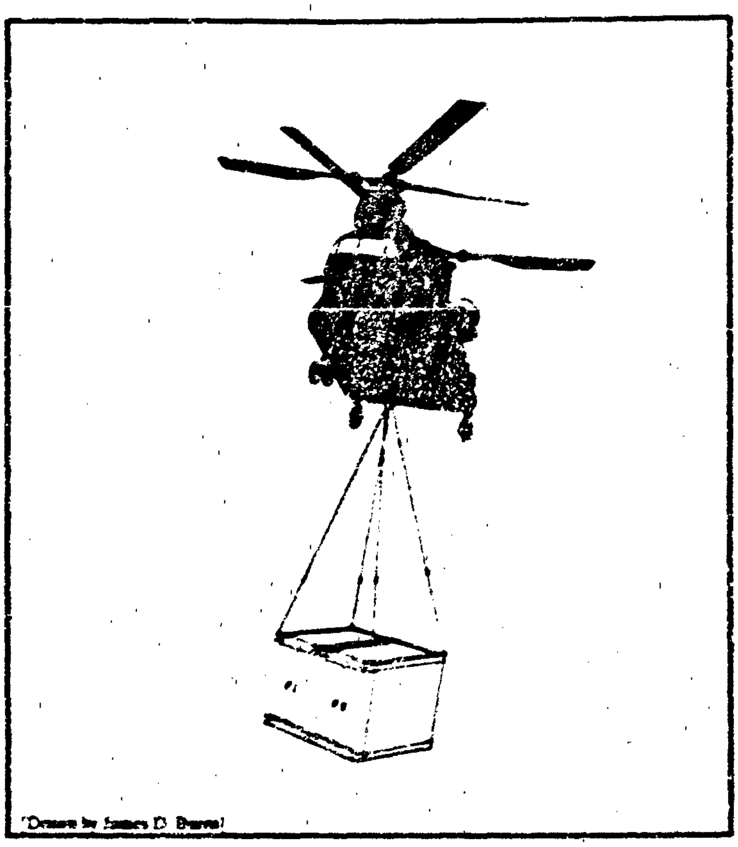


Figure 5.5.3 External Slingload

5.5.3: The Mobility Container

A brief description of Mobility Containers will close-out this section of non-ISO modular containers. These modular intermediate-sized containers are no longer in production, but a limited quantity has been in the Army supply system since the mid-1980's, and is therefore, worth noting. These containers are constructed of fiberglass-reinforced plastics (FRP), and come in four different sizes. Refer to Table 5.5.1 for the various dimensions, national stock numbers and unit price, as listed in the Common Table of Allowances [CTA 50-909]. These mobility containers are listed as intems that can be ordered through unit supply channels.

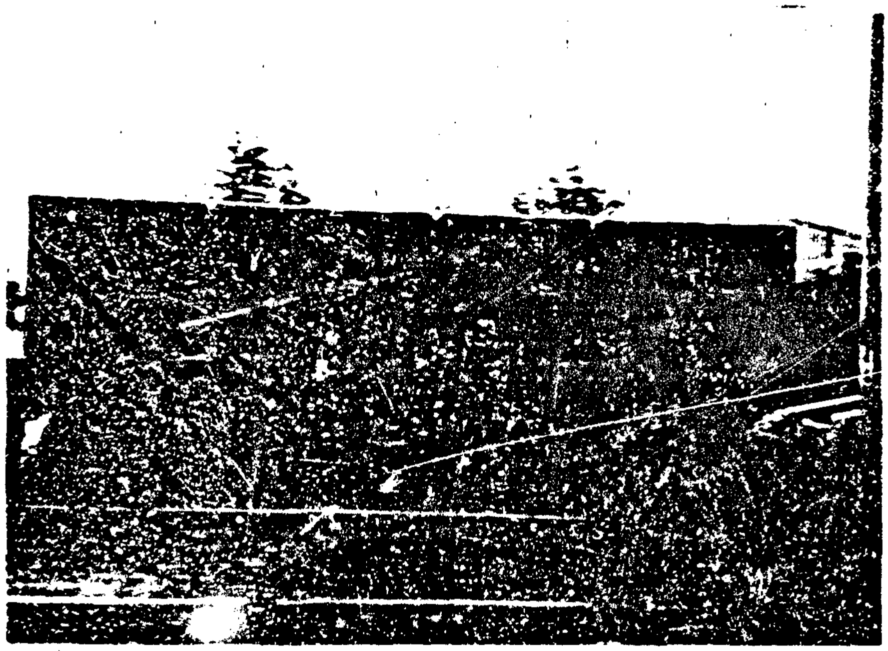
TABLE 5.5.1 Mobility Container Information

DIMENSIONS (W x H x L)	NSN's	UNIT PRICE
84 x 42 x 60	8145-01-118-9873	$1,534
84 x 42 x 30	8145-01-118-9872	$1,295
62 x 42 x 60	8145-01-118-9884	$1,146
62 x 42 x 30	8145-01-118-9874	$1,260

These containers were originally procured by the Air Force, and were designed to maximize the cube usage of 463L pallets. The dimensions of the pallets are 88" x 108", but the usable area of the pallet within the Air Force cargo planes is 84" x 104". These mobility containers were also designed to be stacked and interconnected into a mixed combination set of six to nine containers on the pallets. (Must also meet the height restriction of 90", and the weight restriction of 10,000 pounds per pallet.) All mobility containers feature double doors, removable/adjustable shelves and drawers, and a removable wheel system. The wheels are designed to swivel 360 degrees, are removable without tools, and meet the local pushing and towing requirements at speeds of 10 miles per hour or less. The mobility containers are also two-way forkliftable, have tie-down fittings positioned on the sides, and have interfacing provisions to assist in the precise 'fitting' of stacked containers [DARCOM Report 13-82, 1983].

Advantages: As implied earlier, the fact that these modular unit containers are already in the supply system, may make them accessable to units on installations where these containers were origionally issued. While they do not meet the ISO intermodal dimensions, they are extremely transferable from one mode of military transportation to another. They were designed to fit in sets in Air Force cargo planes, and also fit well onto the Army's 5-ton truck, the HMMWV (High Mobility Multi-Purpose Wheeled Vehicle), and the M871 and M872 semitrailers. Because of their removeable shelving and drawer capability, they are especially useful in carrying repair parts, tools, and field gear for small tactical elements (squad, section or platoon). The mobility containers are lightweight enough to be handled by the wrecker in every battalion-sized unit [DARCOM Report 13-82].

Like the QUADCONs and the TRICONs, maintenance units can greatly benefit from the Mobility Containers. During garrison operations, they can store their repair parts (ASL) in the containers, and work out of them from inside the warehouse. Once a deployment is called, the mobility containers can be easily forklifted onto their semitrailers and driven away. Such a system reduces outloading time, pilferage loss, and enhances unit readiness. Figure 5.5.4 is a picture of mobility containers loaded on an M871 semitrailer.



(Source: Photograph taken by Susan Sowers at Fort Lewis, WA, 1990)

FIGURE 5.5.4 Mobility Containers Loaded on a M871 Semitrailer

Disadvantages: Again, the biggest disadvantage with this container is that it is not ISO configured, and is not directly compatible with the commercial transportation system. It should be remembered, however, that its dimensions are highly compatible with military aircraft and surface modes of transport. So in most situations, it would be loaded as a secondary load on the back of a truck or trailer, and the container would not have the opportunity to be handled separately by the commercial intermodal system. Lastly, since these containers are not currently in production, there are only limited amounts available. This fact may make it difficult for a large number of units to request them, unless the Army approves a new contract for additional mobility containers.

5.6: SIX GUIDELINES FOR CONTAINER SELECTION

Now that the hardware has been presented, there are several container selection considerations that should be addressed. The following selection guidelines provide a tool to assist responsible individuals in how to determine the appropriate mix of containers needed for a particular unit. They serve as reminders of the various defining elements that should be considered for that unit, and require the user to consider a progressive sequence of factors that either eliminate or help to identify the best container-types for the particular unit in question. These six guidelines do not permit the user to determine the quantity of containers necessary, but rather, they help in narrowing the selection of the appropriate types. The first three guidelines serve to help the user eliminate potential container types. The last three guidelines assist the planner in considering the other important parameters necessary to making the final selection from the remaining list of containers.

1) The first parameter considers whether the unit in question is the type that will most likely be airlifted or sealifted. If it is a rapid deployment unit that goes by air, consideration must be given to the containers that are compatible with DOD's MAC aircraft versus the commercial industry's intermodal transportation network. In addition, these types of units are better served with intermediate or small sized containers to ensure that they fit onto any of the aircraft without special loading requirements. Twenty-foot containers, for example could fit into a few of the cargo jets, but they would require unnecessary time-consuming efforts to secure them to several 463L pallets prior to loading. In addition, these large containers would consume too much valuable air space that could be better used for maximizing the number of units that can be initially mobilized to an area.

The opposite is true for units that are more likely to be sealifted. These units are far better served by selecting containers that are ISO compatible, and can be easily transported through the commercial transportation system. If a unit has elements that could be airlifted for certain contingencies, the unit would do better to select ISO intermediate-sized containers rather than those built to meet MAC aircraft dimensions. This is preferred, since the former is flexible enough to be either airlifted or sealifted.

2) Next, consideration of the unit's material handling and transportation assets may enable the planner to immediately eliminate several container options. Units that have trucks capable of hauling 20-foot containers with chassis may prefer to shuttle these large containers, rather than use several intermediate-sized containers. Since intermediate-sized containers must be transported in the unit's limited cargo-carrying space of their vehicles and trailers, the larger container/chassis combination eases some of the requirement for using their vehicles as mobile storage.

In addition to considering the transportation assets of the unit, material/container handling capabilities should also be considered. Units that do not own forklifts or cranes, but are located far enough to the rear of the theater to have access to this kind of equipment, may also be able to use the larger containers. Other units that do not have MHE/CHE, or are moving frequently within forward areas of the battlefield, may prefer the smaller containers, such as PALCONs to carry their loose gear in.

3) The third parameter to consider is the tactical environment of employment, or any other restrictions within the theater of operations, that may impact on the type of container that should be used. By considering the final destination of the container, the user should again be able to narrow the possible container choices. As discussed in previous chapters, knowledge of the unit's most likely location on the battlefield is an important factor in selecting the appropriate size. Units that are well forward and highly mobile are probably not well suited for the large 20-foot containers. Not only would these container/chassis combinations require a good road system for movement, but their size may be difficult to conceal from enemy detection.

Under this same parameter, all units should be advised to select the primary 8 or 8.5 foot high container. Many foreign countries may have height restrictions because of low bridges, that prevent 9.5 foot high containers from being transported inland. Rather than gamble that the next contingency will be in a country with high bridges, it is better for Army units to use the standard shorter-sized containers.

4) The next step in the container selection process requires the user to conduct a detailed examination of each section to determine the various types of cargo that are to be transported. For example, if a particular portion of the cargo is a collection of small loose items, then a container with drawers would be important. Another example, long cumbersome items, such as piping or lumber may be easier to handle in bundles on a unit-owned flatrack than to be constantly restuffed into an end-opening container. The fact that there are no side or roof obstructions enables material handling equipment to efficiently access the materials required. Finally, if some of the cargo is heavy and dense, such as ammunition, the containers with relatively weak flooring can be eliminated for those items.

Obviously, this step requires time to examine the cargo requirements of each section or platoon, but this is where the majority of the final container selection process will occur. After this step is completed, some of the appropriate container selection will have been narrowed to a single container-type for some of the cargo. The other items still might be appropriate to be carried on a couple of the container-types. The last two steps are intended to help narrow the remaining container options.

5) Now that cargoes have been matched with container-types that can carry them, ease of access (loading and unloading cargo) should be considered when selecting the optimal container. If a lot of items are packed into a container and will be randomly required at various times, then it may be more convenient for the unit to have a side-opening container, which provides access to the entire length of the box rather than at just one end. Even for the intermediate-sized containers, some of the containers offer access from both sides, while others do not.

6) In a last attempt to narrow the container options for the various types of cargo, consideration should be given to the container that can be filled to the greatest extent from cargo in the same section or platoon. Filling the container completely serves three purposes. First, this provides maximum capacity utilization of both the container and the other limited transportation assets that move the container. Secondly, a full container provides a more secure stow for the cargo, and does not require additional time to be spend in bracing the cargo with

dunnage material. And lastly, since property accountability is an integral part of maintaining control of unit equipment, the ability to unitize the cargo of a particular hand receipt holder assists in that process.

5.7: RULES OF THUMB

This chapter has focused on providing the military-user with the various tools required for selecting containers appropriate for any type of unit. In this last section, basic rules of thumb for loading containers are presented. While this thesis is not intended to be a users handbook, these rules of thumb provide additional guidence to assist the user is selecting the right types of containers. They include the following five rules:

1) Remember that strategic lift assets (number of ships, railroad cars, trucks and berthing space) are limited during the deployment phase of a contingency. Therefore, select only enough containers to adequately transport the unit equipment. As a general rule, a unit should not take additional containers that will serve only as storage facilities or workplaces in the wartime area of operation, but are not necessary to transport the unit's equipment.

2) To maximize storage capacity, large bulky items are more efficiently loaded in larger containers.

3) It is best to try and nest irregularly shaped items into the spaces of organic equipment rather than to load them into containers. Since containers are themselves box-like in shape, they are more efficiently loaded with regular, box shaped items. (Example: equipment such as boxed tool kits or light sets load efficiently into containers)

4) Do not plan to load and store cargo on transportation assets (such as low-bed trailers), if these assets are required to shuttle other unit equipment (like cranes and crane parts) back and forth to the port.

5) If many small items are intended to be loaded inside a container, they should be unitized first in a smaller box, container insert, or in shelving/drawers. Otherwise, these items will be difficult to locate when the containers are retrieved in the theater of operations, and they are more likely to get damaged in transit.

5.8: SUMMARY

In summary, this chapter has provided many of the tools needed to make appropriate container selections for any unit type. The basic construction information and description of base materials assists the user in understanding structural strengths and weaknesses of containers that should be considered prior to choosing the type that best meets their employment needs. A brief introduction is given to container selection considerations and then the user was presented with three categories of container hardware that have application for unit moves. The last part of the chapter presents the six guidelines for container selection and rules of thumb which help the user to determine the particular container hardware that best suits their equipment characteristics. At this point the user has the necessary background to proceed to the case study in the following chapter. The case study of an engineer company illustrates how to use the various container selection tools that were presented in this chapter by methodically walking the user through the steps.

CHAPTER 6:
CASE STUDY: COMBAT (HEAVY) ENGINEER BATTALION

The purpose of this chapter is to illustrate a methodology that can be used to estimate the type and amount of containers that are appropriate for the deployment needs of the various battalion-types. Since different units have disparate mission requirements and organic equipment authorized, the container requirement for each type of battalion should be evaluated separately Many combat arms units, for example, have very little equipment to deploy other than their weapons systems. These types of units, therefore, may require no, or very few, containers. On the other hand, a combat service support unit such as a maintenance battalion, may require a great number of containers to carry all their tools, repair parts, and various other equipment. In short, the level of containerization needed for each battalion will have to be specifically tailored.

A company from the Combat (Heavy) Engineer Battalion has been selected to model the process for determining the appropriate mix of containers for a unit. The primary reason this unit was selected results from the shared opinion of many military movements officers that consider it one of the most difficult battalions to strategically transport [Davis, Transportation Engineering Agency, interview March 1991]. This is believed to be true because of the battalion's magnitude of outsized equipment and various assortment of equipment, ranging from large to small. Prior to demonstrating the container selection methodology, a brief introduction of their mission and organization is provided to facilitate the reader's understanding of the unit's wartime mission once deployed. Organizational structure and differing missions of the sections within the unit impact the type containers required to best serve their needs.

In this case study, the procedure for selecting the appropriate containers is demonstrated by first obtaining a rough estimate of the number required, which is then followed by a process that refines that estimate. MTMC's Transportability Analysis Reports Generator (TARGET) computer program has the capability to provide the user with that initial approximation of the number of c[illegible]iners required to load a unit. To refine the initial TARGET estimates and determine both the correct <u>types</u> of containers and a more accurate <u>number</u> of containers, the case study demonstrates how to apply the step-by-step container selection process from Chapter 5. Finally, a summary of the case study is provided as an example of how to interpret the results.

6.1: INTRODUCTION TO THE ENGINEER BATTALION

There are various types of engineer battalions within a wartime theater of operation. This wide variety of engineer units provide the particular technical capabilities that are required to meet the diversified tasks throughout the depth of the theater. In addition to the Combat (Heavy) Engineer Battalion, there are four other kinds of engineer battalions: Combat Engineer Battalions, Topographic Engineer Battalions, Bridge Engineer Battalions and Support Engineer Battalions. These various battalions, they are found in different locations within the combat zone and perform different types of missions. The Combat Engineer Battalions support divisions and are located well forward on the battlefield. These units concentrate on such tasks as mine sweeping, placing obstacles to slow the enemy's advance, removing enemy obstacles, and gap crossing. Topographic Engineer Battalions develop detailed terrain analysis products, maps, and digital terrain data, so that commanders in the field can develop plans that best utilize available land. Bridge and Support Battalions are collections of separate engineer companies placed under a battalion headquarters for command and control purposes. These companies are used as tactical requirements dictate [FM 5-100, November 1988].

The unit that concerns this case study, the Combat (Heavy) Engineer Battalion is basically a construction unit. They are located in the corps rear, or as far back as the aerial and sea ports of debarkation. They provide the bulk of engineer construction capability, and thereby fill a vital role in sustaining the supply lines in the rear of a theater [FM 5-100,1988].

Combat (Heavy) Engineer Battalions have a variety of equipment, tools and skilled personnel to perform various types of construction missions. Typically their tasks include:

- constructing or rehabilitating roads and airfields;
- laying pipelines or railways;
- constructing or repairing bridges, ports and buildings; and
- building facilities, such as enemy prisoner of war camps.

[FM 5-100, 1988]

The soldiers of a combat (heavy) engineer unit have both a different mission and different occupational skills than the soldiers assigned to the combat engineer units. The combat engineers need soldiers to detonate explosives, set up wire obstacles, or dig tank ditches. The soldiers of combat (heavy) units, on the other hand, have a great deal of technical skill, and are primarily carpenters, electricians, plumbers or heavy equipment operators. [Schnieder, Ass S-3, 864th Engineer Battalion, interview September 1991]

Under the most current Modified Table of Equipment (MTOE), the Combat (Heavy) Engineer Battalion is authorized 619 soldiers during peacetime and 691 soldiers in wartime [MTOE 05415LFC05 FC09, 1991]. An MTOE is the document that authorizes each particular type of unit to have a certain quantity and type of personnel and equipment. This particular MTOE has been in effect since 17 September 1991.

The battalion is composed of three Combat (Heavy) Engineer Companies (typically referred to as 'line' companies) and a Headquarters and Support Company (HSC). Figure 6.1.1 illustrates the organization of the battalion. Each line company (Figure 6.1.2) consists of a headquarters section, a maintenance section, a horizontal construction (earth moving) platoon, and two general construction platoons (vertical construction). The Headquarters and Support Company (Figure 6.1.3) is the largest company, including a company headquarters section, an equipment platoon, a maintenance platoon (which provides Direct Support maintenance for the entire battalion), and the battalion staff headquarters platoon.

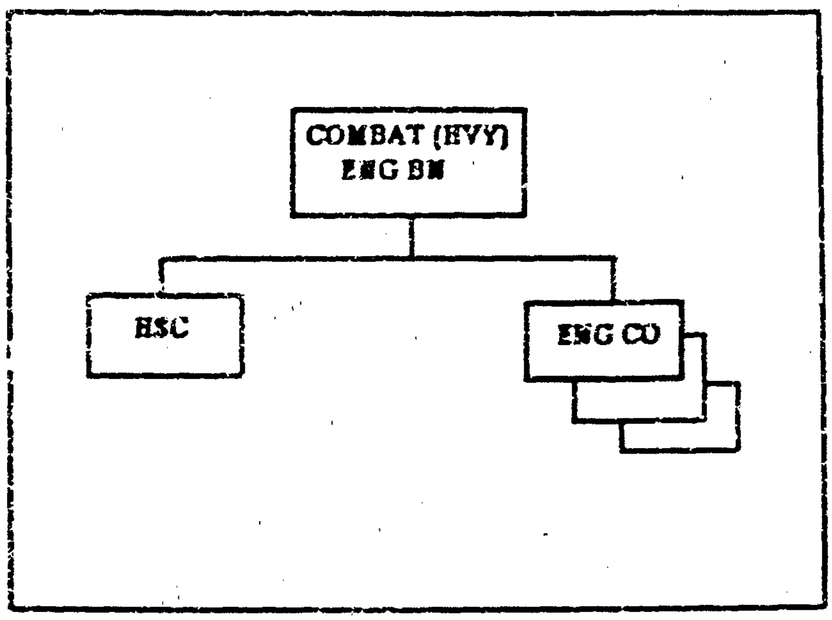


FIGURE 6.1.1 Cosabat (Heavy) Engineer Battalion

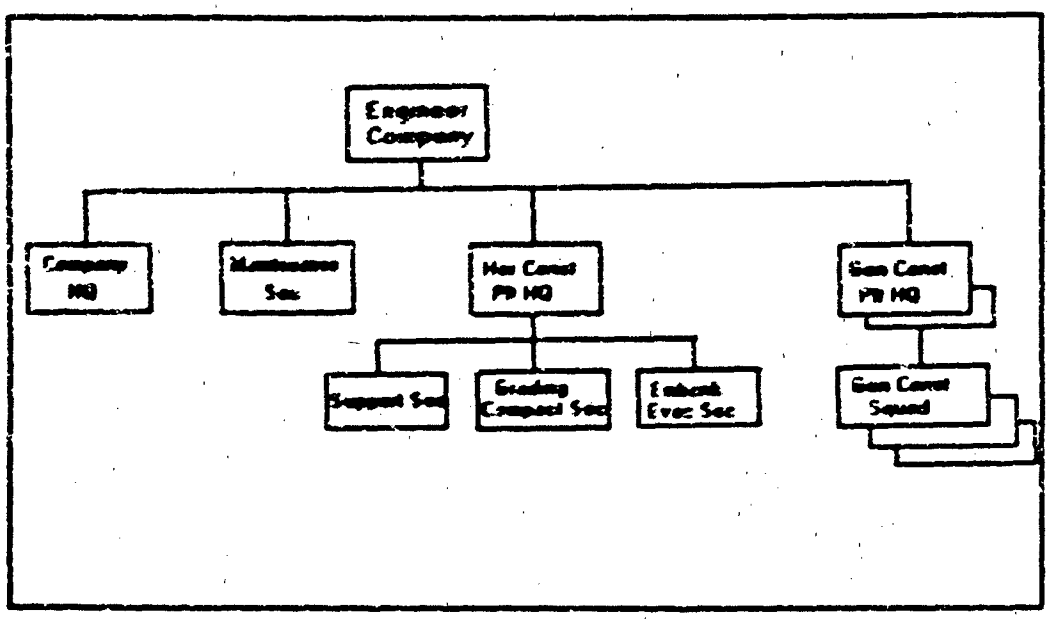


FIGURE 6.1.2 Combat (Heavy) Engineer Company ***(line company)***

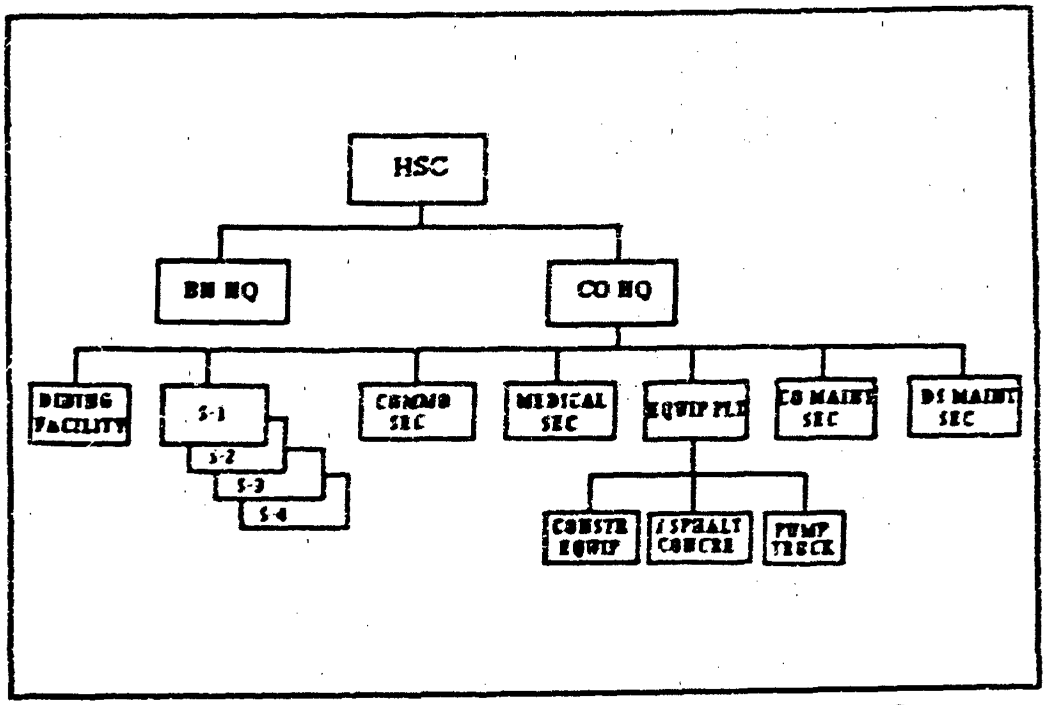


FIGURE 6.1.3 Headquarters and Support Company (HSC)

6.2: RESULTS OF THE TARGET MODEL

As stated in the chapter's introduction, the TARGET model can estimate the number of containers required to deploy a unit. The TARGET software is run in conjunction with a data base that contains all the equipment authorized for each type of unit in the Army. When the TARGET modeling software is inputted with the type of unit and the size of container intended to be loaded, it calculates the number of containers needed to supplement that unit's deployment. This calculation, however, serves as only a general idea of the actual number required, since the program loads containers based on dimensional information only. In reality, equipment is loaded based on many additional considerations, such as maintaining a section's equipment integrity, and being able to quickly reassemble the unit in functioning order once deployed to their area of operation.

Since the data base containing all the Table of Equipment (TOE) allowances required to run this kind of a program is so large, the program is centralized in a single location within Military Traffic Management Command (MTMC). The Transportation Engineering Agency (TEA), located in Newport

News, Virginia, is responsible for analyzing transportability issues for MTMC, and was therefore selected as the ideal location to maintain this kind of transportation analysis capability. TEA will run this program for any unit interested in this type of transportability data. Unfortunately, most units are unaware that this information source is available [Davis, TEA interview, July 1991].

For this particular case study, TEA ran the TARGET program for a Combat (Heavy) Engineer Battalion. Before the model calculates the transportation requirements, it provides some general information on the unit, such as:

* Personnel Strength: 684 (slightly off new MTOE authorization of 691)
* Vehicle Quantity: 412
* Square-Footage of Unit Equipment: 75,741.4 sq ft
* Short-Tons of Unit Equipment: 3,957.3 stons
* Measurement -Tons of Unit Equipment: 14,758.9 mtons

After the general information is given, the TARGET model can calculate the number of containers and supplemental surface transportation required to transport the unit. By changing the dimensions of the container that the unit has available to load, the outcomes will change each time the model is run. For this study, TEA ran the model using two different container sizes. The first run, asked the program to load the unit's equipment in the organic vehicle cargo space, and then load the remaining equipment in 20-foot dry cargo containers. The second run was similar; the vehicle's cargo space was loaded first, the excess equipment was then to be loaded into QUADCONs, and if the items did not fit into the QUADCON, it was to be loaded into 20-footers.

The results of the two TARGET runs are listed below:

1) 20-foot cargo containers: 24 loaded.
2) QUADCONs: 164 loaded, plus 15 20-foot containers for cargo which exceeded the capacity of the QUADCONs [Alan Colvin was the TEA engineer who ran the TARGET program, August 1991].

Before the user begins to develop a more precise estimate, these TARGET results provide useful information. First, the user knows from the second run of the model, that not all the equipment can be loaded into intermediate-sized containers (e.g., QUADCONS and TRICONs) alone. This battalion will require at least some of the larger, 20-foot containers. Secondly, since it takes 24 20-foot containers to load the whole Battalion (four companies), it can be assumed that it will take approximately six containers to load each company. Along these same lines, since the user knows that the Headquarters and Support Company is much bigger than each of the three line companies, it could be further deduced that the line companies will use five containers apiece, and the HSC will use nine. Lastly, the second run also reveals that 164 QUADCONs displaced only nine 20-foot containers (24 - 15 = 9). Mathematically, however, 164 QUADCONs should be able to replace 41 20-foot containers (164 ÷ 4 = 41). These results warn the user of the 'cost' of selecting the intermediate-size containers. The cargo characteristics of this unit seems to load better in the larger containers. Therefore, if too many of the intermediate-size containers are selected in lieu of the 20-footers, the unit runs the risk of taking more of the nation's limited strategic transportation capacity to deploy the unit than is necessary.

6.3: REVIEW OF SELECTION CONSIDERATIONS

After the initial estimate of containers is obtained from the TARGET program, the user can proceed with the more detailed process of determining the correct mix of containers. The person who is tasked to make the container selection should be someone who is extremely familiar with the unit. This person, to be referred to throughout this chapter as, the 'user' or the 'planner,' should know the types of equipment that needs to be packed together due to mission requirements. That person should also be familiar enough with the unit to know what types of items can be nested within vehicle spaces that are not necessarily considered cargo space. For example, those familiar with the deployment procedures of an engineer battalion know that the fuel and water hoses of the Horizontal Construction Platoon are typically loaded inside the empty fuel and water tanks. By placing the hoses inside the empty tanks, the unit can save cargo space elsewhere, and has ensured that items that function together will be available for reassembly at the other end of the deployment. Additionally, other large items such as the clamshell bucket or the concrete bucket might have been loaded into containers or in the 5-ton truck cargo space if a person unfamiliar with the unit had tried to load the equipment. Here again, these items can be nested in areas that were not designed specifically for cargo space. A user familiar with the unit would know to put these buckets into the scraper bowls during deployment, to avoid wasting valuable cargo space.

As stated earlier, the six guidelines for container selection provided in Chapter 5 will be used in this case study to demonstrate the container selection process. In Section 5.6, the six guidelines assist the planner in walking through a logical methodology which allows him to consider important factors that impact on selecting the best types of containers for a particular unit. Provided the user has a basic knowledge of the unit's mission, potential battlefield location, and the equipment characteristics, these guidelines can be used to hone in on the most appropriate types of containers for any unit-type. Once the types of containers have been selected, the planner's previous loading experience with the unit's equipment will assist in determining the number of containers, by type, that are needed. This is a subjective process that requires human judgement, and is therefore not a decision that is innately suited for either quantitative mathematical formulas or a computer program. This case study of an engineer 'line company' is intended to serve as an example for evaluating any unit-type. For ease of reference, the various types of unit-deployment containers discussed in Chapter 5 are listed in Table 6.3.1, and the six guidelines of container selection are summarized in Table 6.3.2.

TABLE 6.3.1 List of Unit Deployment Containers

Commercially Available ISO Containers
* 20-Foot End-Opening Container
* 20 Foot Side-Opening Container
* 20-Foot Flatracks
Modular ISO Containers
* QUADCON
* TRICON
Modular Specialized Container
* PALCON
* Action Containers (ISU Series)
* Mobility Containers

TABLE 6.3.2 Six Guidelines of Container Selection

1. Airlift or Sealift type unit?
2. Extent of unit's internal MHE and transportation assets?
3. Expected tactical environment?
4. Evaluate the types (characteristics) of the unit cargo.
5. Evaluate the requirements for ease of cargo access in/out of container.
6. Maximize (fill) the container capacity.

6.3.1: Airlifted Versus Sealifted

The first factor the user must consider is whether the Combat (Heavy) Engineer Battalion is more likely to be airlifted or sealifted when mobilized for war. Because this unit is primarily used in the rear of the theater and is not critical to the combat mission of the first troops being mobilized, it is generally safe to categorize this unit as one that will be sealifted. In addition, the fact that its equipment is predominantly large outsized wheeled/tracked vehicles, it would be difficult to justify moving this unit by air, in lieu of several light combat units whose presence is more urgent during the first weeks of the war.

Since we consider the engineer battalion a unit that will be sealifted, we can immediately eliminate the expensive ISU-Series intermediate-sized containers that have been specially designed for air transportability. Similarly, even though the mobility containers are the most inexpensive of all the intermediate-sized containers, the unit would be better served with any of the ISO compatible containers rather than one that is airlift compatible. As a result, after considering the first guideline, the two non-ISO modular containers can be eliminated from the possible container choices

6.3.2: Material Handling and Transportation Assets

While the Combat (Heavy) Engineer Battalion is authorized several tractors to perform their construction mission, not all of these vehicles are capable of hauling a commercial chassis. As a result, the three 5-ton tractors (M931's) are the only trucks capable of shuttling 20-foot ISO containers with chassis. (The fifth-wheel of their M920 and M916 trucks are not compatible with the king-pin of the commercial chassis.) Since this unit has so much equipment to deploy and has some internal capability of hauling their own 20-foot containers/chassis, the use of the large 20-foot containers should definitely be considered for this unit [Schnieder, 864th Engineer Battalion, interview September 1991]. It should also be noted, that in addition to their tractors, this unit has a vast assortment of other hauling assets. As a result, they are also capable of hauling either the small or intermediate-sized containers on their organic equipment [MTOE 05415LF C09, September 1991].

In addition to their transportation assets, the engineer battalion is equipped with 25-ton cranes, 10,000 pound, 6,000-pound, and 4,000-pound rough terrain forklifts, and 5-ton wreckers. With this MHE capability, they can handle all of the intermediate-size containers with their own equipment, and some 20-foot containers. For handling fully loaded 20-foot containers without chassis, the battalion may require outside support. Ideally, loaded containers are best handled with the 50,000-pound rough terrain container handler (RTCH), or a 40-ton crane with spreader bars. In addition to lifting and moving the containers, the unit's forklift trucks can provide assistance during the stuffing and unstuffing of the containers. In summary, the battalion is well equipped to transport and handle containers of any size, and is not restricted by this parameter.

6.3.3: The Tactical Environment of Employment

The next factor to be considered is the possible restriction on container types because of the unit's intended tactical environment. As stated in the description of this guideline, any 9.5 foot high container should not be selected in case of potential in-theater height restrictions. More to the point, since the battalion already has so many large pieces of equipment and is working in the rear areas, this unit would not jeopardize their position to the enemy by having the large 20-foot containers in their area of operation. In short, this consideration does not eliminate any additional container choices for an engineer battalion.

6.3.4: Type of Cargo

This next step in the consideration selection process is the most tedious. Here, the planner must consider the various types and sizes of the cargo to be transported. In order to determine an initial estimate of the kinds of containers that could possibly be used to carry the equipment, this step requires a detailed review of the cargo's transport/storage needs within each section . At this point, the container choices have been somewhat narrowed from the first three steps, and should provide a more manageable list of containers from which to select. This initial matching of unit equipment to potential container-types should be conducted in an open-minded fashion which considers all the remaining containers. Some sections' equipment may be eligible to be loaded on two or three different kinds of containers equally well. After the last two guidelines have been considered, however, the eligible container options should be narrowed further.

To illustrate how the process would work, this case study will first look at the cargo requirements of a line company. Since all three line companies are identical, these results can be applied across the board. By referring to the company's organizational chart on Figure 6.1.2, it is evident that there are four types of sections/platoons to be separately examined: the company headquarters section, the maintenance section, the horizontal construction platoon and the two general construction platoons. In order to look at all the equipment authorized for a line company, an actual hand receipt of an engineer company was used. A hand receipt incorporates both the MTOE items (same for all unit-types) and the Common Table of Allowances(CTA) items. Even though every Combat (Heavy) Engineer Company does not have exactly the same quantities of CTA items (such as tents, stoves, tables, etc), this particular company's hand receipt will serve to demonstrate the process.

In Tables 6.3.3 through 6.3.6, all the equipment is listed, by section. (Because of the length of these tables, they are located at the end of this chapter.) A general estimation of the size of each item is provided to assist those readers unfamiliar with the equipment. The potential containers that could accommodate the equipment are then listed in the next column. The following legend will be helpful in reading the tables.

Under the column of 'Generic Container Sizes,' the numbers represent an approximate cubic size of the item to be loaded. Obviously, not every item is exactly rectangular, but its cubic dimensions will closely match the numerical size indicated. If N/A (not applicable) is listed in the columns on Tables 6.3.3 through 6.3.6, that indicates the item is not to be loaded inside a container. Most of the time, these items will be vehicles, trailers, or something that is mounted onto a vehicle.

GENERIC CONTAINER SIZES	TYPES OF CONTAINERS
1 = 1' x 1' x 1'	1 = 20-foot end-openers
2 = 2' x 2' x 2'	2 = 20-foot side-openers
3 = 3' x 3' x 3'	3 = 20-foot flatracks
4 = 4' x 4' x 4'	4 = QUADCONs
5 = 5' x 5' x 5'	5 = TRICONs
6 = 6' x 6' x 6'	6 = PALCONs
7 = 7' x 7' x 7'	7 = ISU Series Action Containers
8 = outsized	8 = Mobility Containers

This analysis completes the fourth step, but the tables will have to be reviewed again after the last two considerations are examined. Once all the guidelines have been considered, the planner can then go back to the equipment lists developed using the fourth guideline, and make a final judgement as to how the equipment in each platoon or section could benefit the most from the remaining container choices. For example, after considering guideline #5, the planner may choose to use one 20-foot side-opening container rather than the normal 20-foot end-opener for a particular section's equipment, because of the benefits that can be gained in accessing randomly located items.

6.3.5: Ease of Access

After looking at all the equipment in each of the sections, the planner must next consider the unit's need to access cargo at various locations from within the containers. If the cargo within the containers will not be unpacked upon arrival for immediate use, then it may be more convenient to have side-opening containers. These allow access to the entire length of the container, versus from just one end.

After looking at the cargo types and characteristics of the company during the fourth step, the section that appeared to need a container with a lot of accessibility was the company supply room in the headquarters section. While the supply room is responsible for the tents and camouflage systems which are typically offloaded upon arrival, they are also responsible for a great deal of loose items that must be retrieved at random times, such as communication equipment, goggles, compasses, and office supplies. As a result, this section would benefit from a side-opening container.

This guideline also ensures that the planner consider whether the items to be loaded would best benefit from bulk containers, or those that come configured with shelving and/or drawers. In the case of the engineer line company, the maintenance section's common number 1 tool kit and its common number 1 supplement tool kit are clearly candidates for containers with shelving and drawer capacity. When listed by components, the tools from these kits cover approximately 20 pages. When placed in drawers, these two tool kits (commonly called tool rooms) could each fill an intermediate-size container by themselves.

6.3.6: Fill the Container

The last parameter that the planner should consider, is to select containers that can be adequately filled and are the right size to enhance mission accomplishment once the unit is deployed to the theater of operations. By completely filling a container, the cargo can be shipped with less damage, it requires less time and dunnage material for loading, and it precludes limited strategic lift capacity from being wasted.

After examining the company's equipment and their sizes, it appears that most of the sections and platoons could benefit from intermediate-sized containers. This size container would enable the various sections within the company to maintain all their gear in their own separate transport and storage facility. Since the mission of the engineers causing them to establish work sites in different locations, the smaller containers, filled with one section's or squad's equipment, would provide them the autonomy of carrying their own equipment to their required work locations. Although 20-foot containers could adequately transport the company's equipment across the ocean, providing some of the individual squads with their own intermediate-size container provides greater benefits to the unit once they are deployed to their area of operation.

6.4.7: Final Container Selection Process

Now that the important factors affecting container selection have been considered, it is time to go back to the equipment analysis conducted during step 4, and choose the specific types of containers for each section/platoon. First, since the 20-foot flatrack was not selected as a potential container to carry any of the equipment, it can be eliminated from the remaining list of containers. The small

PALCON shows some potential, especially for the equipment in the headquarters section, but since that section has so many items, a larger container would offer more versatility. As a result, the final selections will be made from the two 20-foot dry-cargo general purpose containers, or the remaining two intermediate-sized ISO modular containers.

At this point, the preceding six guidelines should have focused the user on the various equipment characteristics. and the many factors that should be considered for the deployment of that particular type of unit. Here, the user's previous experience with the equipment characteristics and the requirement for loading certain items together will help in making the final container selections.

To begin the process, the case study will first select containers for the **Headquarters Section.** After considering the amount of equipment, the various hand receipt holders within the section, and the unit's mission requirements once deployed, the best solution indicates that certain functions, or hand receipt holders within the headquarters section, should get their own container. For example, the armorer is responsible for enough equipment to justify an intermediate-size container. The container could be easily filled with the 12 small arms storage racks, the .50 caliber and 7.72 caliber machine guns, and the other miscellaneous equipment that must be shipped from the arms room. During the strategic movement portion of the deployment, the above listed machine guns will be moved in a transportation system that is outside of the unit's control. Rather than having to place these sensitive items in crates, and then secondary load them in the cargo bed of one of the dump trucks, providing the armorer with a container would greatly improve the security of the unit's crew-served weapons. In addition to the armorer being able to fill one of these modular containers during transport, the container will also serve the unit as a secure storage facility in which weapons can be stored and repaired in the theater of operation.

The unit's NBC noncommissioned officer (NCO) could also benefit from a modular container for deployment. He is responsible for the deployment and accountability of all the unit's chemical and radiation detection/decontamination equipment. By themselves, the 52 M13 decontamination kits justify the NBC room's requirement for an intermediate-size container. In some contingency situations, the company's NBC NCO will also be required to carry an additional protective suit for each soldier. The soldiers will nearly always deploy carrying their own protective masks, but the NBC sergeant is responsible for bringing the replacement parts and tools to repair the unit's masks. Any excess NBC equipment that does not fit inside the container can be carried on one of the trailers assigned to headquarters. In addition to providing a secure deployment platform, once the unit is located in their wartime area of operation, the container can also serve as an office and storage location for the NBC NCO to fix masks and issue NBC equipment as needed.

Finally, the remainder of the equipment, which is hand receipted to the supply sergeant and the communication NCO, is judged to be best deployed with a 20-foot ISO container. Since they have quite a few large, bulky items, such as tents and camouflage systems, a 20-foot container versus several intermediate-sized ones will provide improved space efficiency. In addition to his own equipment, the supply sergeant is responsible for bringing any new equipment that arrives in the company just prior to deployment. Often times, a deploying unit's elevated priority supply status causes them to be flooded with equipment that they are authorized, but never received. The 20-foot container should be adequately filled with the remaining items, such as: tentage, camouflage systems, radios sets, floodlights, drafting equipment, space heaters, manuals and other miscellaneous items. Because all this equipment will not be used immediately upon arrival, the side-opening container would provide easier access to the different types of equipment. If these types of containers were not available, however, an end-opener would provide adequate storage and transport capability.

The General Construction Platoons (2 each) are multi-faceted units designed with skilled craftsmen and equipment to perform individual squad and/or platoon missions. A typical squad (3 each) within the platoon performs electrical, plumbing, pipefitting, carpentry, demolition and masonry activities. The squads were intended to be versatile and somewhat self-sufficient, since they often perform their missions separated from the other platoon elements [Jennings, Engineer officer, interview October 1991]. With this understanding of the platoon's mission capabilities, combined with the equipment list previously developed, it makes sense to provide each of the squads with an intermediate-sized container. With the hauling capacity of their dump trucks and the 1 1/2-ton trailers, they will be able to carry both the containers and any additional equipment that does not fit into the containers. By providing each squad with a

QUADCON or TRICON, they retain the flexibility of working at different site locations, plus have the capability to store their tool kits in a secure and weather-proof environment on location.

The Horizontal Construction Platoon has the primary mission to repair, construct and pave temporary and permanent roadways and airfields. Heavy construction equipment, such as loaders, scrapers, dozers and graders dominate the platoon's inventory and are not suitable for containerization. However, the remainder of the platoon's equipment, tentage and camouflage systems, would best be contained in the larger 20-foot container. In addition to suiting the cargo better than the intermediate-sized containers, the 20-foot container will not detract from the mission requirements of the three sections within the platoon. Unlike the General Construction Platoons, these sections work in the same general vicinity and do not need the independence that the intermediate-sized container can provide.

The last section to be evaluated is the **Maintenance Section**. Of all the sections in the company, this section's equipment can benefit the most from the use of containers. For example, the maintenance tool room is listed on the section's hand receipt as 'shop equip auto #1' and 'shop equip supl #1.' These two listings include hundreds of individual tools and would greatly benefit from container-loading versus the unit constructing wooden build-ups on the back of their 2 1/2-ton trucks. (Most units with tool rooms and repair parts currently meet their storage and transport requirements with wooden build-ups.) In addition to the tool room, the equipment list on Table 6.3.4 shows many large items within this section, such as: the tool cabinet, the camouflage systems, the generators, the compressor, the pumping assembly, the maintenance tent, and the heater duct type (more commonly called, the Herman Nelson heater). Again, these types of large items are more efficiently loaded into 20-foot containers than intermediate-sized containers. In addition to what is listed on the section's equipment list, they are also required to bring the repair parts (PLL) and servicing items (filters and lubricants) for all the unit's vehicles and equipment. This includes both large and small items, ranging from tires, to fan belts, to replacement light bulbs.

With all the equipment that this section must bring, they should be authorized two additional 20-foot containers with chassis to transport their gear. The tool room (unitized in cabinets) and the camouflage systems would completely fill one container. Once deployed to the theater of operation, the camouflage systems would be unloaded, providing space for the tool room clerk to issue tools from the container. The second container could serve as the primary workshop for the PLL, with the excess space filled during transit with the light sets, compressor and tentage. In addition to serving as a good transportation platform to carry all the section's equipment, containers offer the cargo the needed protection from weather damage and pilferage. By ensuring that both of these problems are reduced, the Army would save much money. Tools and repair parts, unless secured adequately, are highly susceptible to theft prior to a unit arriving in their area of operation. Without this repair equipment, the unit's mission capacity is considerably degraded.

6.4: SUMMARY

From this case study on the Combat (Heavy) Engineer Battalion, the process for container selection was illustrated using a line company. The type and numbers of containers recommended for the deployment of that company are listed below on Table 6.4.1.

TABLE 6.4.1 Container Selection Summary (*line company*)

Section / Platoon	Container Selected
Headquarters Section	1 20-Footer, & 2 Intermediate
General Construction Plt	3 Intermediate-Sized
General Construction Plt	3 Intermediate-Sized
Horizontal Construction Plt	1 20-Footer
Maintenance Section	2 20-Footers
TOTAL =	**4 20-Footers & 8 Intermediate**

Rather than selecting either the QUADCON or the TRICON, it is best to merely specify the requirement for an intermediate-sized container. For this unit, the difference in cubic storage space gained from the TRICON is not critical to ensuring that the equipment is fully loaded. By stating that the middle-sized container is required, this allows the materiel directors and those responsible for container procurement, the flexibility to choose either container. In all probability, the QUADCON is the container that is most likely to be procured. The Marines are curr ntly buying these and have offered to let the Army participate in this purchase. Further, since the Navy's purchase of the TRICON three years ago, there have been no additional contracts from the military for these kinds of containers.

Since the line companies require 8 intermediate-sized containers, the selection of the QUADCON would enable each unit to have an even number of 20-foot sized containers to transport. By connecting the modular containers during the strategic deployment phase, the company would have 6 20-foot equivalent boxes. (4 20-footers + 8 QUADs = 6 20-foot equivalents)

Now that the detailed analysis to estimate a more precise number of containers required to load one unit's excess equipment is complete, these results can be compared to the initial TARGET model's estimation. As stated previously, the model estimated that 24 20-foot containers would be needed for the entire battalion. If divided evenly for each of the four companies, that means each unit should get 6 20-footers. Even if the line companies were only given 5 20-footers and the HSC was given 9, these results are very close to the detailed evaluation results. While this is only an example of one unit, if these same results hold true for several others, the user can have a high level of confidence in the number of containers that are recommended from the TARGET model runs.

In summary, the evaluation tools provided in Chapter 4, combined with an understanding of the unit's equipment, mission requirements and hauling/handling capabilities, should prove invaluable in determining the true number and type of containers required for a unit-type. While the TARGET model seems to be fairly accurate in predicting the approximate 20-foot equivalents required, only the detailed selection procedure can determine the appropriate mix of different types of containers that may serve better for certain elements of the unit.

TABLE 6.3.3 Equipment in the Company Headquarters Section

Company Headquarters Section				
ITEM	# AUTH	SIZE	POT CON	SEL CON
calculator	5	1	1,2,4,5,6	2
typewriter	1	2	1,2,4,5,6	2
chemical alarm	3	1	1,2,4,5,6	
analyzer engine set	1	3	1,2,4,5	2
antenna groups	2	2	1,2,4,5,6	2
bayonets, (139)	1 box	3	1,2,4,5	4
water bag	4	2	1,2,4,5,6	2
binoculars	1	1	1,2,4,5,6	2
COMEXs	2	N/A	N/A	N/A
key cabinet	3	1	1,2,4,5,6	2
camouflage system	22	3	1,2,4,5	2 & trlr
camouflage support	36	2	1,2,4,5	2 & trlr
field case	1	3	1,2,4,5	2
M13 decon kits	52	2	1,2,4,5	4
desks, field	9	4	1,2,4,5	2
radiac detector	4	1	1,2,4,5,6	4
compass, magnetic	5	1	1,2,4,5,6	2
KYK-13 (commo)	2	1	1,2,4,5,6	2
floodlight sets	4	4	1,2,4,5	2
national flag	1	1	1,2,4,5,6	2
guidon flag	1	1	1,2,4,5,6	2
mine detector kit	3	2	1,2,4,5	2
drafting set	1	5	1,2,4,5	2
driver projectile	1	1	1,2,4,5,6	2
.45 dummy cartridge	10	1	1,2,4,5,6	4
5.56 dum cartridge	20	1	1,2,4,5,6	4
.50 cal dum cartridge	20	1	1,2,4,5,6	4
7.62 dum cartridge	20	1	1,2,4,5,6	4
tactical filing cabinet	1	3	1,2,4,5	2
visible file index	1	3	1,2,4,5.	4
installation kit	13	N/A	N/A	N/A
leather gloves	163	1	1,2,4,5,6	2
goggles	110	1	1,2,4,5,6	2
guard assembly	1	1	1,2,4,5,6	2
support assembly	1	1	1,2,4,5,6	2
space heaters	4	3	1,2,4,5	2 & trlr
grenade launchers	4	3	1,2,4,5	4
level survey set	1	3	1,3,4,5	2
digital facsimile	1	3	1,2,4,5	2
.50 cal machine gun	3	3	1,2,4,5	4

TABLE 6.3.3 (Continued) Equipment in the Company Headquarters Section

7.72 cal machine gun	10	3	1,2,4,5	4
protective masks	139	N/A	N/A	N/A
.50 cal mount	4	N/A	N/A	N/A
net control device	1	2	1,2,4,5,6	2
night vision sight	5	2	1,2,4,5,6	4
commo pow supply	3	2	1,2,4,5	2
9mm pistol	1	N/A	N/A	N/A
small arms stor rack	12	3	1,2,5	4
radiac set	1	2	1,2,4,5	4
radiac meters	7	2	1,2,4,5,6	4
radio set	25	3	1,2,4,5	2
reciever-transmitter	1	3	1,2,4,5	2
reel equipment	6	2	1,2,4,5,6	2
tent repair kit	2	2	1,2,4,5,6	2
radio test set	1	2	1,2,4,5,6	2
5.56 mm rifle	138	N/A	N/A	N/A
speech security	2	1	1,2,4,5,6	2
3/4 T truck	1	N/A	N/A	N/A
tone signal adapter	1	2	1,2,4,5,6	2
tape reader	1	3	1,2,4,5,6	2
digital telephones	6	1	1,2,4,5,6	2
5/4 T truck	1	N/A	N/A	N/A
load carrying sling	36	1	1,2,4,5,6	4
switchboard	4	3	1,2,4,5	2
microfiche viewer	4	3	1,2,4,3	2
telephone set TA-312	13	1	1,2,4,5,6	2
frame tent	1	4	1,2,4,5,	2 or trlr
GP medium tent	2	4	1,2	2 & truck
GP small tent	4	4	1,2	2 & truck
battery test set	1	2	1,2,4,5,6	2
power supply	10	N/A	N/A	N/A
electric tool kit	1	3	1,2,4,5	2
small arms tool kit	1	2	1,2,4,5	4
telephone wire	2	2	1,2,4,5	2
3/4 T cargo trailer	1	N/A	N/A	N/A
1 1/2T cargo trailer	2	N/A	N/A	N/A
anemometer	2	2	1,2,4,5,6	2
2 1/2T cargo truck	2	N/A	N/A	N/A
plywood trunk	10	3	1,2,4,5	2,4
wrist watches, (17)	1 box	1	1,2,4,5,6	2
visibility vests (27)	1 box	2	1,2,4,4,6	2

TABLE 6.3.4 Equipment in the General Construction Platoons

General Construction Platoon (2 each)				
ITEM	# AUTH	SIZE	POT CON	SEL CON
calculator	1	1	1,2,4,5,6	4
CONEX	1	N/A	N/A	N/A
key cabinet	1	1	1,2,4,5,6	4
concrete vibrator	2	3	1,2,4,5	4
telephone cable	8	2	1,2,4,5,6	4
camouflage system	29	4	1,2,4,5	truck
camouflage supports	33	3	1,2,4,5	truck
field desk	1	3	1,2,4,5	4
compass, magnetic	3	1	1,2,4,5,6	4
demolition set	4	4	1,2,4,5	4
mine detection set	3	2	1,2,4,5	4
3KW generator	3	3	1,2,4,5	trlr
installation kits	1	N/A	N/A	N/A
space heaters	2	3	1,2,4,5	trlr
pneu tool and comp	1	N/A	N/A	N/A
pump centrifical	3	1	1,2,4,5,6	4
pump unit rec pwr dvn	2	3	1,2,4,5	4
wheelbarrow	3	4	1,2	truck
5T dump truck	5	N/A	N/A	N/A
chain saw	3	2	1,2,4,5	4
screen latrine	2	3	1,2,4,5	trlr
low bed semitrailer	3	N/A	N/A	N/A
3/4T utility truck	1	N/A	N/A	N/A
shop equip woodwor	1	3	1,2,4,5	4
5/4T cargo truck	1	N/A	N/A	N/A
frame tent	2	4	1,2,4,5	trlr
GP medium tent	1	4	1,2	trlr
GP small tent	1	4	1,2	trlr
power supply veh	1	N/A	N/A	N/A
carpenters tool kit	4	4	1,2,4,5	4
electricians tool kit	3	3	1,2,4,5	4
mason tool kit	3	4	1,2,4,5	4
pioneer tool kit, plt	1	5	1,2,4,5	4
pioneer tool kit, sqd	3	4	1,2,4,5	4
pipefitters tool kit	4	4	1,2,4,5	4
rigging tool kit	2	2	1,2,4,5	4
port elec tool t/r	1	N/A	N/A	N/A
1 1/2T cargo trailer	3	N/A	N/A	N/A

TABLE 6.3.5 Equipment in the Horizontal Construction Platoon

Horizontal Construction Platoon				
ITEM	# AUTH	SIZE	POT CON	SEL CON
calculator	1	1	1,2,4,5,6	2
CONEX	1	N/A	N/A	N/A
clamshell bucket	1	N/A	N/A	N/A
concrete bucket	1	N/A	N/A	N/A
key cabinet	2	1	1,2,4,5,6	2
telephone cable	4	2	1,2,4,5	2
camouflage system	23	4	1,2,4,5	2 & trlr
camouflage supports	25	3	1,2,4,5	2 & trlr
6,000 g water tank	2	N/A	N/A	N/A
magnetic compass	2	1	1,2,4,5,6	2
25T crane	1	N/A	N/A	N/A
road grader	3	N/A	N/A	N/A
installation kit	4	N/A	N/A	N/A
space heater	3	3	1,2,4,5	2
hose assbly, water	6	N/A	N/A	N/A
hose assbly, fuel	8	N/A	N/A	N/A
scoop loader	2	N/A	N/A	N/A
.50 cal mount	2	N/A	N/A	N/A
speech security	1	1	1,2,4,5,6	2
roller pneumatic	1	N/A	N/A	N/A
roller vibrator	1	N/A	N/A	N/A
earth moving scraper	4	N/A	N/A	N/A
low bed semitrailer	2	N/A	N/A	N/A
3/4T utility truck	1	N/A	N/A	N/A
truck tracktor	4	N/A	N/A	N/A
tagline crane & shov	1	N/A	N/A	N/A
tamper piston-ham	2	3	1,2,4,5	2
GP medium tent	1	4	1,2,4,5	2
GP small tent	1	4	1,2,4,5	2
power supply veh	1	N/A	N/A	N/A
bulldozer tracktor	5	N/A	N/A	N/A
1 1/2T cargo trailer	2	N/A	N/A	N/A
2 1/2T cargo truck	2	N/A	N/A	N/A
SEE (evacuator)	2	N/A	N/A	N/A
frame tent	1	4	1,2,4,5	2

TABLE 6.3.6 Equipment in the Company Maintenance Section

Maintenance Section				
ITEM	# AUTH	SIZE	POT CON	SEL CON
typewriter	1	2	1,2,4,5,6	2
engine analyzer set	1	3	1,2,4,5	2
impermeable apron	2	1	1,2,4,5,6	2
CONEX	2	N/A	N/A	N/A
key cabinet	2	1	1,2,4,5,6	2
tool cabinet	3	3	1,2,4,5	2
camouflage system	22	4	1,2,4,5	2 & truck
camouflage support	26	3	1,2,4,5	2 & truck
field mach case	1	3	1,2,4,5	2
battery charger	1	3	1,2,4,5	2
field desks	3	3	1,2,4,5	2
compass, magnetic	3	1	1,2,4,5,6	2
5 CFM compressor	1	3	1,2,4,5	truck
compressor unit	1	3	1,2,4,5	truck
5KW generator	2	4	1,2	trlr
10 KW generator	2	N/A	N/A	N/A
3 KW generator	1	3	1,2,4,5	trlr
heater duct type	1	5	1,2	truck
space heater	2	3	1,2,4,5	trlr
welding shop trlr	1	N/A	N/A	N/A
light set	1	3	1,2,4,5	2
multimeter	2	1	1,2,4,5,6	2
pumping assembly	2	4	1,2	2
5T wrecker truck	1	N/A	N/A	N/A
tent repair kit	1	2	1,2,4,5,6	2
contact maint truck	1	N/A	N/A	N/A
5/4T cargo truck	1	N/A	N/A	N/A
microfiche viewer	2	3	1,2,4,5	2
tank and pump unit	1	N/A	N/A	N/A
frame tent	1	4	1,2,4,5	2
maintenance tent	1	7	1,2	truck
GP small tent	1	4	1,2,4,5	2
common #1 repair kit	1	7	1,2,4,5	2
cont #1 supl kit	1	6	1,2,4,5	2
gen mech tool kit	17	2	1,2,4,5	2
1 1/2T cargo trailer	3	N/A	N/A	N/A
400 gal water trlr	1	N/A	N/A	N/A
2 1/2T cargo truck	2	N/A	N/A	N/A
5T cargo truck	3	N/A	N/A	N/A

CHAPTER 7:
COMMERCIAL CARRIER'S PERSPECTIVE

Prior to concluding the review of this topic which looks at the question of expanding the Army's use of containers for deploying unit equipment, it is important to also look at this matter from the commercial carrier's point of view. Since the commercial industry's assets serve as primary movers of U.S. forces during national conflicts, it is essential that time-sensitive wartime deployment planning is not conducted in a military vacuum. The industry that will assist in the execution of the plans should be consulted to:

1) determine if the Army's deployment objectives are achievable, and

2) exchange ideas that may streamline the deployment process.

This brief chapter is intended to provide insight from the intermodal carriers on transportation methods which they believe will deliver unit equipment faster and in a more cost-effective manner for both parties.

7.1: BACKGROUND ON DESERT STORM CONTAINERIZATION

Both the military transportation planners and the intermodal carriers view the Persian Gulf War as a watershed event for the Defense Transportation System. This was the first crisis in which the military had the opportunity to utilize the fairly new and sophisticated, intermodal and logistics capabilities that the U.S. carriers provide daily to their commercial customers. Because it was 'a first,' there are many things that can still be done to improve the system for future contingencies. But the support received from the commercial industry during the sustainment phase of the war has convinced many military planners that containerization during deployments has many advantages [Smith, Lessons Learned Cell, June 1991].

Operation Desert Shield/Storm provides a performance-level benchmark as to how the military and civilian transportation systems are collectively operating. It was the largest deployment of U.S. forces since World War II, and was the first true test of intermodalism's role in war ["Post Desert Storm Reflections," August 1991]. Both the commercial and military transportation planners agree that the Persian Gulf War has altered the way in which the military views containerization. Prior to the conflict, containerization was felt to be of little use for deploying unit equipment. Containers were seen primarily as an efficient method of moving resupply cargoes during peacetime, but even with the wartime sustainment cargo, the military logisticians were not fully aware of what the commercial transportation industry could offer. Initially, military planners were trying to use the same deployment concepts that were used during Vietnam. Fairly quickly, however, the intermodal carriers were able to substantiate the advantages of using their fully integrated supply-chain management for the distribution of military sustainment materials.

The opportunity now exists for transporters, both military and civilian, to review Desert Storm's history and examine the effectiveness of their strategic mobility process. One of the biggest problem highlighted during the Congressional Hearings after the war was the nation's dependence on foreign flagged ships during the initial surge deployment [Donnovan, June 1991]. The fact that MSC had to charter 41 Ro/Ro ships from allied nations and could only charter six from U.S. carriers is forcing mobility planners to try to identify additional U.S. sealift sources. ["Post Desert Storm Reflections," August 1991] These identified shortcomings in the militarily preferred Fast Sealift Ships (FSS) and Ro/Ro ships (Chapter 2: 8-10 SSSs and 20 Ro/Ros) is leading to renewed government interest in the role of containerships for both the initial surge and sustainment phases of deployments.

7.1.1: Containerization for Sustainment Cargoes

By far, the greatest percentage of containerization during Desert Storm was conducted under the umbrella of the Special Middle East Shipping Agreement (SMESA). This agreement entitled the military to use up to one-third the shipping capacity of the seven participating U.S. carriers ["Post Desert Storm Reflections," August 1991]. These carriers included: Sea Land, American President Lines (APL), Central Gulf Lines, Farrell Lines, Lykes Brothers Steamship, and Waterman Steamship Corporation ["Guns 'n' Boxes," August 1991]. Under this agreement, the carriers delivered a remarkable 37,000 FEUs (forty-foot equivalent units) of sustainment cargoes to the warzone during the period of August 1990 to March 1991. Making the job even more difficult, the volume of military supplies to be transported was quite erratic from week to week. Even though the containerized SMESA shipments were solely for sustainment supplies (no unit equipment), their cargo equated to 29% of all the dry-cargo shipped to the Gulf region ["Post Desert Storm Reflections," August 1991].

7.1.2: Containerization for Unit Equipment

While U.S. commercial carriers had the chance to establish the wartime benefits of using containers for sustainment cargoes, there was negligible intermodal shipment of unit equipment. (A few unit's from Germany shipped containerized unit equipment on container vessels) Approximately 7,000 containers were used to transport unit equipment, but nearly all of these containers were transported as breakbulk cargo in conjunction with the unit's wheeled vehicles on either Ro/Ro or breakbulk ships ["Guns 'n' Boxes," August 1991]. This method of using containers for shipping unit equipment provides the secondary benefit of a secure 'box' to carry the unit's extra gear, but it does not capitalize on the intermodal logistics services that can be provided for containers that are shipped via containerships and the intermodal system.

The commercial carriers, especially APL and SeaLand, argue that much of the cargo that is typically shipped during the surge phase is containerizable, and should be shipped in the U.S. commercial carrier's intermodal system. Mr Eugene Pentimonti, one of APL's vice-presidents, estimated that 60% (instead of the actual 29%) of all cargo shipped to Desert Storm could have been containerized [DiBenedetto, June 26, 1991]. They contend that if the military had containerized more of their unit equipment, they could have reduced their need to rely upon expensive Ro/Ro charters, or the even more costly airlift transport. This cost savings is anticipated because the military would be utilizing the transportation services (in the role of customer) of an intermodal carrier, versus taking control of a vessel (typically a Ro/Ro ship) by chartering it. When the government charters commercial vessels and pulls them off their normal trade routes, the cost of the charter is usually very high. In addition to the impact from the economic law of 'supply and demand,' this added cost is viewed as compensation to supplement the owner's potential loss of peacetime commercial customers. The carriers would prefer to offer the military a percentage of their entire intermodal pipeline (including rail, truck and ocean service), rather than have the military fragment their network by chartering vessels and pulling them completely off their commercial trade routes.

In an effort to try and educate their large military customer, the carriers are currently presenting briefings to the various military transportation agencies on their capabilities of transporting all kinds of unit equipment. In addition to being able to transport unit equipment that is easily containerizable, they are proposing that many of the military's smaller trucks and trailers should also be shipped in containers. These vehicles can be strategically transported in commercial containers that the carriers currently use to transport automobiles. By adopting a movements strategy which places a relatively large percentage of a unit's equipment on containerships, the military could reserve the limited Ro/Ro ship capacity for outsized vehicles only [APL's white paper, May 1991].

As discussed in Chapter 4, containerships can also be modified with SEASHEDs and Flatracks for carrying outsized equipment. While some containerships would require a great deal of modification to accept SEASHEDs, carriers such as APL and SeaLand have ships that are already in compliance with the national defense ship specifications for accepting them [APL's white paper, May 1991]. By transporting entire units or portions of units on containerships, (rather than waiting for the next available FSS or Ro/Ro ship) the commercial carriers believe that most units would generally get to their destination faster. This being true, the inclusion of containerships in the pool of U.S. flagged surge sealift assets would reduce the nation's reliance on foreign sealift augmentation.

7.2: BENEFITS OF CONTAINERIZING UNIT EQUIPMENT

Since the intermodal shipments during Desert Storm were solely for sustainment cargoes, it is somewhat difficult to precisely extrapolate the benefits to be enjoyed by the military if unit equipment is also shipped in the intermodal system. While there is no empirical evidence from the war to verify the benefits of moving unit equipment on containerships, the benefits from the sustainment moves are listed below and should apply equally well.

1. **Reliability.** This characteristic is an important value added service that is provided by the intermodal carriers to their customers (the military in this case). The SMESA carriers demonstrated the reliability of their service by meeting or exceeding nearly every required delivery date (RDD) set by the military. All transit times were dependable, with the only operational slowdown occurring at the Port of Dammam, Saudi Arabia, on the day the air war began, 16 January 1991

[APL's white paper, May 1991]. While some military planners protested the slower transit times of containerships versus the FSSs, the containerships proved their ability to move cargo just as fast by capitalizing on their pipeline approach (continuous flow) to transportation. Because carriers have the capability to launch commercial containerships to a specific region each day, they can keep tremendous volumes of cargo continuously flowing. In addition to the many ships that can be ferrying cargo, this pipeline approach also incorporates the other elements (rail and truck) of their intermodal transportation network that are constantly feeding the cargo to the right ports ["Logistics," July 1991]. An example of how they used their many assets to ensure reliable service was demonstrated when the crew of one of APL's foreign-flag feederships refused to enter the Gulf. APL was able to meet military deadlines by dispatching one of their own ships to carry the cargo [Hayashi. May 1991].

2. **Operational Flexibility.** The multi-modal companies, holders of such carriers as SeaLand and APL, control massive transportation assets of all modes and can thereby streamline the older 'separate mode' concept of transportation [Hayuth, interview March 1991]. If one port of embarkation becomes congested, they have the internal capability to reroute cargo at any point along its path. Because the rail, trucks and ships are under the control of a single owner, there are no delays in renegotiating rates between the separate mode carriers [Heiton, VP Sea Land, interview July 1991].

The commercial industry demonstrated another side of their operational flexibility by adjusting to the variability of military cargo volumes during Desert Storm. Normally, containerships call on a select few ports and stay only long enough to transfer a precise amount of designated cargo. During this past contingency, however, they had to alter their normal procedures to accommodate for the changing volumes of cargo. For example, volumes rose from approximately 275 FEUs in the early weeks of the war to 3,300 FEUs per week in February 1991. Compounding the carriers' logistics challenge of the volume surges was the military's lack of accurate volume forecasting. Despite the fact that the no-show or late-show cargo factor ran as high as 25%, the carriers showed their willingness to adjust to wartime conditions and made the necessary capacity available as needed [APL's white paper, May 1991].

Now that some time has passed since Desert Storm, both the commercial carriers and the military have had time to regroup and conduct some post-evaluations. Some military planners hesitate on incorporating container vessels for future contingencies because it may not offer developed container ports. The commercial carriers are again demonstrating their operational flexibility by presenting the military with ideas to cope with future contingencies that may occur in a <u>non-container</u> port environment [Hayashi, June 1991]. Rather than just waiting for a crisis to occur, the commercial industry wants to assure their military customer that with their combined assets and preplanning, even a contingency involving undeveloped ports could be accommodated.

3. **Service and Cost Competitiveness.** One of the most important benefits to be gained by shipping equipment in containers is the cost-competitive advantage gained by utilizing the intermodal network rather than contracting separately for independent rail, truck, and ocean services. The intermodal 'package deal' not only provides cheaper shipping costs than chartered ships, but the value-added services that go with their transportation 'product' adds to the cost savings. In addition to the flexible and reliable service gained as a result of the carriers control of several modes of transportation, their information and logistics management services would be invaluable when shipping the tremendous volumes required to support a war ["Post Desert Storm Reflections," August 1991]. Finally, by using the intermodal transportation network, the customer is provided many additional services for the same rates- such as staging container operations, providing chassis, coordinating deliveries, and providing drayage at the ports. Without using intermodal services, all these incidental costs are charged separately [Hayashi, June 1991].

4. **Logistical Support.** Another benefit of using intermodal services to transport military equipment is in the area of logistical support. As a valued customer, the commercial carriers are willing to send their staff out to the various installations that are deploying units to offer assistance on things such as container-stuffing procedures. In Desert Storm, companies such as APL also sent senior staff members to the Port of Dammam to assist the Army on documentation, in-country trucking needs, and customs staging [APL's white paper, May 1991].

The carriers are also working with USTRANSCOM to develop container tracking procedures for the military that are compatible with the commercial industry's. These tracking technologies include both electronic data information (EDI), and the physical tracking of containers through automatic equipment identification (AEI). After action reviews from Desert Storm suggest that better cargo identification could have saved as much as 10 days on final delivery times. The carriers also feel that accurate tracking is the critical element which will allow units to ship their outsized equipment on Ro/Ro ships and containerized equipment on containerships. They contend that their sophisticated tracking systems would enable unit equipment to be properly married-up at the port of debarkation ["Logistics," July 1991].

7.3: REQUIRED IMPROVEMENTS

While the military and commercial transportation organizations of the Defense Transportation System were diligent in their efforts and were able to move greater volumes of cargo faster than in any previous war, there is still considerable room for improvement. Currently, there are three basic areas where the commercial carriers want to improve their partnership concerning military deployments.

1. **Contingency Contracts.** The first area of concern deals with the extended, time-consuming bidding process involved in negotiating shipping contracts. In the case of Desert Storm, no military cargo was moved by U.S. liner vessels for three and one-half weeks after the President mobilized forces. This delay could have been avoided if a contingency contract had been developed in which the government and commercial operators had previously agreed on shipping rates and procedures [Hayashi, June 1991]. With this kind of contract in place, the time-consuming particulars would be arranged ahead of time, requiring only that the document be pulled off the shelf and executed. Such an improvement will enable commercial transportation assets to be used immediately to meet both the economic and **rapid** deployment needs of the military [Helton, VP Sea Land, interview July 1991].

2. **Improve Logistics Planning and Communications.** Another concern held by the carriers is their desire to improve communications between themselves and the military. They are seeking a relationship where they participate in the

planning, and can thereby better anticipate the support that will be required. For example, carriers are requesting that the military confer with them on the basic wartime scenarios that are most likely to occur. Certainly some government security clearances would have to be provided to selected members of the carrier's staff, but without this information it will be impossible for them to immediately adjust their assets on a no-notice basis. By allowing access to this kind of information, certain standard operating procedures can be developed and shelved by the carriers, to be executed should one of the scenarios occur. Such a partnership would reduce operational delays and wasted industry resources [APL's white paper, June 1991].

3. **Regulatory Changes.** Finally, the intermodal industry is interested in streamlining some of the regulatory shipping requirements during wartime. As the regulations now stand, carriers are required to submit lengthy and time-consuming cargo filings to adjust for cargo volume surges. For example, if a feeder ship were required to turn around and make a second trip to deliver more cargo than was expected to arrive in the region, it would have to petition the military for approval. While the granting of approval is certain, delivery of urgently needed cargoes is delayed by paperwork.

The carriers would also like to see the government modify the Sealift Readiness Program (SRP). As described in Appendix A of this thesis, the SRP is an emergency measure which would allow the government to force commercial carriers to offer up certain ships to assist in sealift requirements. Instead, the carriers would prefer to be contracted for a certain percentage of their pipeline. This includes providing service with their entire intermodal capability versus handing over control of a portion of their ocean-going assets ["Post Desert Storm Reflections," August 1991]. Because of the tough international commercial trade competition, pulling individual vessels out of their trade routes may upset a U.S. carrier's trade balance. In such an unforgiving economic environment, programs such as the SRP would cause substantial economic hardship to the commercial carriers if they are not updated. The program modifications they are proposing would enable the carriers to retain control of their assets so that both military and commercial cargoes could be transported. This arrangement gives the carriers the flexibility to maximize the utilization of their equipment, and to meet the needs of the military without losing many of their peacetime customers to foreign carriers [Helton, VP Sea Land, interview July 1991].

7.4: SUMMARY

As described in this chapter, there are many benefits to using intermodal carriers for deploying military equipment and supplies. They include: reliability, expandable capacity, operational flexibility, reduced costs, cargo tracking information, and logistical expertise. Even though the military used these services for sustainment cargoes during Desert Storm, military planners are currently re-evaluating the role of intermodal shipments for surge requirements. The commercial carriers are convinced they can support that effort, but are requesting that several issues be addressed prior to executing another colossal joint transportation effort. Regardless of the cost savings to be enjoyed by the military if they utilize containerships to deploy designated units (rather than the more costly airlift or inflated foreign-flagged Ro Ro charters), the most important benefit would be the anticipated improvement in force closure times. As described in Chapter 4, the military's research as to whether the use of containerships would speed force closure times has already been conducted. For all types of divisions, the simulation models predicted that units or portions of units would arrive at their wartime theater of operation quicker if containerships were used in conjunction with the normally expected sealift assets [Lennon, engineer with TEA, interview July 1991].

Clearly, the military's mind-set on what they can expect from the intermodal carriers has been altered by Desert Storm. The door is now open for the Army to empower the recent policy changes (AR 56-4 Management of Army Intermodal Container Systems) regarding containerization of unit equipment. As stated earlier, the policy's first principle reads as follows:

> Optimize the containerization of Army unit equipment (UE) to reduce force closure time, to meet the needs of the supported commander-in-chief, and to reduce transportation costs.
>
> [AR 56-4, par 6 a., September 1990]

Since the Army has never deployed unit equipment intermodally, a great deal of preparation, coordination and planning is required before this type of mission can be successfully executed. The three concerns of the intermodal carriers are only a portion of the many issues that must first be resolved. But clearly, without contingency contracts and the open communications carriers are calling for, other efforts may prove inconsequential.

CHAPTER 8:
CONCLUSIONS AND RECOMMENDATIONS

In an effort to improve deployment capabilities, this thesis has examined the concept of expanding the Army's utilization of containers during the overseas movement of unit equipment. The fact that the United States is shifting its defense posture from a forward-deployed force to a continental U.S.-based force, makes the requirement to move a large fighting contingency, greater distances, in a shorter time-frame, more critical than ever before. The capability to project power by implementing DOD's new strategic mobility goal, the mobilization of two heavy divisions and one light division in 30 days, is directly tied to the nation's ability to capitalize on its transportation assets when needed.

In light of this mobility challenge, this thesis provided an in-depth examination of the many benefits of containerizing unit equipment for deployment, and subsequently addressed the obstacles which must first be overcome. The preceding chapters examined current military sealift issues, reviewed the U.S. Army's use of containers and its containerization policy, surveyed container hardware systems with potential unit deployment application, and presented a methodology for determining the containerization requirements for any unit in the Army. Out of this broad discussion a number of key conclusions and specific recommendations for the Army can be derived.

8.1: CONCLUSIONS

Specific conclusions relevant to containerizing unit equipment for future military deployments can be categorized into three general areas: 1) benefits gained in an intermodal environment, 2) equipment considerations, and 3) issues regarding policy and doctrine.

8.1.1: The Sealift Issue and Benefits of Intermodalism

After examining the information presented in the previous chapters, it is apparent that the Army could gain many benefits by adopting containerization for the deployment of unit equipment. To some extent, the Desert Storm units that shipped containers as breakbulk cargo along with their vehicles on Ro/Ro vessels, benefited from the secure transport and storage capability that the container provided for their excess equipment. However, the primary benefits to be gained from containerization will not be realized until containers are used in conjunction with the intermodal transportation system. There is an important link between containerizing unit equipment and employing container vessels during the surge phase of deployment. As a result, the proposal to expand the use of containerization during the surge phase of deployments is directly tied to the ongoing debate as to how to best fill the current sealift shortages. It is concluded that the employment of containerships would not only supplement current U.S. sealift shortages, but the use of these vessels would enable deploying units access to the world's most sophisticated transportation and distribution system ever developed.

By expanding the use of ISO compatible containers (both standard and modular) at the unit level, a greater proportion of unit equipment will be eligible to be transported in the commercial industry's intermodal network. In summary, the benefits to be gained by using containers in an intermodal environment during unit deployments include:

- Improved force closure times. Studies examining the use of augmenting deployments with containerships have shown:
  - moderate improvements in force closure times when containerized cargo is offered to containerships and the wheeled/tracked vehicles are shipped on Ro/Ro and breakbulk type vessels, and
  - substantial improvements when the vessels are modified with SEASHEDs and Flatracks to deploy entire units on the same vessel.
- Substantial relief of sealift shortfalls. By making unit equipment more compatible with containerships, these vessels can augment the currently available sealift during the surge phase of deployments.
- Access to the intermodal door-to-door shipment service. This type of service simplifies the military's previous shipping practice of contracting separately for the rail, truck and ocean phase of the movement. When equipment is shipped in the intermodal system, it is booked with the customer's required delivery date, and the carrier coordinates the details of the entire movement.
- Reduced strategic shipping costs. Shipping a percentage of the nation's unit equipment on containerships provides a source of lift that would

otherwise be filled by the inflated Ro/Ro charter rates (both foreign and domestic), or the even more costly airlift methods.

* Increased utilization of the existing merchant fleet results in a variety of secondary benefits to both the government and the commercial carriers, to include:
  - reduces the government's requirement to purchase and maintain reserve ships or strategic sealift ships;
  - does not exacerbate the already acute shortage of seamen required to man the existing reserve vessels;
  - provides the government access to a 'healthy' source of shipping vessels versus relying totally on the much older inactive vessels of the RRF; and
  - provides the opportunity for the shipping industry to profit for the transportation services it provides the government.
* Provision of value added services that are inherent in intermodal shipments, including:
  - a source of transportation expertise that has the staff and resources to meet the challenges that arise during a crisis;
  - a reliable service that has demonstrated its ability to meet the military's required delivery dates even under hostile conditions;
  - the flexibility to expand or shrink transportation support to meet the military's unpredictable cargo levels; and
  - an automated information systems that track containers throughout the entire shipping process, thus enhancing the military's planning abilities.
* Provides added security to the cargo against damage, weathering or pilferage during transport by enclosing the cargo in a container.

8.1.2: Equipment Issues

Several conclusions related to equipment merit recognition:

* Containers provide units benefits aside from access to the intermodal transportation system:
  - they provide an additional transportation platform for items that cannot be nested in the cargo space of a unit's organic equipment; and

- once deployed to their area of operation, they serve as secure, mobile storage facilities.

* From the discussion of ISO container selection considerations, it can be concluded that some dimensional varieties are better for units deployment purposes than others:
  - 9'6" high containers should be avoided since they may not be able to be transported inland due to height restrictions found in some regions of the world;
  - 20-foot containers should be selected over 40-ft. containers due to the dense nature of unit equipment, and the increased signature (target) given by the 40-ft. container;
  - 20-foot, 40-foot, or smaller container subdivisions (e.g., QUADCONs and TRICONs) are preferred over nonconventional sized (24-foot, 45-foot) containers in order to maintain the highest levels of compatibility with the Army's current inventory of container handling and transporting (RTCH and M871/2 Semitrailers) equipment.
* Many units do not possess the material handling capability or organic transportation to handle commercial 20-foot containers. These units may benefit from smaller containers such as the QUADCON, TRICON or PALCON.
* Because the TRICON is not currently being manufactured, the QUADCON seems to be the best replacement for updating the CONEX as an intermediate-sized transport and storage facility for sealifted type units. The QUADCON meets several important selection prerequisites:
  - it can be handled by all units with the unit wrecker,
  - it is small enough to be loaded onto the back of cargo vehicles for ease of tactical unit moves,
  - its ISO dimensions make it compatible with the intermodal transportation system.
* Despite their cost, airlifted units may find the ISU-Series containers to be more practical than the Mobility Containers because of their availability.

* Expanding the use of containers at unit level during peacetime may prove to be an investment in wartime readiness. Units that store their organizational equipment (such as tents, stoves and camouflage systems) in containers would be partially packed at all times. Additionally, working out of containers (20-footers or the intermediate-sized modular containers) during peacetime would be especially beneficial to units that would be required to transport many repair parts. If these items were always located and issued out of containers, then the alerted unit would merely have to close the doors and load the container onto the back of a truck to mobilize.
* The U.S. military currently owns assets (SEASHEDs and Flatracks) to modify containerships so that they are capable of carrying up to 97% of all the equipment from any division type. Additionally enough of these Sealift Enhancement Features have been procured to modify approximately 25 - 30 containerships. From all the available studies, it can be concluded that the Heavy-Duty Flatracks are logistically easier to use and are more cost-effective than the SEASHEDs.
* Desert Storm demonstrated the shortfall of CHE, MHE and transportation support assets currently available in a wartime theater of operation. Since this shortfall exists before containerization is expanded to include unit equipment, it is conceivable that the containerization process could break down if this deficiency in the transportation system is not augmented in the near future.
* Because of the various mission requirements and organizational differences between unit-types within the Army, it has been concluded to be unrealistic to establish a single containerization level which is appropriate for all units. The case study is Chapter 6 demonstrates a systematic methodology for tailoring containerization and thereby selecting containers appropriate for the equipment and mission any unit-type.

8.1.3: Policy and Doctrinal Issues

The following policy and doctrinal issues, outlined in the preceding chapters, lead to the following conclusions:

* The role of containerships for future contingencies still remains undefined by strategic deployment policy makers. In light of the identified shortages in preferred shipping bottoms, it is dangerous to maintain old unit deployment practices which commit all deployment concepts and planning toward the use of Ro/Ro and breakbulk type ships only. Such a focus seems to ignore the acknowledged Ro/Ro ship and able bodied seamen shortages, and prevents the potential system-wide advantages of intermodalism. Either ignoring the issue or adopting a "no-containership" posture for unit deployments introduces risk for future contingencies. Such a stance makes U.S. security dependent on the availability of a disappearing Ro/Ro and breakbulk fleet which is largely under foreign control.
* The Army's generalized container policy as outlined in AR 56-4 does not provide specific guidance to units and transportation agencies. The gap between policy and practice results from the policy's lack of clear detail on <u>how</u> the Army is supposed to proceed toward containerized unit deployments. Before units or transportation agencies can plan for containerization, those responsible for deployment doctrine must answer the following questions:
  - To what extent will the Army employ containerships during the surge phase of deployments?
  - Does the Army intend to maintain its current preference for unit integrity by loading all of a unit's equipment on the same ship, or is it willing to split unit equipment and transport equipment on ships appropriate to their cargo configuration?
  - What role should containers transporting unit equipment serve? Are they to be strictly strategic transportation platforms or should they remain with the unit throughout the deployment to be used as a storage facilities also?
* The lack of a single point of contact for containerization, such as the previous established DOD Program Manager for Containerization, forestalls adequate sharing of container information between the different Services. The current decentralized system results in duplication of research and procurement efforts.

8.2: RECOMMENDATIONS

Policy makers for the Department of Defense and U.S. Army should adopt the concept of deploying portions of unit equipment through the intermodal transportation system. Specific recommendations for implementing this change in traditional deployment practices include:

* Sufficient sealift funds should be allocated toward improving the military's utilization of merchant vessels, specifically containerships, versus budgeting money solely towards a government-owned sealift fleet.
* DOD should conduct a study on the expected impacts to the existing logistics system that would result from containerizing unit equipment during deployments. It should examine both resource shortfalls and determine how the various logistical systems will be affected. For example what changes in the transportation, supply, distribution and information systems will occur due to the added use of containers and containerships. Anticipating these impacts and effecting the necessary changes will be essential to the smooth execution of expanding containerization.
* The Army, in conjunction with DOD, must develop doctrine in support of the current containerization policy which explains how the policy will be implemented. This guidance should be presented in a step-by-step format that integrates the efforts of the impacted organizations at each level. At a minimum, specific guidance and responsibilities should be given for: the Department of the Army's Chief of Staff for Logistics office (DA DCSLOG), the logistics branch schools (Transportation, Quartermaster and Ordnance), the transportation operating agencies, installation transportation officers, and unit commanders.
* Develop prenegotiated contingency contracts with U.S. containership carriers. These plans should specify freight rates, response time, and the amount and type of value added services to be provided. The military should be sensitive to the fact that chartering container vessels and pulling them completely out of their normal trade routes will result in the potential loss of commercial customers to foreign carriers and will fragment the U.S. carriers' network. When possible, the military would better serve the commercial industry and themselves by making

agreements with the carriers for a percentage of their entire intermodal pipeline service. To the extent that the military acts in the role of a preferred customer, the carrier can better manage their limited resources to ensure that both military and commercial cargoes are delivered.

* The government should subsidize the premodification costs to ensure that all containerships in the U.S. fleet are capable of accepting SEASHED installation. Since these modifications can be done concurrently with the vessel's annual maintenance, the modifications could be made without unnecessarily pulling the ships out of their normal trade cycles.
* DOD should reestablish the position of a Program Manager for Containerization. With a limited defense budget, an 'honest broker' is needed to ensure that efforts are not duplicated between Services, and that priority of budgeting is determined by an impartial organization.
* The U.S. Army branch school responsible for containerization (U. S. Army Transportation Center) should develop training programs that assist in the unit containerization process. It should incorporate the 'how to do' things, such as:
  - loading procedures,
  - cargo documentation procedures,
  - maintenance procedures,
  - container handling requirements (with MHE, CHE or unit wrecker), and
  - container load planning considerations for both airlift and sealift situations. This instruction should include information on how to plan for the use of SEASHEDs and Flatracks.
* Installations should incorporate container training in their Unit Movements Course. Every major installation responsible for deploying troop units offers a course to certify unit movements officers and NCO's. Once the installation has trained these key people, they return to their units and are responsible to train and prepare their own unit movements teams. All such training could be standardized across the Army if installations received their programs of instruction on containerizing unit equipment from the U.S. Army Transportation Center.

* The Army's Transportation Engineering Agency should develop automated systems to assist units in load planning for containers. Current automated software assist in vehicle stowage aboard MAC aircraft and various ship types. If the Army is now going to use containerships for deployments, then new software should be designed to aid in stowing outsized vehicles on SEASHEDs and Flatracks.
* Army units should be required to have hands-on training with containers. Units should ultimately incorporate loading portions of their unit equipment into containers during their annual Emergency Deployment Readiness Evaluation (EDRE). Additionally, large annual deployment exercises, such as Return of Forces to Europe (REFORGER) and Team Spirit (to Korea) should use container vessels to deploy the unit's containerized cargo. These large-scale practice deployments will assist in 'working out the bugs' that will initially result from splitting unit equipment into different ships during the sealift phase of deployments.
* MTMC should conduct a study to determine the appropriate number of containers that are needed to support the units located at each installation. This kind of study should look specifically at determining the appropriate mix between government-owned containers that need to be stockpiled at each post versus the percentage that should be obtained from commercial lessors.
* MTMC should coordinate with the container lessors in the vicinity of Army posts to establish no-notice contingency contracts. These agreements should include the amount of containers that can be delivered and in what timeframe. It should also establish freight rates that can be adjusted periodically to compensate for market changes.
* Using a methodology similar to that outlined in Chapters 5 and 6, TEA should determine appropriate levels of containerization tailored for each battalion-type. This baseline information on appropriate types and amounts of containers would assist units in their deployment planning process.
* The Army should join the Marines in their contract to procure QUADCONs.

* For units that will comprise the new 'Contingency Corps' (the Army's future 'first string' for deployments), QUADCONs should be issued to sealifted units, and ISU-series containers should be issued to airlifted units. To improve rapid deployment these containers need to be unit-owned, and incorporated into the peacetime functions of those units. For example, by using containers for the storage and issue of repair parts, these units will save countless hours of loading during a deployment alert.
* Until the final impacts study is complete, the Army should acquire additional CHE, MHE and transportation assets to fill known critical deficiencies identified during Desert Storm.
* The Army should continue to develop its capability to track containers and all types of unit equipment as they pass through the transportation system. Lack of adequate in-transit visibility will hinder the flexibility of transportation agencies in splitting unit shipments to best accommodate cargo configurations, and prevent unnecessary waste of the limited Ro/Ro ship cargo space.

8.3: SUMMARY

To meet the demanding deployment requirements dictated by the nation's new military strategy, the U.S. Army will have to rely on a mix of military and commercial transportation assets. In the sealift category, Ro/Ro vessels will remain the most useful type of ship. Their scarcity, combined with limited defense monies for procuring a totally government-owned fleet, makes the use of containerships a logical supplement to the total sealift mix.

Containerizing portions of a deploying unit's equipment will not only make the cargoes compatible with these additional sealift bottoms, but it also allows the Army to benefit from the advantages of the highly developed U.S. intermodal transportation network. To the extent that the Army 'intermodalizes' unit equipment so that it can be moved from origin (home station) to destination (area of operation) in an efficient manner, our nation will improve its ability to meet future strategic mobility challenges and safeguard its world-wide interests.

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APPENDIX A:
HOW MILITARY SEALIFT IS OBTAINED

If the United States should need to deploy military forces abroad for national defense reasons, there are several sources from which sealift is obtained. Depending upon the situation, the progressive steps in acquiring sealift are generally utilized in the following order.

1. MSC Controlled Fleet:

The initial source of sealift would be filled from the MSC Controlled Fleet. These ships are under the direct control of Navy and would be readily available when needed [NPW 80]. There are three categories of ships found in the MSC Controlled Fleet. They include:

(a) The Nucleus Fleet. This fleet is composed of the U.S. Naval ships permanently assigned to MSC for operation and administration. The fleet includes: 8 Fast Sealift Ships, 2 Hospital Ships, 2 Aviation Logistics Support Ships, and 11 Auxiliary Crane Ships [NACOA, 1985]. This small group of ships fulfil a special strategic sealift need that cannot be found in the merchant marine vessels. The Fast Sealift Ships, for example, are vital to deploying the first units only a couple days after the mobilization alert. The Fast Sealift Ships are maintained at high levels of preparedness and are partially crewed. These actions ensure that there are ships designed to carry outsized unit equipment which are readily available in times of crisis.

(b) MSC chartered ships. These are privately-owned U.S. merchant vessels that were already under long-term contractual agreement with MSC.

(c) Prepositioning ships. There are two categories of prepositioning ships, including:

- Afloat Prepositioning Forces (11 ships), which are forward deployed and carry U.S. Army and Air Force military supplies and equipment; and
- Maritime Prepositioning Ships (13 ships), which carry three U.S. Marine Corps Expeditionary Brigades [Warren, 91].

2. Commercial U.S. Chartered Ships:

The next source of sealift consists of commercial U.S. flagged shipping lines that voluntarily offer their vessels to MSC for charter. The pool of active, privately owned U.S. flag ships (considered "militarily-useful") numbered 398, as of July 1990 in MSC's official guidebook, Ship Register. The breakdown of registered U.S. commercially-owned vessels includes: 195 Dry-Cargo ships, 199 tankers, and 3 passenger transports [MSC P504 Ship Register, p12].

3. Ready Reserve Force:

The next source of strategic sealift is from a specific portion of the reserve sealift fleet, called the Ready Reserve Force (RRF). These ships are laid up and maintained by the Maritime Administration (MARAD) for MSC, and are crewed by the commercial sector once activated. (MARAD is an agency within the Department of Transportation)

The RRF is the quick responsive sealift portion of the larger National Defense Reserve Fleet (NDRF), and is required to be ready for use within 5, 10 or 20 days of notification [Donnovan, 1991]. The RRF consists of 96 older cargo ships that are no longer economically competitive in commercial trade [Warren, 1991]. These vessels are kept idle, at different levels of readiness, and can be selectively activated and assigned to MSC as needed.

There are several problems with the RRF that were identified as a result of Desert Storm. First, chronic underfunding has lead to years of deferred maintenance and very few sea trials. In 1990, for example, Congress cut MARAD's Ready Reserve Fleet budget request of $239 million to $89 million. Of the 68 ships that were activated for Desert Storm, only 21 of these ships had ever been sent out on a sea trial [Donnovan, 1991]. Some of these vessels had been idle for more than 12 years. With only a few days to reverse all the years of these ships sitting idle, the majority of the RRF vessels were not ready for delivery within their required time period [Warrens, 1991].

The second problem with the present day RRF is that the fleet is outmoded. Most of the propulsion systems found in these ships are steam versus the more modern diesel plants. (81 of the 96 ships have steam systems.) These older ships make the task of finding repair parts and qualified engineers to run the systems very hard.

Lastly, the dwindling maritime support industry causes logistical problems when activating a large number of these ships at the same time. Luckily during Desert Storm the RRF was called up in phases: 42 ships in August, and 36 ships in December. The Maritime Administrator, Captain Warren G. Leback, said that, " had all 96 been needed at once, there would not have been sufficient repair facilities or enough crew available to meet the demand." [Warren, 1991]

4. Sealift Readiness Program

Implementing the Sealift Readiness Program (SRP) is the next available source in which the Department of Defense can obtain additional sealift under less than full mobilization conditions. To utilize this program clearly crosses the lines of normal procedure. At this point in the sequence, the government is acquiring commercial vessels that are not voluntarily chartered from the shipping lines. The SRP, approved in July 1971, evolved from a series of programs designed by the government to ensure reliable and responsive sealift augmentation is available when needed. It was developed to identify the additional ships, support systems and equipment from the maritime industry which would be available to support anticipated strategic mobility requirements in emergency scenarios [MSC working papers on the SRP].

The SRP consists of a formal contractual agreement between U.S. flagged ocean carriers and MSC for the acquisition of ships. There are two sources of commitments to this program. The largest source is based upon Section 909's amendments (in 1981) to the Merchant Marine Act of 1936, [Public Law 97-35] whereby, carriers receiving Construction or Operational Subsidies must be offered for enrollment. The second source is from those carriers that participate in the movement of DOD cargoes during peacetime. To be eligible to participate in the movement of DOD cargo, 50% of the carriers' U.S. flagged ships must be enrolled in the SRP. The call-up procedure of these unsubsidized ships is time-phased. Each carrier must agree to make 20% of their committed ships available within the first 10 days, 30% within 30 days, and the remainder within 60 days of the call-up. Program execution is quite complicated; requiring both the approval of the Secretary of Defense, Secretary of Transportation, and an economic impact study completed by MARAD on the anticipated effect on the impacted industries. Part of the reason that the SRP was not used in Desert Storm was because of the long-lead time that would have been required in obtaining these vessels, and the fact that foreign-flagged ships were made available for charter [Fields, Chief of Operations @ MSC, interview April 1991].

5. Requisitioning:

Requisitioning is another option made available to the government for obtaining sealift augmentation without ship owners' consent. Under Section 902 of the Merchant Marine Act of 1936, the Secretary of Commerce (now the Secretary of Transportation) has the authority to requisition or 'hire' any vessel owned by U.S. citizens or under construction in the U.S., in times of a presidentially declared state of national emergency. This option, of immediate take-over of a vessel from a private carrier, is intended to be used in emergency situations, and only in conditions of full mobilization. World War II was the last time that this procedure was used to obtain sealift. The carrier must be given "just compensation," based on the fair market value, for use of their ship.

The SRP was developed as an alternative to requisitioning. The conditions upon which each of these programs can be used, however, are different. Unlike requisitioning, the SRP can be used in less-than full mobilization conditions and does not require a Presidential declaration of national emergency. Since the SRP is essentially a contractual agreement with the carriers, the rates for service can be negotiated with the carrier, rather than the government merely offering them "fair market value." With the knowledge of these differences- if the nation is in a full-mobilization posture, the government still has the option of using the older requisitioning procedures of obtaining ships, rather than using the SRP (which is undoubtedly more expensive to the government). Under current law, they can choose whichever method is more desirable, even if their decision is based purely on economic considerations [McGinnis, MSC working papers, 1976].

6. The Effective U.S. Controlled Fleet and the National Defense Readiness Fleet:

The last method of obtaining U.S. vessels, would be to use the Effective U.S. Controlled (EUSC) Fleet, or activate the oldest portion of the reserve sealift fleet, called the National Defense Readiness Fleet (NDRF).

a) There are a total of 19 dry cargo ships and 99 tankers (militarily useful) in the EUSC. Ships in this category are owned by U.S. carriers who fly flags of convenience typically under the registry of the Bahamas, Honduras, Panama or Liberia. These ships are only available in the event of a Presidential declaration of national emergency. Written agreements list the EUSC ships which may be called-up. The timing of their return is contingent on the ships' location and load. Using these ships is not the ideal option, since they are principally crewed by foreign nationals that are not necessarily from U.S. allied countries [NWP 80].

(b) The remaining portion of the NDRF, which does not include the more modern RRF, consists of a "mothball fleet" of 172 vessels [Ship Register, 1990]. They are stored in three locations around the coastal waters of the United States, (James River, Virginia; Beaumont, Texas; and Suisan Bay, California) and may take as much as a year to activate for service. NDRF ships (less the RRF) are available only on full mobilization or Congressional declaration of emergency. These ships are unmanned and kept in a minimum state of preservation. Many were built in the 1940's and would require herculean efforts to renovate. The United States currently lacks either the seamen or the shipyards that would be required to activate the NDRF. [U.S. Merchant Marine Data Sheet, 1 August 1986]

7. Foreign-Flagged Ships:

The last source of sealift augmentation is from foreign flag ships. These are obtained through agreements with U.S. Allies, provided conditions existed such that allied interests are involved. Foreign flag chartering proved disastrous during Vietnam, because of the lack of world-wide support. Its use during Desert Storm, however, enabled the U.S. to "get to the war on time". The fact that sealift was a coalition effort, prevented the U.S. from having to rely on its World War II-vintage NDRF ships [Warrens, 1991].

APPENDIX B:

ARMY REGULATION 56-4

1. Purpose

This regulation provides responsibilities, policies, and procedures for Army use of intermodal container systems [illegible] and implements the policies, procedures, and responsibilities contained in DOD Directive 4500.37 (app B). This regulation [illegible] the [illegible] standard application of containerization to support strategic mobility. Containerization is an integral part of intermodalism, which permits the rapid movement of goods from origin to destination with minimum handling, using airlift, sealift, highway, and rail transport.

2. References

Related publications are listed in appendix A.

3. Explanation of abbreviations and terms

Abbreviations and special terms used in this regulation are explained in the glossary.

4. Responsibilities

a. The Deputy Chief of Staff for Logistics (DCSLOG) will—

(1) Establish programs to provide funding to procure [illegible] and Army-owned containers and intermodal assets.

(2) Establish and provide interpretations of Army containerization policy.

(3) Periodically review and update this Army regulation as necessary.

(4) Monitor the Army program for compliance with this regulation and correct deficiencies.

b. The Commanding General, Forces Command (CG, FORSCOM), will—

(1) Provide guidance to active and reserve component units on [illegible] requirements.

(2) Plan and train for mobilization and deployment of Army unit equipment and containerizable wheeled vehicles using American National Standards Institute (ANSI) and International Organization for Standardization (ISO) standard containers.

(3) Plan, program, and [illegible] and maintain container loading and handling capability.

(4) Plan and train to stuff containers at [illegible] and installations.

(5) Train units to respond to [illegible] at port calls.

(6) Train units to block, brace, and tie down equipment on intermodal assets.

(7) Provide appropriate cargo category code for Army unit equipment and vehicles when producing the Army Type Unit Characteristics file.

(8) Support peacetime containerization training and the use of commercial containers, [illegible], and other intermodal assets in exercises.

(9) Support and coordinate levels of containerization [illegible] by warfighting commanders-in-chief.

c. The Commanding General, U.S. Army Training and Doctrine Command (CG, TRADOC), will—

(1) Establish container doctrine and level of training required for proficiency.

(2) Determine requirements for Army-owned ANSI/ISO containers [illegible].

d. The Commanding General, Military Traffic Management Command (CG, MTMC), will—

(1) Act as the DOD Single Manager for Military Traffic, Land Transportation, and Common User Ocean Terminals per DODD 5160.53.

(2) Determine Army container and container handling equipment requirements (type and quantity) to support Army contingency, exercise, and peacetime operations.

(3) Assist in [illegible] in the Equipment Characteristics File containerizable Army unit equipment and vehicles.

(4) Manage and monitor the use of DOD-owned and commercial intermodal surface containers in common user service while these containers are in the Defense Transportation System.

(5) Determine the container requirements, inventory, and [illegible] availability to meet contingencies, mobilization, and deployment.

(6) Provide systems and operations analysis and transportation engineering support for Army containerization and intermodal activities.

(7) Coordinate procedures so that a unit's equipment, when called to port, is prepared for shipment aboard the type of vessel (roll-on, roll-off, breakbulk, or containership) available for lift. This will include guidance on containerizing wheeled vehicles.

e. The Commanding General, United States Army Materiel Command (AMC), will procure standard ANSI/ISO or ANSI/ISO-compatible containers for use as Army unit equipment or DOD-owned common user equipment as evaluated by TRADOC and the container manager, MTMC.

5. Goals and objectives

a. The Army goal is to optimize use of strategic lift, focusing primarily on sealift, to improve force closure time for unit equipment and sustainment supplies and meet national defense objectives.

b. The Army objectives are to—

(1) Optimize the use of origin-to-destination containerization to support peacetime, war planning, transition to war, and wartime Army transportation requirements.

(2) Develop origin, in-transit, destination, and force structure container-handling capabilities consistent with Army transportation requirements.

(3) Review regularly Army container requirements against commercial availability and capability to ensure an adequate number of containers are available on a timely basis to support peacetime and wartime requirements.

(4) Maintain unit integrity by keeping a unit's equipment together in the same container or the same ship.

6. Policy

Army containerization efforts are guided by the following principles:

a. Optimize the containerization of Army unit equipment (UE) to reduce force closure time, to meet the needs of the supported theater commander-in-chief, and to reduce transportation costs.

b. The 20 foot long by 8 by 8 foot high or 8 foot wide ANSI and ISO container is the primary unit container for unit equipment shipments. Larger containers may be used in contingency or [illegible] operations. However, unit capability to handle and transport these containers must be the overriding consideration (for example, what is the availability of capability of container handling equipment).

c. Stuff Army UE in containers at origin or nearest container [illegible] points.

d. Stuff all sustainment items (resupply) at origin (for example, origin, [illegible] facility, or containerization consolidation point).

e. [illegible] commercial container transportation capability and ensure origin-to-destination handling ability.

f. Achieve rapid and forward container unstuffing (unloading) and the return (retrograde) of containers.

g. Develop doctrine and train for containerization at all levels.

h. Maintain ANSI/ISO container standards to ensure compatibility with the commercial intermodal transportation system.

i. Containers and associated equipment may be procured or leased under conditions outlined in DOD Directive 4500.37.

j. Use containers in peacetime to train for transition to war, to meet training requirements, and to reduce transportation costs.

APPENDIX C:
GLOSSARY

Aerial port of debarkation (APOD) - A station which serves as an authorized port to process and clear aircraft (scheduled, tactical, and ferried) and traffic for entrance to the country in which located.

ANSI/ISO standards (American National Standards Institute and International Organization For Standardization) - ANSI and ISO have established standards for the design and construction of containers used in intermodal transportation systems, and have recommended procedures and specifications for their testing. The Department of Defense adheres to those standards to the maximum extent practical. Their standard nominal exterior dimensions for surface containers are 8 feet wide, 8 to 9 feet 6 inches high, and 5 to 45 feet long. The standard nominal lengths are 20 and 40 feet.

Battalion - A U.S. Army organization that consists of soldiers and equipment directed to accomplishing a particular mission. Battalions are part of a larger organization usually called Brigades or Groups. Typically battalions are formed of one primary occupational speciality. For example, an infantry battalion consists primarily of 11B infantry soldiers trained to fight a ground war. While this unit is supported with soldiers of other specialties, such as truck drivers, cooks and mechanics, these soldiers are authorized only to augment the fighting mission assigned to the 11Bs.

Breakbulk cargo - Cargo which is not shipped in a container and must be lifted separately as it is transferred at each terminal.

Breakbulk ship - A ship with conventional holds for the stowage of breakbulk cargo, below or above deck and equipped with cargo-handling gear. Ships may also be able of carrying a limited number of containers, above or below deck, secured by conventional methods.

Chassis - A trailer-constructed to accommodate containers that are moved over-the-road.

Common-user transportation - a point-to-point transportation service managed by a single service for common use by two or more services or authorized agencies, for which reimbursement is normally required from the service or agency receiving support.

Container - An article of transport equipment designed to be carried on various modes, designed to optimize the carrying of goods by one or more transportation modes without intermediate handling of the contents,and equipped with features permitting its ready handling and transfer.

Container handling equipment (CHE) - Mechanical devices such as straddle carriers and side-loaders designed to support containerized cargo storage, handling and transter operations

Containerizable cargo - Cargo that will physically fit into a container.

Containerization - The use of containers to unitize cargo for transportation, supply and storage. Containerization incorporates supply, security, packaging, storage, and transportation into a distribution system from source to user.

Container load - A sufficient load in size to fill a container either by cubic measurement or by weight.

Containership - A ship specially constructed and equipped to carry only containers without associated equipment, in all available cargo spaces, either below or above deck. The ship may or may not be a self-sustaining ship.

Corps - U.S. Army organization responsible for two to five divisions. A corps will also have, as a part of its force, additional non-divisional combat, combat support, and combat service support units. The organization of a corps is very flexible, dependent on the corp's mission and its basic organization of combat forces that must be supported in the field. A generic corps consists of approximately 100,000 soldiers or more.

Defense Transportation System - The collection of civil and military transportation facilities, transport systems, and services utilized by DOD for movement of cargo and personnel.

Deployment - That relocation of forces to the desired area of operation.

Division - The division is the largest U.S. Army organization that trains and fights as a team. It is organized with varying numbers and types of combat, combat support, and combat service support units. A division may be armored, mechanized (often referred to as heavy divisions), infantry, light infantry, airborne, or air assault. Divisions usually fight as part of a larger force, in a corps. The division headquarters has the capability to control and administratively support 15 maneuver battalions and many other support battalions. A division, depending upon its type, will typically consist of 12,000-17,000 soldiers.

Dunnage - Material used within a container to prevent movement of cargo.

Effective US Control (EUSC) - A shipping asset, operating under a foreign flag, but owned by a U.S. corporation and subject to be called into service to support DOD.

Flatrack Container - A container with no sides and frame members at the front and rear. This container can be loaded from the sides and top.

Force Closure - The point in time when a deployable unit arrives in theater of operations.

Home station installation - the base, facility, or post to which an individual or unit is assigned on a nontemporary basis.

Intermodalism - Providing a product with common transportation characteristics so that the product can be transferred, with limited handling, among more than one transport mode (air, rail, highway, or sea) without being broken down or reaggregated.

Intermodal transport - The capability of interchange of freight among the various transportation modes. Designed for origin-to-destination movement without intermediate handling of cargo.

Lessor - A person or firm who grants the container lease (owner).

Load - A grouping of vehicles, equipment, or passengers to be loaded into a specific ship, container, or vehicle.

Loading plan - A document which gives detailed instructions for the arrangement of personnel and equipment aboard a given transport mode; also serves as a manifest.

Maritime Administration (MARAD) - A federal agency that promotes the merchant marine, determines ocean ship routes and services and awards maritime subsidies.

Material handling equipment (MHE) - Mechanical devices for handling of supplies with greater ease and economy; for example, forklifts and container handling equipment.

Measurement ton (MT) - A term of measure used in water transportation for rate-making. Measurement tons equal total cubic feet divided by 40. (1 MT = 40 cubic feet)

Military Airlift Command (MAC) - The single-manager operating agency for designated airlift service.

Military Sealift Command (MSC) - The single manager of ocean transportation to provide, under one authority, the control, operation, and administration of sea transportation for personnel, mail, and cargo of the Department of Defense (formerly designated Military Sea Transportation Services (MSTS)).

Military Traffic Management Command (MTMC) - The joint staffed, industrially funded major Army command, serving as the Department of Defense single-manager operating agency for military traffic, land transportation, and common-user ocean terminal service.

MILVAN - A DOD-owned and managed 20-foot standard end-opening container.

National command authorities (NCA) - The President and the Secretary of Defense or their deputized alternates or successors.

Non Self-Sustaining Containership - A containership that does not have a built-in capability to load or offload containers, and requires port crane service.

Organic - Assets internal to a unit's authorized equipment listing.

Port call - Request from the loading agency for movement of supplies, personnel, or units from point of origin to loading area. For unit movement overseas it is issued by the appropriate MTMC commander or overseas major Army commander to reach the unit's home station not later than 15 days before the equipment shipment date and personnel shipment ready dates. It is specifically the date on which unit personnel and equipment must arrive at the port of embarkation.

Port of debarkation (POD) - The geographic point (port or air) in the routing scheme where a movement requirement will complete its strategic deployment. The POD may or may not be the same as the destination.

Port of embarkation (POE) - The geographic point (port or air) in the routing scheme where a movement requirement will begin its strategic deployment. This point may or may not be the same as the origin.

Roll-on/Roll-off (Ro/Ro) - A feature designed in a specially constructed vessel to expedite the loading/discharge of rolling cargoes.

SEASHEDs - An open-topped, large cargo-carrying structure that fits across three cells of a containership and provides lift capability for heavy or outsized cargo.

Side-opening containers - A container fitted with at least one side-opening door.

Spreader - A piece of equipment designed to lift containers by their corner castings.

Stuffing - The packing of cargo into a container.

Sustainment - Cargoes intended to support and resupply deployed goods. Typically sent after unit equipment has been deployed.

TARGET - (see Transportability Analysis Reports Generator)

TEU (Twenty-foot Equivalent Unit) - A standard measure used in reference to container capacity.

Theater of Operation- The geographic area outside the United States for which a commander of a unified or specified command has military responsibility.

Throughput - The estimated traffic (expressed as an average daily capability of measurement tons, short tons, or passengers) that can be moved into and through a port. The total port movement capability is a function of reception, discharge, and clearance - the smallest of these is the estimated throughput.

Transportability Analysis Reports Generator (TARGET) - A system, developed under the direction of MTMCTEA, designed to retrieve and analyze the item dimensions and weight characteristics to support item and unit transportability analyses.

Transportation Control and Movement Document - The basic document for all cargo movements; document containing the basic information needed to make movement management decisions through the worldwide DOD transportation system.

Transportation Officer - Person appointed or designated by the commander of a military activity to perform transportation services and movement management at a district, base, installation, or activity; also applies to movement management officers.

Unit equipment and supplies - All equipment and supplies that are assigned to a specific unit or that are designed as accompanying supplies.

Unit loading plan - A plan for loading personnel or unit equipment on transport equipment; for example, organic transportation, commercial, or military carrier equipment. Unit loading plans are an integral part of the unit movement plan and form the basis for preparation of unit movement data.

Unit movement officer (UMO) - A unit officer (or senior NCO) designated by the commander to prepare and maintain appropriate documentation, unit loading plans, and so forth, and to handle all other unit arrangements for a unit movement.

Unit movement plan - A detailed description of required actions and up-to-date information needed to facilitate preparation for movement. A separate movement plan is normally prepared for each motor march, a rail or commercial motor movement, or an air movement. Unit movement plans include, in addition to unit movement data and load plans, organization for movement (requirements for and instructions to move staff, advance party, loading teams, and so forth) and procedures at home stations, en route, and at destination, including requirements for movement reports.

Unstuffing - The removal of cargo from a container (also referred to as stripping).

US Transportation Command - The United States Transportation Command was established by National Security Division Directive in April 1986. The USTRANSCOM is a unified command that provides global air, land, and sea transportation to meet national security objectives. The Transportation Operating Agencies (MAC, MSC, MTMC) are components of the USTRANSCOM.

Weigh Out - When a container reaches its payload weight capacity.

Wheeled/tracked vehicles - Military combat, transportation, and supply vehicles, including tanks, armored personnel carriers, trucks and construction equipment.

APPENDIX D:
LIST OF INTERVIEWS

Mr Allison. The Fort Lewis Installation Transportation Officer; Fort Lewis, Washington: personal interview December 1990.

Phillip Barickman. Project Engineer for the Research, Development & Engineering Center; Fort Belvoir, Virginia: personal interviews in March and July 1991 and telephonic interviews in August 1991.

Kevin Burns. Military Sealift Command (N-9), Washington D.C.; personal interview on 23 July 1991 and telephonic interview in April 1991.

William Brower. Project Engineer for the Research, Development & Engineering Center; Fort Belvoir, Virginia; personal interview conducted in March 1991 and telephonic interviews in August 1991.

Jamie R. Cannon. Containerization Program point of contact for the Civil Engineering Support Office, Naval Construction Battalion Center; Port Hueneme, California: personal interview in March 1991 and telephonic interviews in December 1990 and January 1991.

Richard S. Carlyle. Marine Transportation Officer at the Military Traffic Management Command, Pacific Northwest Outport: Seattle, Washington; personal interview in October 1990.

Alan Colvin. Engineer at the Transportation Engineering Agency; Newport News, Virginia: personal interviews in March and July 1991 and written correspondence in September 1991.

Ron W. Corkrey. Program Manager Office of Technology Assessment, U.S. Department of Transportation, Maritime Administration; Washington, D.C.: telephonic interviews in November 1990 and June 1991, written corespondence in July 1991.

Charles J. Davis. Director of Operations Branch, Military Traffic Management Center-Tranportation Engineering Agency. Newport News, Virginia: personal interviews in March and July 1991, telephonic interviews in January and August 1991, and written correspondence from January-October 1991.

CDR Ronald W. Dewy. Director of the Civil Engineer Support Office, Naval Construction Battalion Center; Port Hueneme, California: personal interview in March 1991.

David Dias. Sealift Readiness Program point of contact for the U.S. Transportation Command; Scott Air Force Base, Illinois: telephonic interview in April 1991.

LTC Barbara Doornink. Battalion Commander, 53d Transportation Battalion; Kaiserslautern, Germany: personal interview in September 1991.

Thomas J. Dowd FCIT. Affiliate Professor at the University of Washington; Seattle, Washington: personal interviews from January-November 1991.

CPT Floyd Driver. Container point of contact for Military Traffic Management Command-Europe; Rotterdam, Holland: personal interview in September 1991.

Major David Fastiband. Special Projects Officer for the Commander of U.S. Forces Command; Fort McPherson, Georgia: personal interview in July 1991.

Norman H. Fertman. Project Director, Logistics Equipment Directorate, Belvoir RD & E Center; Fort Belvoir, Virginia: personal interview in March and July 1991.

COL Richard Fields. Plans and Operations Officer for Military Sealift Command; Washington D.C.: personal interview in July 1991 and telephone interview in April 1991.

David E. Fleming. Logistics Management Specialist, Materiel and Logistics Systems Division, U.S. Army Quartermaster Center and School; Fort Lee, Virginia: telephone interviews in June and July 1991.

David Fuchs. Containerization point of contact, Department of the Army. Deupty Chief of Staff for Logistics (Author of AR 56-4); Washington D.C.: personal interview July 1991 and telephone interview April 1991.

Major John Gardner, Special Project Officer for the U.S. Army Staff, Washington D.C: personal interview July 1991 and telephone interviews in October and November 1991.

LTC Griffin. Commander of the 864th Combat (Heavy) Engineer Battalion; Fort Lewis, Washington: personal interview upon his return from Saudi Arabia in July 1991.

1LT Michelle Hare. Movements Officer for the 864th Combat (Heavy) Engineer Battalion; Fort Lewis, Washington: telephone interview in October 1991.

1LT John Houston. Assistant S-4, 864th Combat (Heavy) Engineer Battalion; Fort Lewis, Washington: personal interviews in November 1990.

Jack Helton. Vice President of Government Marketing for SeaLand Services Inc; Washington D.C.: personal interview in July 1991.

Major Henderson, Strategic Mobilility Division of theDepartment of the Army's Deputy Chief of Staff for Logistics; Washington D.C.: telephone interview in April 1991.

Yehuda Hayuth. Visiting Professor at the University of Washington in Seattle from Haifa University; Haifa, Isreal: personal interviews from January - March 1991.

Major Howard Jacobi. J-4 Staff, Forces Command; Fort McPherson, Georgia: telephone interview in June 1991.

Richard Jennings. Former U.S. Army Engineer Officer; Puyallup, Washington: personal interview in September 1991.

Commander Philip Carl Kasky. Commanding Officer Military Sealift Command Office, Seattle Outport: Seattle, Washington: personal interview October 1990.

COL Kelley. Deputy J-5, U.S. Transportation Command; Scott Air Force Base, Illinois: telephone interview in April 1991.

Nancy Kinslow. MILVAN point of contact for the Joint Container Control Office, Military Traffic Mangement Command-Eastern Area; Bayone, New Jersey: telephonic interview in August 1991.

Major Scott Laraby. MITLA point of contact in the Directorate of Combat Developments, U.S. Army Transportation Center and School; Fort Eustis, Virginia: personal interview in July 1991.

Peter Lennon. Project Engineer, Military Traffic Management Command-Transportation Engineering Agency; Newport News, Virginia: personal interview in July 1991 and telephone interviews in June and August 1991.

Commander Michael J. Lynch. Military Sealift Command (N-9), Washington D.C.; personal interview in July 1991 and telephone interview in April 1991.

Major Michael Marner. Executive Officer of the Movements Control Center at the Port of Damman, Saudi Arabia; Fort Eustis, Virginia: personal interview July 1991.

CPT Thomas E. O'Donovan. U.S. Army Engineer Officer; Seattle, Washington. personal interview in March 1991 and telephonic interview in September 1991.

Eugene K. Pentimonti. Vice President Processes & Systems for American President Lines, LTD; Oakland, California: telephonic interview September 1991.

Linda Pettitt. UDC-A Project Engineer (Action Containers), Aviation Applied Technology Directorate; Fort Eustis, Virginia: personal interview in July 1991.

Lynn Prybor. International Cargoes, Military Traffic Management Command; Washington D.C.: telephonic interview in July 1991.

LTC Daniel Ross. U.S. Joint Staff, J-4; Washington D.C.: telephonic interview June 1991.

CPT Kent Savre, S-4, 864th Combat (Heavy) Engineer Battalion; Fort Lewis, Washington: personal interviews in November 1990.

Lee Scarborough. JUITI point of contact for Military Traffic Management Command; Falls Church, Virginia: telephone interviews in June 1991.

CPT Mark Schnieder. Assistant S-3, 864th Combat (Heavy) Engineer Battalion; Fort Lewis, Washington: telephone interview in September 1991.

LTC David Smith. Transportation point of contact for the Desert Storm After Actions Team; Fort Leavenworth, Kansas: telephone interviews June-August 1991.

James Spires. Point of Contact for the QUADCON and PALCON, Marine Corps RD&A Command; Washington D.C.: telephonic interview in August 1991.

Greg Stratton. Engineer for the Civil Engineer Support Office, Naval Construction Ba. ɪalion Center; Port Hueneme, California: personal interview March 1991.

Timothy Weisflog, Containerization point of contact for the U.S. Army Transportation School; Fort Eustis, Virginia: personal interview in March and July 1991.

Donna Woodman. Engineer in the Intermodal and Logistics Systems Division, Volpe National Transportation Systems Center (Department of Transportation); Cambridge, Massechusetts: telephone interview in September 1991.

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