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OPTIMIZING WARTIME MATERIEL DELIVERY: AN OVERVIEW OF DOD CONTAINERIZATION

VOLUME III

ANNOTATED BIBLIOGRAPHY

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Final Report

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1.0 INTRODUCTION

1.1 General

This annotated bibliography, Volume III of the study entitled, Optimizing Wartime Materiel Delivery: An Overview of DOD Containerization Efforts, documents studies related to containerization. The study was conducted by the Transportation Systems Center of the U.S. Department of Transportation for the Organization of the Joint Chiefs of Staff (OJCS, J-4). Several objectives of the study were defined. These include:

1. Provide documentation of DOD containerization programs and identify issues around the use of containers in wartime. An overview approach was specified whereby general issues related to DOD's optimal use of a commercial delivery system, which is container-dominated, would be identified. Development of the annotated bibliography was part of this task.

2. Highlight unresolved issues. This study indicates those areas where the integration of containers has not been achieved or where the impacts of containerization have not been fully evaluated. Volume I of this study addresses the findings of tasks 1 and 2.

3. Develop a framework for action to address unresolved issues based upon analysis of the findings of (2), above. Volume II presents this framework which includes actions, sequencing and priority schemes, and responsible DOD elements.

Citations in this bibliography are included based upon satisfaction of one or more criteria. Namely, the work must (1) document key past or current containerization effort(s), (2) address specific containerization issues, (3) provide a methodology which can be applied to containerization issues, (4) provide general information on the DOD and/or civil sector distribution/logistics systems which is pertinent to container distribution, and/or (5) define roles of DOD elements that have responsibilities in the area of containerization.

1.2 Organization

The bibliography is divided into the following sections, with works categorized by their primary focus: Section 2.0, Army; Section 3.0, Navy; Section 4.0, Marine Corps; Section 5.0, Air Force; Section 6.0, Ammunition Containerization; Section 7.0, Logistics Over the Shore; and Section 8.0, General. Citations in Section 8.0 include those of DOD-wide interest and those related to the civil sector.

2.0 ARMY

American Power Jet Company. U.S. Army Cargo Containerization Requirements. Ridgefield, NJ: 1968. (DTIC - AD 847768).

Comparative analysis of the shipment of Army materiel in containers versus breakbulk. Two major trade routes considered: CONUS to Europe and CONUS to Vietnam. Movement to forward areas for users was not considered. Estimated container inventory requirements and cost, labor and time savings on the two trade routes if containers used. Discusses need for central control of Army-owned containers and an analysis of using Army-owned versus commercial assets. Analysis excluded ammunition and refrigerated cargo.

Department of the Army, Deputy Chief of Staff for Logistics. Assessment of the Study of Army Logistics - 1981. Washington, DC: 1983. (DLSIE LD-54682A-C)

DA DCSLOG was assigned as lead agency to conduct the Army's assessment of the recommendations of the Study of Army Logistics -1981 and determine which should be adopted. A full-time assessment coordination office was established. This three-volume assessment contains a synopsis of the recommendations with data on their status, and detailed descriptions of each. Action items related to containerization are included. A rationale and analysis of each, as well as expected benefits and resource requirements for implementation are included.

Evaluation Research Corporation. Study to Analyze New Cumberland Army Depot's Consolidation and Containerization Point. 1977. (DLSIE - LD 39C95A)

Study addressed how to improve container utilization for shipments from New Cumberland within Army Direct Support System requirements. Physical facility recommendations, operational alternatives and automated support addressed.

General Accounting Office. Army Deployment - Better Transportation Planning is Needed. Washington, DC: 1987. GAO/NSIAD-87-138

Results of study to determine if U.S. Army can mobilize and deploy rapidly within prescribed time-frames of OPLANs. Movement from home and mobilization stations to POEs depends upon availability of commercial transportation resources and adequacy of unit readiness and unit and installation plans and preparations. In general, report finds that Army has not (1) identified the type and amount of equipment to be moved commercially by rail and truck, (2) determined the availability of commercial transportation, and (3) analyzed and reconciled disparities between planned capabilities in unit outload plans and those in OPLANs.

General Research Corporation. A Methodology for Developing Alternative Consolidation and Containerization Point Loading Policies. McLean, VA: 1974. (DLSIE - LD 28563A)

Study prepared for AMC to evaluate alternative CCP loading policies. Part of an analysis of the Direct Support System, implemented by the Army in 1970, for delivering certain classes of supplies from CONUS direct to user. A computerized Simulation Model for Loading (SIMLOAD) was developed to examine the relationship among loading factors using as a criteria the number of containers loaded under alternative policies. Factors included CCP hold times, number of consignees per container, affect of alternative cluster arrangements.

Kirkpatrick, Bruce. Container Requirements and Shipping Frequency under the Direct Supply Support System. U.S. Army Logistics Management Center, Ft. Lee, VA: 1970.

Analysis to establish minimum cost shipping policies for certain supplies from CONUS depots to users without intermediate breakbulk shipping. Cost, time and volumes are considered as well as various container sizes and container utilization factors. The use of 20' and 40' containers was evaluated.

Military Traffic Management Command, Transportation Engineering Agency. Air Cargo Containerization. Newport News, VA: 1970.

Study to determine if use of containers for airlift of peacetime supplies was justified. Determined that volumes justified use of 8'x8'x10' air/land containers only, and the Army would benefit most from container use.

Military Traffic Management Command, Transportation Engineering Agency. Military Applications for Double-stacking Railcars. Newport, News, VA: 1988. MTMCTEA Report OA 87-4B-35.

Study to assess the utility of double-stack container railcars for military movements. Examined the extent to which UE for seven Army division types could be accommodated in containers or on flatracks that could be moved by double-stack trains. Developed the Double Stack Compatibility Model to merge data on TRADOC's TOE allocations, FORSCOM's Equipment Characteristics File (COMPASS) and dimensional and weight constraints of railcars, containers and flatracks.

The study found that large quantities of Army UE could be transported on these railcars and that 20- and 40-foor flatracks were the most useful. The Light Infantry Division was best suited for a double-stack movement and heavy divisions were the least suited. The study also recommends that installations be prepared to outload using double-stack trains. General

impacts of double-stack railcars on the Defense Transportation System are addressed.

Military Traffic Management Command, Transportation Engineering Agency. Transportability Data for TOE and/or Outsize Equipment Eligible and Non-eligible for Loading in Cargo Containers, Lash Lighters, and Seabee Barges or on Flatracks. Newport News, VA: 1973. USATEA Pam 55-1.

Transportability data listing dimensions and weights of TOE vehicles and vehicle-mounted equipment eligible for loading on 35- or 40-foot flatracks or dry cargo containers.

Military Traffic Management Command, Transportation Engineering Agency. Unit Deployment by Container/Containership. Newport News, VA: 1971. Report 71-15. (DTIC - AD 892140)

Study to determine the feasibility of using containers and containerships in unit deployments to overseas areas. Focus on three general areas: survey of the U.S. container and containership fleet, selection of types and sizes of dry cargo and special purpose containers for consideration in the study (based upon probable availability for military use) and testing the selected containers against authorized equipment.

Specifically, study matched dimensions, including weight, of items in TOE against available cubic capacity and weight carrying capability of commercial containers. If an item fit into a container, it was matched against available space in container cells or on the weatherdeck of a containership. Constraints imposed by containership utilization examined. The availability and desirability to actually deploy units by containership was not determined.

Study considered combat, combat support and combat service support units. The study concluded that it was feasible to deploy the equipment of Army units by containerships. Also recommended further studies.

Military Traffic Management Command, Transportation Engineering Agency. Unit Deployment by Containership - A Comparative Analysis of Concepts. Newport News, VA: 1971. Report Number 71-41.

Examination of moving the equipment of an Infantry Division by four different 35-foot container/containership cell systems. TEA report, Unit Deployment by Container/containership examined the use of commercially available containers. That report noted significant problems with standard containers, platforms and deck loading. Specifically, deck loading significantly reduced the ships' cargo carrying capacity. This study considered other methods for increasing containership utilization including break-bulk loading with platforms (false decking), hypothetical oversized containers used in conjunction with 35-foot containers, and a combination of 35-foot containers

and 35-foot flatracks. Estimated the number of containerships required to carry load under each plan. Use of a combination of 35-foot containers and 35-foot flatracks with varying between deck clearances required the least number of ships.

Military Traffic Management Command, Transportation Engineering Agency. Utilization of Flatracks in Force Deployments. Newport News, VA: 1971. Report 71-39.

Study that assessed the capability of moving the equipment and 15 days' ammunition of a five-division force to Europe. Objective was to determine impacts of using flatracks in conjunction with expected 1976 fleet.

Compared requirements for deploying using only 35-foot dry cargo containers to requirements for deploying with dry containers and flatracks for 2-1/2 and 5-ton vehicles that were not otherwise containerizable. In the deployment scenario, ammunition was loaded in 20-foot containers. Using flatracks and dry containers, the amount of containerizable materiel grew from 24 to 56 percent and average ship tonnage increased. Also, the number of ships required for the deployment fell by 23 percent and the number of ship sailings fell by 25 percent. General conclusion: the use of flatracks increases the utilization of containerships and reduces overall shipping requirements.

Study includes division profiles. Lists container requirements by type of cargo and lists square footage of non-containerizable equipment.

Science Applications, Inc. Survey Report of the Status of Container Integration in the Army Supply System. McLean, VA: 1983. (DTIC - AD B072249; DLSIE - LD 55231A)

Report completed for U.S. Mobility Equipment Research and Development Command, Ft. Belvoir, VA. Assessment of the Army's capability to implement the container doctrine specified in FM 54-11, "Container Movement and Handling in a Theater of Operations." Primary focus on hardware problems, but descriptions of Army doctrine and DOD agencies impacting container system integration. Found that the most serious unresolved container and container handling problems were associated with LOTS operations in undeveloped areas.

U.S. Army Aberdeen Proving Ground. Development Test II (Engineering Phase) of Refrigerated MILVAN Container - Final Report. Aberdeen Proving Ground, MD: 1974. (DTIC - AB B003040).

Results of test for refrigerated MILVAN containers prior to procurement of organic fleet. Refrigeration, structural, environmental and transportability tests performed.

U.S. Army Armor and Engineering Board. Development Test II (Service Phase) of Refrigerated MILVAN Container. Fort Knox, KN: 1975. (DTIC- AD B003140)

Test results of refrigerated MILVAN containers prior to Army procurement.

U.S. Army Concepts and Analysis Agency. Army Strategic Mobility System Assessment (ASMSA). Bethesda, MD: 1986. Report Number: CAA-SR-86-25 (DLSIE-LD 63370A)

Feasibility study to determine whether method could be developed for analyzing the Army's entire strategic mobility system. Concern that there may be unrecognized bottlenecks in the system and realization that correction of the problems through the Planning, Programming, Budgeting and Execution System process needed precise evaluation to validate problems. Methodology to be used by DA DCSLOG (DALO-TSM) in developing budget submissions. Presents several alternatives for modeling the transportation system. Options included using combinations of existing models and the development of new models. Analyzed budgetary process to determine requirements for Decision Support System.

U.S. Army Concepts and Analysis Agency. Containerized Cargo Distribution Analysis (COCADA) (U). Bethesda, MD: 1983. (Secret)

(U) Goal of the study was to develop and demonstrate a methodology for determining the most effective use of containers in cargo distribution during contingency or mobilization operations. Methodology to be used to assess capabilities of alternative transportation networks and provide basis for capital investments to acquire the appropriate mix of equipment and units required to implement specific containerization policies. Methodology demonstrated using OPLAN 1004.

U.S. Army Concepts and Analysis Agency. Containerized Cargo Distribution Analysis - Southwest Asia 88 (COCADA SWA 88) (U). Bethesda, MD: 1984. (Secret)

(U) Results of a simulation using an adaptation of the Simulation for Transportation Analysis and Planning (SITAP) model to estimate the effects of various levels of containerization on the intratheater movement of cargo in the SWA distribution system. Developed for DA DSCLOG (DALO-TSM). Goals was to test containerization policies by identifying shortfalls and improvements in theater delivery capability. Looked at number and types of units to accomplish containerized cargo movements.

COCADA used database specified in DOD Sealift Study and WIMS (FY88 Program Force) and used the level of containerization implicit in this scenario for its base case. Ammunition, general cargo and unit equipment were considered as cargo types. Cargo handling and transportation units were held constant in the model so that critical constraints could be identified against this

fixed capability for a fixed amount of cargo. Changes in containerization policy were assessed in terms of increase/decrease in delivery of cargo in terms of tonnage over time.

Analysis of force structure changes also considered. In these cases, the containerization is held constant and the force structure varied iteratively until the force structure met movement requirements.

The policy issues considered at the direction of DA DCSLOG were:

1. Level of containerization,
2. Echelon to which containers are distributed,
3. Day on which retrograde of containers begins,
4. Time allowed to cycle containers,
5. The day containerized cargo is introduced into the theater.

U.S. Army Concepts Analysis Agency. Support Force Structure Sensitivity to Logistics Planning Factors. Bethesda, MD: 1986. Report Number CAA-SR-86-13. (DLSIE-LD 65480A)

Determination of the impact of controlled changes to selected Army Force Planning Data and Assumptions to determine the effects on support force service requirements. Uses Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS) model. Study explains results of sensitivity analysis around Class IV and Class IX consumption rates, throughput policy for bulk POL, distribution of modal assignments and rate of supply movements. Effects of changes in current containerization planning factors on force structure requirements not addressed, but study indicates capability for this analysis using FASTALS.

U.S. Concepts and Analysis Agency. Total Army Analysis (TAA) Force Design Process. Bethesda, MD: 1984. Report Number CAA-TP-84-7 (DLSIE - LD 59115A)

Description of the process by which time-phased requirements for non-divisional forces to support programmed combat forces in a global scenario are derived. FASTALS is the primary tool of a number of automated models used in the process. FASTALS produces a time-phased trooplist of conbat and support units based upon current doctrine. Requirements are also matched to eligible units in the process. Results are used in development of the Army's Program Objective Memorandum (POM).

U.S. Army Concepts and Analysis Agency. Transportation Improvements Program Requirements (TRIPR): Functional Description of the Strategic Mobility Module. Bethesda, MD: 1987. Report Number: CAA-D-87-2.

Functional description for strategic mobility module drawn from the design concept of the Army Strategic Mobility System Assessment (ASMSA). Module to

support HQDA in PPBES matters impacting upon strategic mobility issues. Specifically, to permit "what if" analyses around lift requirements and closure capability. Provides link to already developed models addressing the strategic mobility system.

U.S. Army Concepts and Analysis Agency. Transportation Improvements Program Requirements (TRIPR): Concept Paper of the Strategic Mobility Module. Bethesda, MD: 1987. Report Number: CAA-TP-87-5.

Concept paper for development of strategic mobility module for use by DA DCSLOG (DALO-TSM) to determine interaction of transportation system capabilities with increases/decreases in funding for PDIPs. Module to consist of several options:

1. POM/Budget analysis,
2. Transportation analysis,
3. Force Structure analysis,
4. Equipment Distribution analysis, and
5. Transportation system Capability and Readiness analysis.

Pertinent to containerization is the addressing the capability to handle containers at nodes in the transportation system.

U.S. Army Materiel Development and Readiness Command. The Study of Army Logistics - 1981. Alexandria, VA: 1981.

The first broad analysis of the total Army logistics system after the JLRB study in 1970. Goal of the study was to define doctrine, policy, plans and organizational structures. Report consists of 28 sections presented in viewgraph format, of which Section 18 addresses transportation aspects of the logistics system. Containerization conclusions and recommendations are included in Section 18.

U.S. Army Mobility Equipment Research and Development Command. Forty-foot Flatrack Container. Fort Belvior, VA: 1978. (DTIC - AD B031048, DLSIE LD 43284A).

Report of the testing of prototype flatracks for use in carrying Army unit equipment in containerships.

U.S. Army Test and Evaluation Command. Methodology of Improved Transportability Container Test Capability. 1981. (DTIC - AD B059269L)

Study to provide sufficient background data to permit the evaluation of the necessity for preparation of technical data packages for portions of the container transportability test facilities. The results of this study were:

1) the updating and modification of computer systems; 2) that a landing facility should be developed and evaluated.

U.S. Army Training and Doctrine Command, U.S. Army Logistics Center. The Army in the Field Container System Study. Ft. Lee, VA, March, 1974.

The document consists of an Executive Summary and seven volumes:

Executive Summary (DLSIE -LD 24007AA)
Volume I - Main Report and Appendices A - E (DLSIE-24007BA)
Volume II - Appendix F - Containerization (DLSIE-24007CA)
Volume III - Appendix G - The Effect of Containers on the Supply System (DLSIE-24007DA)
Volume IV - Appendix H - The Effect of Containers on the Transportation System (DLSIE-24007EA)
Volume V - Appendix I - Discussion/Analysis (DLSIE-24007FA)
Volume VI - Appendix J - Quantitative Requirements (DLSIE-24007FA) and Annex to Appendix J - Airborne "D" Package (DLSIE-24007HZ)
Volume VII - Appendix K - Coordination (DLSIE-24007GA)

The Army in the Field Study (AFCSS) develops a supply container distribution system to support a seventeen division force in mid-intensity conflict. The maximum use of containers is emphasized and the study concentrates on the development of required methods, organizations and equipment. The study follows from the JLRB recommendation that DOD efforts be directed toward early development of container-oriented distribution systems.

In the study, concepts and doctrine are developed and modifications to existing supply and transportation systems are identified including requirements for MHE, transportation equipment and containers. Necessary changes to organizations, field manuals and doctrinal literature are enumerated. The AFCSS develops three container-supported supply patterns that can be tailored to meet variations in levels of conflict intensity. Study provided the foundation for current resupply doctrine.

3.0 NAVY

Department of the Navy. Military Sealift Command Eastern Atlantic and Mediterranean, Bremerhaven, Germany: Audit Report. 1987. (DLSIE - LD 42864A)

One in a series of audits appraising accounting records and evaluating management controls over mission support functions, utilization of resources, and expenditure of funds. The findings/recommendations of this audit include; 1) minimization of container detention charges must be achieved; 2) effective monitoring of container movement and the prompt reporting of excessive overcharges for storage must improve.

Department of the Navy. Supply Management: Audit Report. Port Hueneme, CA: 1981. (DLSIE - LD 49813A)

Audit to evaluate the Supply Department's mission of managing supply services to support active duty Naval Construction Battalion Center, Port Hueneme, CA. (CBC), deployed units to the Pacific Area, organizational components of CBC, tenant activities, ships import, and special projects as assigned. The following recommendations were made: 1) to perform a commercial/industrial review on shipping containers; 2) to properly account for inventory items.

Department of the Navy, Naval Supply Systems Command. Container Oriented Network Distribution Analysis (CONDA) System. Washington, DC: 1980. (DTIC - AD 4090308)

Study to summarize the two major components of the Container Oriented Distribution Analysis (CONDA) Program. This program was developed and incorporated into the Navy Supply System in order to provide the capability to determine the extent, types, and manner in which containers and unitized cargo should be handled. The two components of the program are: 1) the design and development of a data base to address specific areas of inland cargo movement; 2) a study by the J. J. Henry Co., Inc., focusing on containerized cargo and the documentation flow for seven cargo moving from origin of destination through a water terminal. The CONDA Program is a decision-making tool providing management with the historical data necessary to analyze and evaluate route patterns and rate structures for both container and break-bulk cargo moving through the Naval Supply System.

Department of the Navy, Naval Supply Systems Command. Navy Support Technology for SMLS -Cargo Handling; Phase II: Cargo Handling Between Merchant and Amphibious Ships During the Replenishment Phase. Naval Coastal Systems Laboratory. Panama City, FL: 1974. (DLSIE - LD 30882A)

Report evaluates the naval crew requirements needed to transfer military containerized cargo in the offshore Amphibious Operations Area (AOA) from merchant ships to lighterage or directly into US Navy amphibious and

combatant ships. Four types of merchant ships and their handling gear were examined. Personnel and training recommendations were made specifically for the Navy Cargo Handling and Port Group (NAVCHAPGRU).

Department of the Navy, Strategic Sealift Division. U.S. Strategic Sealift Programs. Washington, DC: 1985.

Document provides general information on the Navy's Strategic Sealift Program. The Program is comprised of two components: ships and Sealift Support Systems. The document provides an overview of ship availability to provide quick reaction to military requirements beyond the capability of commercial vessels. Similarly, the document describes Sealift Support Systems which are primarily Sealift Enhancement Features, e.g., flatracks, SEASHEDs, that enable commercial vessels to discharge in-the-stream and enable containerships to transport unit equipment. In addition to the programmatic discussion, the document provides an overview of military requirements and methodology used by Navy planners for program development.

E. G. Frankel, Inc. Study of Cargo Management System of the Military Sealift Command. Boston, MA: 1980. (DTIC - A05957)

Examination of the Military Sealift Command's management system, in particular the problems of headquarters and commands. The following recommendations resulted: 1) introduce formalized cost accounting; 2) refine forecasting techniques behind the force plan and price setting; 3) overhaul Military Sealift Command routing and scheduling procedure; 4) rationalize administration of CALSTAT system; 5) integrate sources of information supplying the Military Sealift Command; 6) implement a booking system of limited complexity.

General Accounting Office. Navy Sealift: Observations on the Navy's Ready Reserve Force. Washington, DC: 1979. (DLSIE - LD 68134A)

Study to provide an assessment of the Ready Reserve Force (RRF) as the main source of quick response Sealift in a contingency. Several managerial issues were found which could affect the mobilization of the RRF within the Department of Defense mandated 5-15-20 day mobilization period. These issues were: 1) congestion at current fleet locations, 2) the lack of and continued decline of both shipyard resources and of Merchant Marine crews, 3) backup scheduling of ship maintenance, 4) incomplete inventory of spare parts, 5) limited test activations, 6) lack of the systematic evaluation of test results. Actions undertaken by the Maritime Administration to address each of these issues are described briefly within the report.

National Academy of Sciences. Containership Underway Replenishment. Washington, DC: 1971. (DTIC - AD 761672)

Interim study that evaluates the feasibility of resupplying naval vessels at sea from commercial containerships. Only the handling of provisions and consumables was included within the scope of this study. Conclusions and recommendations found in the final report.

Naval Air Systems Command. Containerization Evaluation Study: Final Report. Washington, DC: 1972. (DTIC - AD B003002-L)

Study to assess the effectiveness of containerization for aviation support, and to provide a program plan for implementation of containerization in support of the Naval/Air Forces. The study evaluates a number of hardware and ship configuration factors impacting NAVAIR requirements, and the feasibility of container use. The study concludes that containers used as tactical shelters have the potential to eliminate redundancy in air base maintenance and General Support Equipment (GSE) shops and therefore, would be cost-effective to pursue and develop.

Naval Medical Field Research Laboratory. ISO Containerization of MUST. Camp Lejeune, NC: 1975. (DTIC - AD B003546)

Report of study that investigated the feasibility of containerizing a Medical Unit, Self-contained, Transportable (MUST). MUST was the Army's medical services mobile combat hospital system, comprised of an inflatable soft shelter, an expandable hard shelter, and support equipment and hardware. The report compares and assesses various ISO shelters for their potential adaptation to the MUST system for use by Fleet Marine Forces. The report concludes that the shelters available at the time were mostly for general purpose use and not usable by Fleet Marine Mobile Medical Facilities. The report recommends a program to define an ISO container/shelter system that would fulfill the Fleet Marine Forces requirement.

Naval Weapons Station, Earle, NJ. Shipping of Retrograde Missile Containers from NAVMAG Lualualei to Naval Weapons Station Concord in ISO Containers on Empty Containerships Going to Concord. Colts Neck, NJ: 1988. (NWS Report 8025-AW)

This report documents a feasibility study to assess the operational and cost effectiveness of shipping empty missile containers (cylinders) from Hawaii to NWS Concord. Currently, retrograde of missile containers is done by air. The study concludes that due to the lack of frequency of such shipments and due to the associated costs that surface ISO containerization is not justified. Continued air transport is recommended.

Navy Sea Systems Command. Amphibious Sea-Base Replenishment Using Merchant Ships. Washington, DC: 1974. (DTIC - AD 531817)

The purpose of this document is to investigate different types of amphibious supply support other than those in use at the time of the study. This document summarizes the results of an examination of existing and near-term U.S. Flag Merchant Ships in replenishment of landing forces in three scenarios. The investigation concludes by identifying seven criteria for selecting resupply ships for use in replenishing of PHIBOPS.

Office of Naval Research. Containerships Underway Replenishment. A Study of the Use of Containerships for Naval Underway Replenishment. Washington, DC: 1971. (DTIC - AD 761672)

Interim evaluation report of the feasibility of resupplying naval vessels at sea from commercial containerships. Four areas were evaluated: 1) current and projected technology as well as the operational capability of the merchant containership fleet to resupply naval vessels at sea; 2) the capability of the merchant containership fleet to meet operational requirements set by the Navy; 3) identification of problem areas inherent with state-of-the-art systems; 4) identification of additional systems capabilities and technology to provide for optimum utilization of containerships. Conclusions/recommendations are contained within the final report.

U.S. Naval Operations (Logistics). Characteristics of Deepwater Seaports Within the Continental U.S. Washington, DC: 1984. (DLSIE - LD 60574A)

The purpose of this study was to design and implement a database of deepwater seaport characteristics within the continental U.S. Included in the study were both military and civilian ports capable of handling general, container, roll-on/roll-off, and petroleum/petroleum product cargo. Data sources are documented and thereby verifiable. The database utilized for implementation is the Joint Reporting Structure - Two (JRS2) which provides for database query and continuous update.

4.0 MARINE CORPS

Bourdon, P.J. Marine Corps Container System. Naval Postgraduate School, Monterey, CA. Thesis (DTIC - AD A096319)

This study describes the use of merchant ships and containerization in an amphibious operations (PHIBOPS). The document addresses five areas surrounding the use of containers: 1) mission and organization of the Marine Corps and Navy amphibious lift capability; 2) trends and problems in the merchant fleet; 3) the military suitability and functional characteristics of the current merchant fleet; 4) development of the Services' LOTS capability; and 5) the impact and requirements of containerization as it relates to Marine Corps amphibious operations. The study concludes with a series of recommendations that attempt to remedy what the author believes are serious mobility and cargo-handling problems inhibiting optimal container use and effective phibops.

Center for Naval Analysis Memorandum 87-243. An Analysis for Exercise Freedom Banner 1986. Alexandria, VA: 1987.

The objective of this report was threefold. First, to document setup times and operational rates at selected stages of the 1986 Maritime Propositioned Force (MPF) operations during "operation Freedom Banner," second, to document delays and chokepoints, third, to develop guidelines for future response time for full the squadron of MPF ships and make recommendations to remedy observed shortfalls. Analysis findings that directly impacted the use of containers include the documentation of the time required to off-load lighters, the Rough Terrain Container Handler (RTCH) system availability impact on container throughout rates, and the varied container throughout capacity according to the type of barge ferry deployed.

CINCLANT/USMC Combat Development Command. TACMEMO PZ005700-1-88: Deployment of the Assault Follow-On Echelon (AFOE). Quantico, VA: 1988.

Document to provide the major planning and execution aspects of Amphibious Operations (PHIBOPS). It serves to augment the Naval Warfare Publication (NWP) series, particularly NWP 22 "Doctrine for Amphibious Operations" and NWP 81, "Joint Logistics Over the Shore." The TACMEMO details the AFOE concept of deployment, responsibilities during PHIBOPS, marshalling and embarkation of AFOE cargo, and operations in the AOA. The document also contains ten annexes. Annex D addresses the arrival, management, and onward movement of containers in the AOA.

Department of Defense. Computer-Aided Embarkation Management System (CAEMS): Computer-Aided Embarkation Planning Support for Maritime Prepositioning Force (MPS) T-AKX (Maersk Line) E Class Ships. 1985. (DTIC - AD B104272)

Report to develop a software package for the Computer-Aided Embarkation Management System (CAEMS) which would be suitable to assist U.S. Marine Corps

personnel in the preparation of loading plans for the Maersk Line E - Class Prepositioning Ships. As a result of this study, a software package was developed and implemented using cargo, pallet, and vehicle data available to aid in the planning and execution of embarkation plans for amphibious and other rapid deployment operations.

Friedenberg, P.E. Follow-on and Resupply Shipping Assets for a Representative Marine Corps Situation. Naval Supply Command: 1986.

The principle purpose of this evaluation was to assess the capability of break-bulk and container merchant vessels and requirements in a notional AOA. Examining the logistical resupply requirements for a notional Marine Amphibious Force (MAF), study identifies hypothetical merchant vessel/lighterage requirements. Capability effectiveness is measured by the ability of the transportation system to meet the notional lift requirements. The study identified and assessed the sensitivity of which system parameters can be manipulated to optimize cargo delivery. Within the parameters of the 1976 scenario the report finds that the lift requirements cannot be met for all days. The author concludes that the data indicate the most efficient system in meeting lift requirements is one which optimizes the use of containerships where the CHE is available.

Harrington, Douglas C., CAPT. Maritime Prepositioning Ships (MPS). Maxwell Air Force Base, AL: 1986. (DLSIE - LD 64524A) Research paper.

Paper is show the historical development of the Maritime Prepositioning Ships (MPS) program and the problems encountered during its development. Areas discussed include: 1) supply and accounting interface systems; 2) attainment of designated Marine Corps assets; 3) automated data processing systems; 4) quality control; 5) maintenance support methods. Study recommends continued centralized management controls over the five areas discussed.

Hayes, Edward F., CMDR, USN. Naval Prepositioning and the Maritime Strategy. Naval War College. Newport RI: 1986. (DTIC - AD B103212) Research paper.

Examination of the advantages and disadvantages of prepositioning aviation ordnance in Norway to eliminate potential shortages of supply during NATO/European contingencies. Both land based and maritime-based prepositioning are detailed. The author concludes that some form of prepositioning (preferably maritime) appears to be worthwhile and that a detailed cost/benefit analysis be conducted.

Marine Corps Development Center. Intermediate Size Containers: Advanced Development Testing (DT-1). Quantico, VA: 1981. (DLSIE - LD 47420)

Study to evaluate the design of intermediate containers, specifically Inserts, PALCON, PALCON racks, QUADCON, and QUADCON racks. Tests conducted included structural and weather-tightness as well as cold environment testing.

Marine Corps Development and Education Command. Container Marshalling Within a Combat Service Support Area. Alexandria, VA: 1983. (DLSIE - LD 56740A)

Study to aid in the establishment of a doctrine concerning the marshalling of containers ashore in support of a Marine Amphibious Force (MAF) level amphibious operation in a hostile environment. Information regarding the selection and use of material handling equipment was included. Recommendations were: 1) a marginal terrain capable straddle lift be utilized as a container handler in a Combat Service Support Area (CSSA); 2) containers should be loaded with identical items so as to minimize container handling during unstuffing; 3) the development of an optimum method of container loading prior to mountout and inventory control within CSSA be developed.

Marine Corps Development and Education Command (MCDEC). Containerization for Fleet Marine Forces, 1973-1982. Quantico, VA: 1974.

This study provided the baseline for the current Marine Corps Field Logistics System (FLS). The study's objectives were divided into three areas:

1. Determine how containerization could be effectively used by the Marine Corps in both land and amphibious operations,

2. Determine Marine Corps MHE/CHE requirements to support implementation of container use,

3. Develop containerization implementation plan.

The study included an assessment of early container alternatives and respective trade-offs. Document concluded by recommending the use of PALCONs, QUADCONs and TRICONs and identified related equipment requirements. The implementation plan was not included in the document.

Marine Corps Development and Education Command (MCDEC). Joint Navy/Marine Corps Study of the Concept for Development of the Assault Follow-on Echelon (AFOE) (CONOPS for AFOE Development). Quantico, VA: 1988.

The primary purpose of this study is to assess the complete process of embarkation, movement and landing of Marine Corps assault echelons and

assault follow-on echelons. The following container-related issues are examined:

1. Maintenance of unit integrity,

2. CONUS preparation of supplies and equipment,

3. Marshalling, moving, and staging of materiel including the interface procedures with TOAs and U.S. TRANSCOM,

4. Load planning and embarkation materiel,

5. Special assessments and considerations for the procurement, positioning, stuffing/unstuffing, loading/unloading, management, retrograding and reuse of containers, and

6. Refinement and development of concepts and procedures for integrating Marine Corps and Navy operations with Army operations in a JLOTS scenario.

Document includes an Appendix on containerization.

National Security Industrial Association. Assault Follow-On Echelon (AFOE) Ship-to-Shore Study. Washington, DC: 1988.

The purpose of this study is to provide a mechanism for industry to provide information on cost-effective means to move AFOE vehicles and cargo in a Marine Expeditionary Force (MEF) operation. The study is to provide additional resources to the Navy/USMC study, TACMEMO PZ005700-1-88 Deployment of the AFOE, which was in progress at the time of this document's circulation. The NSIA study identifies 6 problems: 1) T-ACS potential chokepoint; 2) lighter transportability; 3) ship/craft relative motion; 4) beach container handling; 5) ship-to-shore controls; and, 6) container availability. The study recommends a series of studies, hardware and configuration changes, and procedural refinements in an effort to resolve these issues.

Office of Naval Research. Marine Corps Materiel Throughput Distribution System (1977-1986). Stanford Research Institute, Menlo Park, CA: 1978. (DLSIE - LD 32846)

Analytic study to develop alternatives within a mobilization and deployment environment for improved Materiel Throughput Distribution System performance within the scope of Marine Corps management responsibility. A simulation model for an amphibious assault was utilized for this evaluation. Interface problems in the handling of containers at user terminals in Logistics Support Areas were specifically emphasized.

Container specific recommendations included the following: 1) the inclusion within embarkation plans of truck unloading and shiploading capacities of each Port of Embarkation (POE) for both breakbulk cargo and containers; 2)

the need for a centralized container stuffing location within the container transportation system; 3) careful allocation of cargo ships to numbers of container-handling cranes available at POEs; 4) development of suitable containers for use in shipping bin-type items from supply sources to the LSA; 5) a number of computer enhancements to facilitate throughput real-time cargo movement.

Naval Facilities Engineering Command/Marine Corps Development and Education Command. Container Marshalling Within a Combat Service Support Area. Port Hueneme, CA: 1983. (DLSIE - LD 56740A)

The purpose of this study was to aid in the establishment of a doctrine concerning the marshalling of containers ashore in support of a Marine Amphibious Force (MAF) and to provide useful information to Marine Corps planners regarding the selection and use of handling equipment. Two alternative concepts for container marshalling were developed and are described in detail. Conclusions included the following: 1) neither the Caterpillar 988B nor the Drott 2500 were suitable for container handling Marine Corps requirements; 2) a marginal terrain capable straddle vehicle be utilized in a Combat Service Support Area (CSSA); 3) containers should be loaded with identical items to avoid container handling during over stuffing; 4) distributed storage of containers should be provided in a high threat

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5.0 AIR FORCE

Air Force Logistics Management Center. Application of Air Containerization. Gunter AFS, AL: 1984. (DLSIE - LD 63835A)

Analysis to determine if any Air Force or other DOD element generated enough air cargo in peacetime to justify the regular use of containers. Military hold-time standards were applied and volumes by month and year examined. No location generated sufficient quantities.

Department of Defense. Office of the Inspector General. Container Utilization: The Container Consolidation Point, Robins Air Force Base, Georgia. Arlington, VA: 1983. (DLSIE - LD 54901A)

Audit report that concluded that the Air Force should terminate operations at the Robins AFB CCP. CCP had been established after Air Force claimed excessive time delays when shipping through MOTs. Inspector General found problems with the analysis supporting the establishment of the CCP and with savings calculated after the first year of operation.

Gellman and Associates, Inc. United States Merchant Marine Experience with Containerization and the Implications for U.S. Military Logistics System Reliant upon Airlift to Meet Emergency Requirements. Jenkintown, PA: 1978.

Objectives of the study to examine economic incentives for use of containers by commercial air carriers and determine impacts of increased use of containers military logistics. Considered the situation analogous to changes in the commercial maritime industry that led to rapid changes in the maritime fleet. Especially sensitive to containerships, developed for a commercial role, not being conducive to supporting military operations.

Found that is the development of containerization in the air industry paralleled that of the maritime industry, aircraft might be designed only to carry containerized cargo. This would cause problems for airlift due to deployment problems of moving non-containerizable out size unit equipment, possibly to airfields lacking throughput capability.

Recommended that the Air Force monitor development of commercial aircraft to determine if trend is to container-only cargo airlift.

Headquarters, Air Force Logistics Command. An Analysis of the Inventory and Readiness Impacts Associated with the Establishment of the Warner Robins Consolidation/Containerization Center. Wright-Patterson AFB, OH: 1978. (DLSIE - LD 43758A).

Briefing report summarizing the expected impacts of establishing a CCP at Robins AFB, GA, for surface shipments to the United Kingdom and the Federal Republic of Germany.

HQ MAC/HQ DARCOM. International Organization of Standardization (ISO) Container Test-Final Report. 1983

Results of a joint test of MAC's transporting Army ALOC (Air Lines of Communication) cargo by pallets and containers. Potential application for containerized airlift between New Cumberland Army Depot and USAREUR supply support activities in the Federal Republic of Germany. For the test, MAC leased twelve commercial lightweight air/land containers (tare weight 2,100 - 2,600 lbs.). The use of pallets was compared to the use of containers throughout the test.

The results of the test showed:

o In peacetime, less cargo could be moved in containers than pallets. In wartime, more cargo can be moved containerized with fewer missions due to increased payloads, except for a 747 aircraft where more cargo could be moved by pallet in peacetime and in wartime.

o There were time savings over pallets for stuffing a container at the depot and for unstuffing at Dover, time costs at Rhein-Main and Ramstein for stuffing containers, but no significant difference for stuffing/unstuffing for Army units in Germany.

o On-hand MHE was suitable for handling small quantities of containers, but more would be required to meet wartime requirements.

o Additional costs were incurred for moving cargo in containers due to the tare weight, which exceeded that of pallets.

o MAC savings, if any, were minimal for peacetime moves, but MAC felt the need to practice for wartime.

o MAC recommended a peacetime program to both train personnel and to identify system constraints and required enhancements to meet surges in wartime. MAC requested OASD approval to purchase 50 air/land containers to begin a regular airlift program for peacetime ALOC cargo.

Note: The test was conducted using lightweight air/land containers which seemed to be growing in commercial use, but which never gained widespread acceptance. If MILVAN-weight containers had been used, the tare weight penalty would have been more substantial thereby increasing costs. Therefore, care must be used in extrapolating these results to other container types.

Headquarters, Military Airlift Command. Feasibility Test: Mobile Straddle Crane As A Container Handling System. Airlift Center Final Report. 1982. (DTIC - AD B04560)

The purpose of this study was to determine the minimum equipment and personnel needed to off-load, assemble, and utilize a Mobile Straddle Crane (MSC) as a container handling system in the military airlift environment. Since container weights currently exceed the capacity of assigned forklifts,

aerial ports need equipment for heavier lifts. A simulation of airhead conditions was conducted. The general findings indicate that an MSC similar to the one tested (an RPC Corporation model C-502) would be operationally effective and suitable once MAC air transportability requirements are met through modifications allowing for the increased lift capacity of 60,000 pounds to be met.

Headquarters, Military Airlift Command. MAC Participation in Joint Service Testing of the Intermodal Modular Container (MODCON). Scott AFB, IL: 1974. (DTIC - AD 916698)

Test to pursue integrating containers into MAC 463L airlift system. Test conducted in 1973 between Dover AFB, DE, and Rhein-Main AB, FRG. Testing of modular containers (MODCONs), MODCON adapters and MILVANs. Two types of MODCONs tested: small modules (24 form 8'x8'x20') and large modules (six form 8'x8'x20'). Found that tare weight could equal as much as 50 percent of total weight lifted. Adapter was not compatible and MODCONs suffered damage in transit. Also, identified need for crane at aerial ports.

Military Traffic Management Command. Study Analysis and Findings of Air Force CCPs. Washington, DC: 1982.

Analysis to determine if the Air Force CCPs at Robins AFB, GA, and McClellan AFB, CA, were providing required services at the lowest overall costs to the Government. Prior to establishing the CCPs, any cargo that could not be source stuffed into containers at vendors or depots for direct shipment to overseas destinations was routed to Military Ocean Terminals (MOTs) for consolidation and containerization.

Four options were considered for routing cargo being shipped through the Air Force CCPs, and total costs compared. Study recommended that for East Coast shipments (alternative to Robins), the least cost alternative was expanding the Defense Depot at Mechanicsburg, PA, and shipping GSA supply support should return to pre-Robins configurations. For West Coast shipments, consolidating at West Coast MOTs was deemed most cost effective.

Office of the Assistant Secretary of Defense, Director for Energy and Transportation Policy (MI&L). Air Movement Plan for a Container-Oriented Distribution System. Washington, DC: 1984.

Air Force input to the DOD Container Oriented Distribution System Plan, published by OASD (MI&L). Outlines program objectives, tasks and milestones for achieving integration of containers into the airlift system. Revised document currently being reviewed.

Price, Michael, et. al. Aerial Port Container Handling Equipment Requirements and Air Transportability for Intermodal Containers. Wright Patterson AFB, OH: 1974. ASD-TR-74-10. (DTIC - AD 783620)

Report prepared in support of DOD Land-Air-Land containerization effort. Study of aerial port container handling requirements for 1975-1980 time-frame. Categorized aerial base operations to determine equipment types and quantities that would be required. Identified major and minor container handling bases. Identified functions in container airlift operation. Addresses port container handling equipment, but not requirements for MHE to stuff and unstuff containers. Assumed five percent level of containerization for air transport in 1980. Focuses on Air Force cargo containerization, not lift requirement for other services. Specifies container handling equipment requirements, by base, for 1980.

Rice, Michael M., et al. The Potential of an 8 x 8 x 5 Foot Intermodal Container as a Unitization Medium for Routine Military Cargo. Wright-Patterson AFB, OH: 1975. (Masters Thesis). (DTIC - AD A006675)

Study addressed the selection of an optimal size intermodal container for use in the airlift system. Analyzed the use of the 8'x8'x5' container. Used 1974 air cargo data. Made conclusions based upon the container utilization which the authors saw as one aspect of determining the optimal container for airlift.

Sugg, Joseph. The ANSI/ISO Shelter: Impact on Air Force Tactical Mobility. Air Command and Staff College, Maxwell AFB, AL: 1978. (Research Report) (DTIC - AD 028134)

Addresses problems for the Air Force in handling ANSI/ISO tactical shelters in the airlift system including aerial port MHE, the airplanes and surface vehicles. Concern that DOD direction (DODI 4500.37) to conform to commercial standard could degrade Air Force mobility requirements. Need to identify impacts of adopting the standard on Air Force capability. Study addresses Air Force tactical shelter requirements only.

U.S. Department of Transportation, Transportation Systems Center. Air Container Movement Requirements in the Year 2000. (U) Cambridge, MA: 1986. (Secret)

(U) Study to determine the number of ISO containers and tactical shelters that might require airlift in the year 2000. Basis of estimate: DG-92 requirements for airlifted units and supplies. Four services in three theaters considered.

(U) Study polled services for container airlift policies on which to base container airlift estimates. Airlift of tactical shelters was a major concern because they are considered unit equipment and cannot be identified

in UE inventories. Study traced number of ISO shelters already delivered and scheduled for delivery through 1991. Allocated them to airlifted units based upon service guidance.

(U) PC-based model was developed for the study. Based upon weight and volume of containerizable materiel, "what if" analyses can be performed to determine number of required containers. Variables: containerization level, by service and theater; containerization level by type of cargo (UE, ammunition, resupply); container specifications. Algorithm maintains unit integrity at the lowest level in DG-92 database.

Weingarten, Joseph. Impact of Intermodal Containerization on USAF Cargo Airlift. Wright-Patterson AFB, OH: 1972. Technical Report: ASD-TR-72-76. (DTIC AD 753906)

Documents impacts of containerization on airlift. Discusses problems of integrating containers that are meant to move from source to user into an airlift system (463L pallets) which is meant to support APOE to APOD moves.

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6.0 AMMUNITION CONTAINERIZATION

BDM Corporation. Survey of the US Army Ammunition Logistics System Concept. McLean, VA: February, 1986. (DTIC - AD B101295)

Detailed analysis of the Army's ammunition logistics system. Not directed at the use of containers but provides framework for considering their impact on current functions. Describes key variables. Goal of the analysis is development of a functional description for a logistics system model to estimate emerging concepts on the system.

DARCOM Ammunition Center. The MILVAN Temperature and Humidity Test. Savanna, IL: 1976. (DTIC - AD B016034L)

Evaluation to determine the suitability of MILVAN containers for ammunition point-of-use storage. Temperature and humidity within test containers was monitored. Goal was to determine the effects after two years' storage. Representative commercial containers were also tested. Found that the storage time did not adversely affect the ammunition.

DARCOM Ammunition Center. Top Handling MILVAN Containers with Slings. Savanna, IL: 1977. (DTIC - AD B023350L)

Evaluation to determine the feasibility of using a four-sling system with a crane for lifting fully-loaded MILVANs.

Department of the Army, Fourth Transportation Brigade. Containerized Ammunition Study. APO, NY: 1979.

Study to identify factors that limit the handling of containerized ammunition shipments that the European theater is capable of receiving, distributing and storing to satisfy peacetime requirements. Found storage capacity to be critical factor. Provides synopsis of early CADS efforts.

Department of the Army. Headquarters, Modern Army Selected Systems Test, Evaluation and Review. Tactical Support Container - SIXCON. Fort Hood, TX: 1975. (DTIC - AD B004416)

Test of a small container to be used in CADS for combat forward area supply points. SIXCON container (8'x6 2/3'x4') was equipped with side rails and cross-restraints as the full-size MILVAN, had a lift-off top and a drop side to form a ramp. Two rows of three could be attached to form a standard 8'x8'x20' envelope.

Because of its weight, test found that the SIXCON was not suitable for air support of forward points but that is was suitable for general cargo operations.

Department of the Army, Training and Doctrine Command, Army Logistics Center. Containerized Shipment and Storage of Ammunition (COSSA). Fort Lee, VA: 1977. (DTIC - AD B024088)

Following from the Army in the Field Container System Study, the COSSA study refines the Container Distribution System concept to provide a detailed analysis of containerized shipments of conventional ammunition. Study develops doctrine for shipping and storage and provides a concept for direct delivery to the lowest practicable echelon. Modifications to supply and transportation organizations are addressed, as are equipment requirements. Considers ammunition containerization for a theater of operations for the 1975-1985 time-frame for a mid-intensity conflict.

General Accounting Office. Progress Made and Improvements Needed in Developing a Containerized Ammunition System. Washington, DC: 1978. GAO-LCD-78-222A

GAO study concluding that basic questions about containerizing ammunition during a mobilization needed to be resolved, and that system requirements and capabilities had to be defined. Also, coordination was required between the Army and the Navy, and a CADS Plan needed to be developed.

Headquarters Marine Corps. Marine Corps Containerized Ammunition Study (1985-1995). Washington, DC: 1985. (DTIC - AD A166502)

The primary purpose of this study was to assess containerization of ammunition from the beach to the end user in the buildup of the assault follow-on echelon. Retrograding containers was also addressed. Study objectives included:

1. Development of concepts for containerized ammunition support for Marine Expeditionary Forces and a Marine Expeditionary Brigade from initial assault through the mid-range period,

2. Identify shortfalls for implementing the concept, e.g., MHE/CHE requirements,

3. Recommend alternatives to alleviate shortfalls.

The study recommended development of a series of retail ammunition distribution points throughout the AOA. Each distribution point would have CHE/MHE to unstuff ammunition and deliver in in breakbulk form to users.

Study assumes that FLS can accommodate and implement the concept of distribution. One critical shortfall could be the availability of the rough terrain cargo handler. Other issues beyond the scope of the study are recommended for analysis:

1. CHE requirements for distribution of other supply classes,

2. Level of containerization for Class V,

3. Analysis of MHE/CHE reliability and availability.

Joint Conventional Ammunition Program Coordinating Group. Definition of a Joint Conventional Ammunition Containerization System Concept, Including Unification of Containerization Requirements (U). 1975. (Secret)

(U) Study following from the USEUCOM Surface Lift Movement Analysis concluding that existing ammunition terminals in 1975 were not capable of meeting container throughput requirements of the USEUCOM study.*

Military Traffic Management Command. Transportation Engineering Agency. Ammunition Container Criteria. Ft. Eustis, VA: 1970. AD 725776

Study to determine optimum container characteristics to transport ammunition. Criteria developed in study to be used to design, develop, test and produce an ammunition container. Followed Sea-Land test of containerized ammunition shipments (Operation TOSCA) where 35-foot containers were used with low (25 percent) cube utilization. Four container sizes were considered: 8'x8'x20'. 8'x8.5'x20', 8'x4'x20', and 8'x8'x6 2/3' (TRICON). Study that determined the 8'x8'x20' container was the preferred size for ammunition shipments.

Military Traffic Management Command, Transportation Engineering Agency. Ammunition Terminal Requirements/Capabilities - 1980. Newport News, VA: 1976. MTMC Report TE 75-59. (DTIC - AD C007351). Declassified 1983.

Goal of the study was to determine potential East and Gulf coast terminals to satisfy vessel system outload demands for ammunition from USEUCOM Surface Lift Movement Analysis. USEUCOM study had determined that 23-26 percent containerization was optimal. A study by the Joint Conventional Ammunition Program Coordinating Group, Definition of a Joint Conventional Ammunition Containerization System Concept, Including Unification of Containerization Requirements, following from the USEUCOM study concluded that existing ammunition ocean terminals would not meet the container throughput requirement.

MTMC study looked at the operating concepts, support facilities and equipment of all former, existing and potential ammunition ocean terminals on the East and and Gulf coast. Determined no commercial ports could be used due to safety restrictions. Concluded that there were three options: Military

Ocean Terminal, Sunny Point, NC; Military Ocean Terminal, Kings Point, GA; and NWS, Earle, NJ. Determined that 50 percent of requirement could be met and, therefore, outlined improvements and costs for modernization.

Military Traffic Management Command, Transportation Engineering Agency. Department of Defense Ammunition Test Shipment in Sea-Land Containers. Fort Eustis, VA: 1970. TEA Report 70-7.

Results of DOD's initial shipments of ammunition using commercial containers (TOSCA - Test of Containerized Shipments of Ammunition). Engineering report covering handling of the containers and analysis of transportation environment shocks experienced moving from the manufacturer to a forward ammunition point. Two hundred twenty-six containers of eight different types of ammunition were shipped.

Military Traffic Management Command. Transportation Engineering Agency. West Coast Ammunition Port Requirements Study. (U) Newport News, VA: 1987. (Secret)

Study to determine if a requirement exists for a west coast ammunition container vessel support system and for other port enhancements on the east and west coasts, based upon Joint Program Memorandum for FY92. Using the RAPIDSIM, analyzed several scenarios for meeting closure requirements. Enhancements to NWS Earle, NJ, NWS Concord, CA and the Military Ocean Terminal at Sunny Point, NC. Base case assumed 50 percent containerization. Concluded enhancement of 2 CVSSs (one east and one west coast) and would significantly improve closure time. Seventy percent ammunition containerization best utilized the surface fleet.

Naval Ammunition Depot Earle. Evaluation Report on Project Autumn Leaves. Colts Neck, NJ: 1972. (DTIC - AD 754425)

This report evaluates Project Autumn Leaves which was the simultaneous sealift of naval ordnance in a self-sustaining containership and lighter aboard ship (LASH) vessel. This operation, which was conducted from both an Eastern and Western CONUS port, named Autumn Leaves East and West, respectively, was the most extensive exercise of its nature conducted up to 1972 by DOD. The evaluation's primary finding was that a cost-effective system for throughput container shipments is possible. Moreover, container use was more cost-effective and efficient when munitions were stuffed at the source activity rather than at the port.

Naval Weapons Handling Center. Readiness and Implementation Study for a Reusable Ammunition Restraint System in Commercial Intermodal Containers. Colts Neck, NJ: 1979. (DLSIE - LD 44233A)

Report evaluates implementation and readiness options applicable to a reusable, mechanical restraint system for ammunition during transport in 8'x8'x20' commercial intermodal containers. Lead-time stockpiling, inventory size, reusability, production during the contingency, and other elements are discussed. The study concludes that a plan encompassing an inventory of complete restraint systems as well as the development of new systems would be advisable.

Office of the Assistant Secretary of Defense (MRA&L). Program Management Plan for Containerized Ammunition Distribution System Development (Conventional Munitions). Washington, DC: 1978 and 1983.

Document providing direction, guidance, responsibilities, objectives, tasks, priorities and target dates for developing CADS. Under AMC as Army single manager of for conventional ammunition. In 1983 version, sixteen major program tasks are outlined. Development of transportation subsystems is the key organization, with other-than-Army responsibilities outlined, where appropriate.

Reith, John E. A Study to Determine Where the United States Army Should Load Containers - At the Ammunition Plants or at the Port of Embarkation. June, 1987. Research Paper. (DLSIE - LD 71794A)

Description of the functions and costs associated with source and port stuffing of ammunition.

U.S. Army Defense Ammunition Center and School. The MILVAN Thermal Kit Environmental Test. Savanna, IL: 1979. (DTIC - AD A072974)

Results of test of insulation for ammunition MILVANs.

U.S. Army Materiel Command Ammunition Center. Optimum Size Container. Savanna, IL: 1973.*

Study that concluded that the 8'x8'x20' container was best for ammunition shipments.

U.S. Army Project Manager for Ammunition Logistics and U.S. Army Training and Doctrine Command. Joint Ammunition Logistics Plan. Dover, NJ, and Huntsville, AL: 1985.

Plan which presents an integrated concept for a total ammunition logistics system. Presents detailed analysis of deficiencies at nodes throughout the system. Actions required to solve problem areas and a schedule for completion are included. Analysis of combat systems is also included.

U.S. Army Tropic Test Center. Final Letter Report - Engineering Design Test of Thermal Insulation for MILVAN Containers. APO Miami, FL: 1980. (DTIC - AD B048867)

Results of environmental tests of MILVAN ammunition containers conducted from 1977 to 1980. Humidity and temperature tests to determine insulation and paint effects.

U.S. Department of Transportation, Transportation Systems Center. Availability of Ammunition-Serviceable Containers. Cambridge, MA: 1987.

Study for the Program Manager for Ammunition Logistics to (1) determine the inventory of twenty-foot, end-opening containers, (2) determine the number and location of off-hire (immediately available) containers, and (3) estimate the number that would pass U.S. Coast Guard condition standards for carrying ammunition. Results: approximately 2 million end-opening twenty-foot containers in world fleet of which 800,000 are U.S.-owned; most U.S.-owned are owned by leasing companies; 75 percent of world fleet controlled by foreign carriers; approximately 100,000 off-hire containers (available for immediate use) were located in CONUS at the time of the study; a container survey found that 50 percent of off-hire containers met Coast Guard standards for condition to carry ammunition. Study contains data on inventories and maps of offshore container locations.

USEUCOM Surface Lift Movement Analysis (U). Appendix to SM-51-75, Organization of the Joint Chiefs of Staff. Washington, DC: 1975. (Secret)*

(U) Study concerning shipments of ammunition to support NATO OPLAN. Concluded that optimal level of ammunition containerization was 23-26 percent. Recommended that Services jointly pursue whether CONUS ammunition ports could meet the requirement. Follow-on studies addressing the issue were Definition of a Joint Conventional Ammunition Containerization System Concept, Including Unification of Containerization Requirements and Ammunition Ocean Terminal Requirements/Capabilities - 1980.

7.0 LOGISTICS OVER THE SHORE

Army LOTS Evaluation Team. Evaluation of the Army's Capability to Conduct Logistics-Over-the-Shore (LOTS) Operations. Fort Eustis, VA: 1978. (DLSIE - LD 42061A)

This study evaluated the capabilities of the Services to deploy Logistics-Over-the-Shore (LOTS) units and equipment, and to handle containerships, barge ships and their cargo in an over-the-shore environment. The study was conducted in three phases: Phase I (initial operations in a bare beach environment); Phase II (Amphibious Follow-on Echelon); Phase III (semi-improved beach with mobile pier facilities). The test was conducted in near-perfect weather conditions with Sea State I constant. Overall, a sustained 300 container per day discharge operation in a LOTS environment is considered attainable but does not presently exist within the Army force structure.

Findings/recommendations include the following: 1) shipside - factors affecting the TCDF are its reach limitations, vulnerability to increased stress in use above Sea State I; 2) of the five types of lighterage employed, the LACV-30 air cushioned vehicle proved most effective although offset by its load limitations and the inability to discharge the LCUs and LCM-8s during low tide made their numerical superiority, load cap, and maintenance dependability far less effective; 3) shoreside - little or no difficulty was encountered by the three shore crane systems utilized; 4) container handling equipment - of the front-end loader, side loader, yard tractor and trailer, only the side loader proved impractical for an unimproved environment; 5) container management - incomplete and inaccurate manifest data at the operating site required personnel to operate in a manual mode to reconstitute missing data. Cargo operations would have been greatly facilitated with machine produced accounting documents and reports.

BDM Corporation. Logistics Over-the-Shore (LOTS) Main Test Data Presentation Report. Norfolk, VA: 1977. (DTIC - AD D027134L)

This report examines the capabilities of modern merchant ships to handle cargo to over-the-shore environments with insufficient port facilities. Cargo handling, movement, and management are detailed. Various positioning patterns, equipment, and procedures were utilized in a variety of scenarios. Innumerable equipment and procedural changes/modifications are recommended in this highly detailed and lengthy study.

Berg, T. Independent Evaluation Plan for the LACV-30 Follow-on Evaluation, Final Report. U.S. Army Training and Doctrine Command, Fort Eustis, VA: 1981.

In response to the 1973 US Army Trans-Hydro Craft Study's requirement for an Air-Cushion-Vehicle (ACV) capable of transporting up to 30 short tons in support of a LOTS operation, the Lighter/Air-Cushion-Vehicle (LACV-30) was developed. This evaluation plan prescribes a 5-year assessment of the

capability of the LACV-30 to conduct containerized cargo movement operations and to control lighterage during a LOTS scenario. The study assessed the following container related performance issues:

-ability to move and discharge containers.

-number and adequacy of container tie-down points.

-LACV-30 speed and endurance over land and water (according to Sea State) as it affects cargo throughout.

E. G. Frankel, Inc. Development of a Conceptual Design for a Self Propelled Container Discharge Facility. Cambridge, MA: 1973. (DTIC - AD 772797)

This report examines the design development of a self-propelled Container Discharge Facility. In order to meet the mission requirements of: 1) the discharge of containers from nonself sustaining ships; and, 2) the discharge of general cargo from general cargo and special purpose ships to lighterage/air transport in Logistics Over the Shore (LOTS) operations, therefore recommends that the adaptation of a Reserve Fleet vessel, C2 cargo type, with a speed requirement of 13 knots be carried out.

E. G. Frankel, Inc. Development of a Conceptual Design for a Self-Propelled Container Discharge Facility. Cambridge, MA: 1973. (DTIC - AD 772798)

This report examines the design development of a self-propelled Container Discharge Facility with a speed of 16 knots. The study concluded that no vessel existed that met the Container Discharge Facility needs and that research, development, tests, and implementation should be carried out.

E. G. Frankel, Inc. Development of a Conceptual Design for a Self-Propelled Container Discharge Facility. Cambridge, MA: 1973. (DTIC - AD 772796)

This report examines the design development of a self-propelled Container Discharge Facility with a speed of 10 knots. As a result of this study, operational and design parameters were established for such a vessel.

E. G. Frankel, Inc. Development of a Conceptual Design for a Self-Propelled Container Discharge Facility. Cambridge, MA: 1973. (DTIC - AD 772795)

This report examines the design development of a self-propelled Container Discharge Facility. Within this report design parameters have been developed for this vessel with a speed of 8 to 12 knots and for the mission requirements.

JLOTS II Evaluation Team. Logistics Over The Shore II Throughput Test: Sept.-Oct. 1984. Operational Test Report. 1985. (DLSIE - LD 558 4D)

Study evaluating the effectiveness of the Services' capabilities to discharge dry cargo and bulk POL from commercial ships at offshore anchorages. Various handling equipment developed between 1975 and 1985 were utilized. This study is a continuation of the Roll-on/Roll-off Test and the Deployment Test conducted prior to the throughput phase.

Test results are summarized by major functional LOTS areas within the report. The following recommendations were made: 1) the capability to discharge containerized cargo on a sustained basis is limited to sea conditions of up to Sea State 2; equipment and procedural improvements are necessary to increase throughput capacity in Sea State 3 or above; 2) since the demonstrated capability to transfer bulk POL products was limited or nonexistent, the Services must pursue the development of POL systems capable of greater standoff distances and adequate mooring systems for POL product transfer; 3) the updating of shore doctrine and procedure cognizant of new sealift assets must occur; 4) periodic exercises should be conducted to assure continued LOTS capabilities of active and reserve forces.

JLOTS II Evaluation Team. Logistics Over the Shore (LOTS) Interface Systems Analysis. 1984. (DTIC - AD B089069)

Study contains a description and a systems analysis of both equipment and procedures utilized in phases of a Logistics Over the Shore (LOTS) operation: ship unloading, lighterage, beach unloading systems, and transportation systems to a marshalling area. Containerized, breakbulk, Roll-on/Roll-off, and bulk liquid cargo are examined. Shortfalls are identified. Recommendations are made in the following areas: 1) that of landing heavy cargo across shallow gradient; 2) unloading containers in stream from nonselfsustaining containerships in high state seas; 3) transportability of certain LOTS equipment; 4) optimization of LOTS systems for containerized cargo; 5) inadequacies in bulk liquid delivery over the beach; 6) vulnerability of the LOTS system.

JLOTS II Evaluation Team. Joint Over the Shore II Test and Evaluation Analysis and Evaluation Report (JLOTS II). 1985. (DLSIE - LD 63971A)

The purpose of the JLOTS II test and evaluation was to assess the Services' current capability in Assault Follow On Echelon (AFOE) and Logistics Over the Shore (LOTS) operations. Five major objectives were assessed: 1) the capability to deploy, on designated commercial ships, selected outsized military equipment needed for over the shore operations; 2) the installation and preparation of over the shore systems and equipment for cargo operations; 3) over the shore systems and equipment capabilities for sustained container, break-bulk, vehicle, and bulk POL systems operations; 4) the capabilities of the Services' to manage and control the movement of containers and break bulk cargo in sustained throughput operations over the shore; 5) the capability of the Services to transition from a Navy ALS/Marine

Corps FLS operation to an Army LOTS operation. Three test phases were conducted and covered in separate reports.

JLOTS Evaluation Team. Joint Logistics Over the Shore II Test and Evaluation Deployment Test Report (JLOTS II). 1985. (DLSIE - LD 63972A)

Assessed in this portion of the JLOTS II study is the Services' current capability to conduct Assault Follow On Echelon (AFOE) and LOTS operations. The specific objective of this phase is to assess the capability to deploy the logistics delivery equipment in merchant ships to an operating area. Detailed descriptions of all aspects of the tests and evaluation of equipment, procedures, personnel, times, environmental impact, and conclusions/recommendations are provided. For both Seabee and Lash,testing results were generally favorable. Additional recommendations in the areas of equipment modification, personnel preparedness, acquisition, and environmental concerns.

JLOTS II Evaluation Team. LOTS II Test Design. 1983. (DTIC - A132737)

Tests and systems to be tested for each phase of the JLOTS II evaluation are described in detail including cargo type, weight distribution, type of container utilize. Specific JLOTS II procedures are identified and summarized in order to evaluate the capabilities of the Services to transition from a Navy/Marine Corps ALS/FLS operation to an Army LOTS operation.

JLOTS II Evaluation Team. JLOTS II Phase II Roll-On/Roll-off Field Test Plan. 1984. (DTIC - AD A132849)

Phase II of JLOTS II evaluates the capabilities of the Services to utilize ramps, platforms, and lighterage that permit the off shore discharge of vehicles via Ro/Ro Calm Water Off-load Facility and selected lighterage. Included are details of selected test equipment and a schedule of events for Ro/Ro testing.

JLOTS II Evaluation Team. Joint Logistics Over-the-Shore II Test and Evaluation JLOTS II Roll-On/Roll-Off Ship Operations. 1984. (DLSIE - LD 53584C)

This continuation of the JLOTS II study assesses the Services' capability to assemble, install, and operate a discharge facility. Two ships representative of Roll-On/Roll-Off ships in the US Flag Fleet were utilized. Off-loading and backloading of selected Army and Marine Corps vehicles using the Navy's Ro/Ro discharge facility and Army and Navy lighterage were evaluated. The results of these tests were used to refine operational techniques and to establish planning estimates for future Ro/Ro operations.

Only minor improvements to procedures and equipment were recommended so that improved efficiency and elimination of potential unsafe practices will result. Details of tests, equipment, military units involved, and analysis of results are included in this phase of the JLOTS II evaluation.

JLOTS II Evaluation Team. JLOTS II Roll-On/Roll-Off Ship Operations. 1984. (DLSIE - LD 53584CA)

The purpose of this portion of the JLOTS II evaluation was to assess the capability of the Services to assemble, install, and operate the discharge facility. The results of these tests support the results of the Ship Operations Study. (LD 53584C)

Mathiowitz, D. R., LCDR USN. Utilization of Containerships for Amphibious Resupply. Norfolk, VA: 1973. (Research Paper) (DLSIE - LD 30090)

Study to determine the optimum method for the utilization of non-self-sustaining cargo ships in the resupply of amphibious forces. Alternative equipment, ship type, and earlier research studies were discussed. Two conclusions resulted: 1) the utilization of commercial mobile cranes on deck leads to a limited capability for the employing of non-self-sustaining containerships; 2) modification of existing LSDs can be economically attained to assume the collateral mission of containership support.

Military Sealift Command. Container Off-loading and Transfer System, Crane on Deck, and Hatch Cover Bridge Tests. Panama City, FL: 1980. (DLSIE - LD 47139A)

Study to assess the feasibility of off loading a non self sustaining containership by utilizing a standard commercial crane placed aboard a containership. This crane on deck DT11 phase of the COTS program was conducted during joint LOTS testing. Tests concluded that off-load rates of up to five containers per hour were feasible during calm seas. Off-load rates rapidly deteriorated at higher sea states due to a lack of devices to control pendulation and vertical motions associated with the "off the shelf" crane being utilized. Other factors impacting directly on off-load productivity were: 1) lighter scheduling, 2) equipment availability, and, 3) seamanship.

Military Sealift Command. Container Off-loading and Transfer System (COTS), Temporary Container Discharge Facility (TCDF). Panama City, FL: 1980. (DTIC - AD B054727).

Evaluation to assess the operational suitability of a Motion Compensation System (MCS) for the Container Off-loading and Transfer System Temporary Container Discharge Facility (COTSTCDF). The MCS assessed in this study

serves as a ship mounted crane conducting containerized cargo off-loading and retrograde operations at a rate of 10 containers per hour in an off shore environment through sea state 3.

Contained in this evaluation is general background of the overall COTS program, rationale for the incorporation of a motion compensating control system, systems requirements, and capabilities. Documented support of both the hardware and software components of the system are included.

Recommendations were: 1) to develop a more functional arrangement of frequently used controls and operator prompting features, 2) to rewrite the MCS manual, 3) to hardwire signalling for serial multiplexing into the control processor, 4) to alter the ROCM configuration for system compatibility.

Military Sealift Command. Container Off-loading and Transfer System (COTS): Technical Evaluation of Temporary Container Discharge Facility (TCDF). 1982. (DLSIE - LD 40488A)

This evaluation study presents findings, conclusions, and recommendations regarding the operational suitability of the TCDF crane. Equipment being assessed is described in detail in addition to descriptions of tests required for the technical evaluation of the TCDF crane. A concise chronology of events from the preferred TCDF configuration of two mounted cranes to a single crane mounted on a deactivated LSD hull for evaluation is included. Recommendations included: 1) the procurement, installation, and testing of a heavier more reliable crane swinger drive system; 2) a variety of hardware design changes and modifications; 3) suitable documentation to meet ASU requirements.

Military Sealift Command. Container Off-loading and Transfer System (COTS): Temporary Container Discharge Facility Motion Compensation, Etc. Vol. II. 1980. (DTIC - AD B054728)

Volume II of the COTS TCDF study provides basic descriptions and results of Motion Compensation System (MCS) tests as well as modification recommendations for each of the following: 1) basic manual crane control system; 2) rider block tagline control system; 3) MSC system concept validation; 4) MCS control system base selection rationale; 5) actual control configuration. The general findings indicate operational effectiveness and suitability when cited modifications are in place.

Military Sealift Command. Container Off-loading and Transfer System (COTS) Temporary Container Discharge Facility (TCDF) Motion, Etc. Vol. III. 1980. (DTIC - AD B054776)

Volume III of the COTS TCDF study consists primarily of documentation in algorithmic form of the crane operating system software which was developed

as part of the overall initial design effort. General configurations of the crane operating system hierarchy and the crane operating system software managing Executive Control System are included. Explanations and flow charts of all levels of software designed to support the COTS in the MCS Manual Operating Mode are included. Although not totally comprehensive, the software documented is detailed tall levels. Further work was recommended on the algorithmic design and the required FORTRAN coding before test implementation.

Military Sealift Command. Container Off-loading and Transfer System (COTS) Temporary Container Discharge Facility (TCDF) Motion, Etc. Vol. IV. 1980. (DTIC - AD B054777)

Volume IV of the COTS TCDF study is a preliminary mathematical evaluation of the COTS Motion Compensation System (MCS) and design computation which utilizes symbols and geometric relationships. Mathematical symbols are referenced for the convenience of the user. Illustrated definitions of specific crane angles are provided.

Military Sealift Command. Container Off-loading and Transfer System (COTS) Temporary Container Discharge Facility (TCDF) Motion Compensation System. 1980. (DTIC - AD B054778)

This study presents a program for the development of the COTS MCS project in order to facilitate planning and scheduling. Both graphical and tabular formats are utilized. Hardware breakdown structure contained in the study was utilized as the criteria for the selection of task areas for graphic representation. PERT, Gant, and PROMIS charts are utilized with separate tasks. Preliminary analysis resulted in a definition of development task requirements.

Military Traffic Management Command. Offshore Discharge of Containerships. Newport News, VA: 1971. (DLSIE - LD 26468A)

Evaluation to assess the ability of the Army to off-load containerships, where port facilities are not available, through the utilization of helicopters, lighters, and related operations at the shore and air terminal. Shock levels encountered during container movement and handling were determined by having two containers instrumented for this purpose. Simulated beach operation resulted in the following recommendations: 1) need optimum environmental conditions (i.e., sea state below State 2) helicopter loading/off-loading of container cargo can be maintained but helicopter cell loading/off-loading must be practiced; 3) stabilizing equipment for gantry cranes should be studied; 4) equipment to prevent container puncturing should be studied and modified; 5) containers married to MILVAN chassis or to M-127 trailers should be accomplished by suitable ground equipment rather than by helicopter; 6) need modifications to both front-end loader and side-loader for containers to facilitate locking the lifting device to the container on

uneven ground; 7) additional equipment for Over-the-Shore operations be studied.

National Security Industrial Association. An Assessment: Intelligence to Support Over-the Horizon Amphibious Assault. Washington, DC: 1988.

This report outlines and describes the Over-the-Horizon (OTH) assault tactic and the operational and intelligence deficiencies such a tactic may cause in the present systems. The report then recommends a series of technological innovations commercially available to eliminate potential OTH shortfalls.

Naval Coastal Systems Lab. Navy Support Technology for SMLS Cargo Handling Phase II. Panama City, FL: 1974 (DLSIE - LD 30882A)

Study to assess the Navy manpower and training requirements needed to resupply cargo to an Amphibious Task Group (ATG) which has landed elements of a Marine Amphibious Brigade. Merchant ships of various types were utilized including breakbulk, container, barge, and Roll-on/Roll-off ships. Conclusions/recommendations were as follows: 1) Merchantship types - although breakbulk, barge, and Ro-Ro ships continue to be utilized, solutions must be found to optimize the use of container ships in the AOA scenario; 2) Container/Flatrack Handling - container modification, provision for container handling equipment, solving problems of unstuffing 2nd, 3rd tier containers must be achieved; 3) Cargo Handling Equipment - investigation of off-the-shelf commercial equipment must be increased; 4) Crane Operations - heavy cranes will require trained personnel; floating cranes or barge mounted cranes should be operated by Amphibious Construction Personnel; 5) LASH and SEABEE barges are recommended for use; 6) VERTREP Unloading Operations - equipment developmental, and investigation is recommended in all areas including from containerships, helicopter landing areas, from LASH and SEABEE barges, and the verification of unloading rates for helicopters.

Navy Facilities Engineering Command. Army/Navy Test of Off-Shore Discharge of Containerships. Port Hueneme, CA: 1971. (DTIC - AD 921514L)

Study to evaluate and observe offshore discharge of various containerships in a sea environment to test operational techniques with available container handling equipment. The intent of the evaluation was to determine the optimum methods of interface among containerships, transportation terminals, lighterage and port clearance units, heavy lift helicopters, and receiving terminals normally involved in such operations. Operation of the heavy lift helicopter proved successful at sea state 3 as well as in reduced visibility conditions. Recommendations included: 1) the development of improved techniques and equipment to stack containers quickly and accurately allowing them to be placed and locked onto a MILVAN chassis; 2) remedy problems of escape and rescue from a container cell; 3) safety hazards created by lack of suitable access inside a hold to be solved; 4) although no experimentation

was conducted, mooring adaptations/modifications for high-wind/high-current conditions are advised.

Naval Facilities Engineering Command. Army/Navy Test of Offshore Discharge of Containership I: 5-9 December 1970. Washington, DC: 1971. (DTIC - AD 921524)

Study to evaluate and observe the offshore discharge of containerships in a sea environment. Test was initiated by the Army with the participation of the Navy to test operational techniques for handling containers with available equipment. Numerous doctrinal, equipment modifications, and procedure definitions resulted from the study.

Naval Facilities Engineering Command. Applications of the Magromover in Amphibious Logistics. Port Hueneme, CA: 1975. (DLSIE - LD 34661A)

Assessment of the operational suitability of the Magromover (an air powered device designed to move containers). Use in Marine and Navy logistics operations was evaluated. Measuring the rate of travel, maneuverability, and slope climbing ability of the Magromover were emphasized within the scope of this evaluation. Containers utilized in this evaluation ranged in weight from 5,000 pounds to 45,000 pounds. The study concluded that the Magromover meets all requirements for horizontal movement of loads while climbing slopes of up to 10 percent. It was determined most suitable for tasks where the operating surface is both flat and free of high doorsills or similar obstructions particularly in shipboard movement in confined areas.

Naval Facilities Engineering Command. Concepts for Improving Logistic Capabilities Over-the-Shore. Port Hueneme, CA: 1985. (DLSIE - LD 65109A)

Interim study describing several concepts for improving the capability and the reduction of various logistics burdens of cargo transfer facilities. The exploration and development of the Advanced Cargo Transfer Facility (ACTF) will enhance the Navy's Container Off-loading and Transfer System (COTS). A variety of technological developments are detailed including spanning and cargo handling elements and mooring elements. Development schedules/costs are included. An estimated time frame of four years is given for the completion of the remaining technology.

Naval Facilities Engineering Command. Naval Beach Group Capabilities in Support of Seaborne Mobile Logistics System (SMLS). Port Hueneme, CA: 1975. (DLSIE - LD 33127A)

Evaluation the demands posed by new cargo concepts such as large barges/20 ton containers being utilized in early follow-on supply operations for Naval Beach Group units (NBGs) as part of functions required by the Seaborne Mobile

Logistics System (SMLS). Analysis of these NBG functions were made relative to the cargo handling systems proposed for transferring cargo ashore and operations during the early-ashore time frame. Testing was conducted as part of PHIBLEX V, an amphibious training exercise. Recommendations were: 1) modification to the proposed Barge Cargo Transfer Facility (BCTF) in order to handle container cargo as well as palletized cargo; 2) large barge mooring installation and equipment; 3) appropriate lighterage such as the self-propelled causeway; 4) beach improvement including surfacing, container warehousing, and container handling equipment.

Navy Operational Test and Evaluation Force. Temporary Container Discharge Facility. 1981. (DTIC - AD B056242L)

Operational evaluation of the Temporary Container Discharge Facility (TCDF) portion of the Container Offshore Transfer System (COTS). An assessment of TDCF readiness for approval for service use (ASU) and production was determined. The recommendation of provisional ASU status was based on the following; 1) improvements/modifications to the TCDF platform to off-load containers in sea state 3; 2) modifications to the "off-the-shelf" crane (Manitowoc 4100 Series III Ranger crane) with additional counterweights; 3) published crane operating limits re: hookload, reach, vessel motion; 4) improved logistics, training, and technical manuals; 5) correction of all identified safety hazards; 6) follow-on operational testing and evaluation.

Nix, Virgil, LTC. Containerization - Surface 1990s. National War College, Washington, DC: 1985. Research paper. (DTIC - AD B093356)

Study focusing on current status of over-the-shore container logistics. Details and descriptions of equipment and vessels for discharging in-the-stream. Also includes description of Marine Corps and Navy resupply systems, especially the Marine Corps FLS container program.

OPTEVFOR Evaluation Report: Roll-on/Roll-on Discharge Facility. Norfolk, VA. November 1983. (DTIC - AD 0788142L) (COT CNO Project 299-OT-IIF)

Evaluation report to assess the operational suitability of the Causeway Platform Facility (CPF) and Calm Water Ramp (CWR) components of the Ro/Ro Discharge Facility used during a LOTS operation. Covers assessment of operability under extreme environmental stress, establishment of reliability, maintainability, availability hardware values, and adequacy of procedures relating to safety, training, and human factors. Findings indicate that the CPF and CWR are both operationally effective and suitable for use in an AOA.

U.S. Army Combat Development Command. Report of Observation and Evaluation of the Offshore Container Ship Discharge Exercise. Fort Story, VA: 1970. (DLSIE - LD 26468B)

Evaluation to provide a basis for the development of Army doctrine, equipment modifications, new equipment requirements, and definition of procedures for the discharge of a self-sustaining containership via various transport systems (OSDOC I). Thirteen areas are evaluated with recommendations for each area provided in separate Annexes to the report.

U.S. Army Combat Developments Command Transportation Agency, US Army Trans-Hydro Craft, 1975-1985, Fort Eustis, VA: 1973.*

Study addresses materiel handling and transport equipment in support of over-the-shore discharge of containerships.

U.S. Army Training and Doctrine Command. Independent Evaluation Lighter Air Cushion Vehicle 30 Ton (LACV-30). Fort Eustis, VA: 1978. (DTIC - AD B028812L)

Independent Evaluation Report (IER) to assess the operational capability and suitability of container handling equipment, and the adequacy of the military hardening of the LACV-30. Included are assessments of reliability, availability, and maintainability characteristics; doctrine and method of employment. Details of the test,statistics, and findings are also included.

Detailed conclusions/recommendations follow each of the 24 areas evaluated including the ability of the LACV-30 to handle adequately up to three 8'x8'x20' ANSI/ISO containers.

U.S. Army Transportation Center. After Action Report: Evaluation of Off-Shore Discharge of Containerships. Fort Eustis, VA: 1970. (DTIC - AD 722796)

Report to evaluate procedures and techniques pertaining to offshore discharge of containerships. A 5-day simulation employing MILVAN containers of 5-20 tons, various surface lighterage, and helicopters was utilized. Findings were generally favorable with numerous recommendations for handling equipment modifications being made.

U.S. Naval Operations. Operational Evaluation of the Elevated Causeway Elements of COTS Operational Test and Evaluation Force. Norfolk, VA: 1979. (DTIC - AD B040902)

Study to evaluate the operability of the Elevated Causeway (ELCAS) element of the Container Off-load and Transfer System (COTS) during a full scale

amphibious exercise (Solid Shield). Determination was made as to its readiness for service use and production. Detailed equipment description is provided. Recommendations made were: 1) to approve the ELCAS system for use, 2) to provide Commanders with detailed ELCAS space requirements for amphibious operational planning prior to delivery of the first system, 3) to use ELCAS on a rotating basis during LANT/PAC annual fleet exercises in order to provide training continuity, 4) to incorporate ELCAS operation into the official Naval Beach Group mission and to determine additional billets required to support erection and operation of the production system, and 5) to update the TEMP 299 database to reflect the results of this study.

Vaughters, T.G. Roll-on/Roll-off (Ro/Ro) Discharge Facility Tests with MV CYBNUS and SS Atlantic Bear. D.W. Taylor Naval Research and Development Center. November 1983. (DTIC - AD A139346)

Evaluation study to assess the viability of using a Ro/Ro Discharge Facility concept for both on-loading and backloading of military vehicle cargo off-shore in an AOA with non and self sustaining vessels as required in a LOTS operation. Utilizing the self sustaining CYGNUS and the non-self-sustaining SS Atlantic Bear with a representative number of causeway ferries and LCVs, the operational test was designed to validate procedures developed during a March 1983 Ro/Ro Discharge Facility evaluation. Generally the hardware and procedures to be tested fell into 5 categories:

- -suitability of ramps and accompanying systems.
- -testing of system technical manual procedures.
- -validation of assembly procedures.
- -identify minimum number of personnel, equipment, lighterage required to assemble, transport, position, and moor the CPF.

The results of the evaluation revealed that the Discharge Facility can safely and efficiently off-load or back-load military vehicles from self-sustaining and non-self-sustaining Ro/Ro merchant vessels in Sea State 0-2 conditions. In addition, the study's conclusions enumerate 20 general operational and hardware specific recommendations to facilitate "safe and efficient use."

8.0 GENERAL

Acquavella, Joseph and Robert Schneider. Rail Service in the Year 2000 and the Impact on Mobilization. 1985. (DLSIE - LD 64665A; DTIC - AD B093970). Student Research Paper, Industrial College of the Armed Forces, National Defense University.

Paper describes trends in the railroad industry, particularly since 1980 and their potential impact on mobilization. Suggests monitoring of container size, flatcar fleet and rail abandonments.

Angel, D., et al. Containerization - A Snapshot of the 1980s. National Defense University. 1983. (DTIC - AD A137964) Student Paper.

Study assesses the DOD community's movement toward adopting containers as the primary means of sustaining deployed combat troops. The authors identify and evaluate service policy guidance, management strategies, operational planning, and questions concerning doctrine and hardware. The findings of the study characterized the DOD commitment to a container policy as "decentralized and fragmented, and hence, less effective." The study recommends that the DOD through the Intermodal Steering Group or through a similar organization, 1) reassert control over containerization, 2) make greater efforts at assuring adequate funding, 3) increase R&D in the use of containers, and 4) require the inclusion of mobility and sustainment criteria in all future post exercises.

Bernhardt, Karl-Heinz. Double-stack Unit Train Container Service: Its Commercial Impact to the Military Shipper. Monterey, CA: 1986. Thesis. (DLSIE - LD 69937A)

Detailed explanation of both the economic incentives for the development of double-stack container trains and engineering aspects. Discussion on the impacts on DOD references the study currently underway by MTMC/TEA.

Bryan, William, MAJ. An Analysis of the Implications of A Department of Defense Single Manager for Containerization. Air Force Institute of Technology, Wright-Patterson AFB, OH: 1971. Thesis. (DTIC - AD 891388)

Study to evaluate the effects of having a single manager for containerization within DOD. Identified issues best dealt with through single manager and those issues that are best dealt with by the Services. Concluded that Service-specific supply distribution patterns precluded single manager in this role because it would infringe on the authority of each Service to support its mission. Did concluded that role single manager's role to avoid duplication of efforts was important. Includes background on single manager structure in DOD.

Department of the Army, DOD Project Manager, Surface Container Supported Distribution System Development. Surface Container supported Distribution System - Department of Defense Master Plan. Washington, DC: 1973. (DLSIE - LD 29678)

Master Plan for coordinated development of a surface container-supported distribution system. Key document for the DOD Project Manager, established in 1971 after the Joint Logistics Review Board recommendation. Contains program description, tasks and milestones for the scheduled three-year duration of the project. System concept included.

Department of Defense. Congressionally Mandated Mobility Study. (U) Washington, DC: April, 1981. (Secret)

(U) Study to determine overall U.S. military mobility requirements including mix of airlift, sealift and propositioning required in areas of potential conflict during 1980s. Forces deployed limited to those programmed for 1986. Used planning factors for CONUS movements and assumed reception ports and airfields were adequate for flow. Four scenarios considered; lift shortfalls existed for all. Difference between lift demand and capability represented a shortfall. Looked at alternatives to reduce shortfalls, particularly in early days.

(U) Container related:

(1) Need to better utilize container ship resources. In scenario simulations, fast container ships went unused because loading of unit equipment was not readily accommodated. Systems that improve containership utilization (flat racks, SEASHEDS) merit attention.

(2) Need program to improve ship off load capability in austere environments. LOTS programs should receive heightened visibility. Most of the unused container ships are non-self-sustaining.

Department of Defense. DOD Sealift Study. (U) Washington, DC: March, 1984. (Secret)

(U) Study examines requirement for ships, prepositioning and cargo off-load capability to meet Defense Guidance 85-89 deployment objectives for world-wide, conventional war. Inter-theater movement requirements for all deploying units (excluding ships but including forces moving on amphibious lift), plus ammunition and resupply for all forces. Study used as basis for estimating container requirements for Container Requirements and Availability Study - 1985 (U).

(U) Inter-theater movement modeled using MIDAS (Model for Intertheater Deployment by Air and Sea). Determined sealift capability may exist to meet objectives in terms of amounts and types of materiels but may not exist to meet schedule for particular units. May need more efficient scheduling.

(U) Also, Army should review deployment sequence development process to ensure that selection of specific units to fill "type unit" requirements is done to minimize geographic dispersion of units with similar RDDs.

General Accounting Office. Container-Oriented Logistics System--Will It Be Ready When Needed by the Department of Defense, GAO LCD-77-234, 1977.

This document describes general advances made by DOD in developing a container-oriented distribution system, following from the recommendations of the Joint Logistics Review Board in 1970. Provides management review of the 1971-1976 time-frame (when there was a DOD Program Manager for developing the system), and in the first two years after adopting a decentralized "lead service" approach. Found critical elements of the system still lacking in 1977, including centralized management, a comprehensive container system plan and a LOTS/OSDOC capability. Also, indicates that acquiring the appropriate MHE has been slow and that the issue of using flatracks (from the commercial sector) for large equipment had not been resolved. Containerization of ammunition is not addressed in the report. Makes observations on the original management and the inadequacies of the first Master Plan for a Container-Supported Distribution System. Makes specific recommendations for solving some deficiencies.

General Accounting Office. Material Handling Equipment - A Weak Link in the Defense Logistics Chain. Washington, DC: August 1979. LCD-79-212.

Assessment of the capability of Army and Air Force units in Germany and Korea to handle peacetime and surge-condition volumes of cargo. Goal to document the readiness and adequacy of MHE. Examination in light of changes of breakbulk fleet to containerization which necessitates DOD's capability to handle containers and unstuff contents. Found that on-hand MHE could not handle requirement. Recommended that replacement of old equipment and acquisition of new be programmed.

Harbridge House, Inc. A Study of DOD Organization for Transportation and Traffic Management. Boston, MA: 1980.

Study conducted for OASD (MRA&L) to analyze functional relationships among the three Transportation Operating Agencies. Interrelationships were examined and operations were evaluated in terms of responsiveness, efficiency and cost-effectiveness under peacetime, emergency and wartime conditions. Of particular interest is the evaluation of thirteen activities in moving containerized cargo under the three conditions. Generally, the evaluation found that performance of many of the functions would be unsatisfactory under wartime conditions. The study raised issues about the fragmentation of traffic management responsibility between MTMC and MSC and proposed organizational restructuring alternatives. Particular focus was on the creation of a Unified Traffic Management Command.

Hinneburg, Patricia, et al. Service Logistics: Concepts Organization and Planning. Washington, DC: 1985. Instructional Material for NDU/ICAF. (DTIC - AD B093663; DLSIE - LD 64978A)

Explanation of the DOD's logistics organizations. Detailed sections for each Service and for DLA.

Information Spectrum, Inc. Container Facilities Requirements. Arlington, VA: 1977. (DTIC - AD C016948L)

Report analyzed, determined problems and requirements, and recommended solutions for the loading and discharge of containerships. The study simulated movement of Five Year Defense Plan (FYDF) forces to Europe, and origin-to-destination movement of CONUS capabilities. Recommendations included: 1) containership balance and utilization planning between ammunition, resupply, and unit equipment; 2) increased containerization of ammunition; 3) the research and development of specialized container requirements; 4) the research and development of over-the-beach container handling facilities/equipment for certain case scenarios.

Institute for Defense Analysis. Increased Use of Containerization (U). Alexandria, VA: 1988. IDA Report R-317 (Secret)

(U) Analysis of the use of containers and sealift enhancements (flatracks and SEA SHEDs) for unit equipment to utilize non-self-sustaining containerships available to USCENTCOM for deployment. Study also addressed procedures to ensure that matching the capability of these ships with lift requirements is considered in the deliberate planning process.

(U) USCENTCOM's automated Cargo Containerization System (CCS) was used to evaluate materiel for containerizability in regular containers and in ship enhancements. CCS runs against TPFDD and for this study determined containerizable cargo not coded as such. Raises issues for cargo coding in the deliberate planning process to match lift availability.

Joint Logistics Review Board. Logistic Support in the Vietnam Era, Monograph 7 - Containerization. Washington, DC: 1970.

Principal document that served as the "blueprint" for DOD efforts to develop a container-oriented logistics system in the 1970s were based. Recommendations led to the establishment of the Army-led Project Manager and the Air Force-led Land-Air-Land Task Group. The American Power Jet Company study, Containerization - Based upon Lessons of the Vietnam Era, is Appendix A to Monograph 7. Concluded that DOD logistics system had to be container-based in the future and that Service, DLA and TOA procedures had to be coordinated in support of the system, while retaining Service-specific requirements.

Report describes the experiences of using containers in Vietnam and the benefits that would have accrued had they been used more extensively. Recommended the maximum use of containers saying the DOD should adopt a policy that all oceangoing cargo that will fit in a container should move in a container, with deviations treated as exceptions. Documents facts and findings related to three main areas: (1) cargo and cargo distribution, (2) equipment and facilities and (3) management and control.

Logistics Management Institute. A Guide to Interagency Support for DOD: Military Force Deployment, Civilian Noncombatant Repatriation and Military Patient Regulation. Bethesda, MD: 1986. (DLSIE - LD 62950A)

Guide to the roles, responsibilities and relationships of Federal departments and agencies involved in the deployment of military forces, the repatriation of civilian noncombatants and military evacuation and regulation. Of particular interest is the discussion of domestic and international deployment support and the descriptive material on the roles of the TOAs and various Offices of the Secretary of Defense, and on the OPLAN development process.

Logistics Management Institute. Assessing Department of Defense Logistics Systems Capability. Washington, DC: January, 1984. (DLSIE - LD 58407A)

Discussion of ways in which JCS' Joint Operations Planning System (JOPS) could provide data to OASD (MRA&L) to assist in determining current logistics systems capabilities. These data would provide basis for the Illustrative Planning Scenario specified in the Defense Guidance.

Study contains details on deliberate planning process, especially the constraints considered by the TOAs in determining the feasibility of an OPLAN. These data provide insights for considering the impacts of containerization on the scheduling of movements by the TOAs.

Logistics Management Institute. DOD Cargo Management Systems. Bethesda, MD: 1985. (DLSIE - LD 65108A)

Detailed description of cargo management systems in DOD. Conclusions focus on the importance interface among systems used by the Services, TOAs and DLA. Indicates need for long-range system automation plans to monitor development of system compatibility to ensure that DTS operates as an integrated system.

Military Traffic Management Command. Container Requirements and Availability Study - 1985. (CRAS-85) (U). Washington, DC: 1984. (Secret)

(U) Study to estimate the inventory and availability of containers to support the DOD Sealift Study which focuses upon a global, conventional war. CRAS-83

had assessed commercial container adequacy to support NATO wartime requirements as outlined in SMRP-83, and CRAS-84 had addressed a Persian Gulf contingency outlined in SMRP-84. Requirements to support the containerization of ammunition and general cargo are considered on a time-phased basis. U.S. container inventories (current and projected) are presented, and estimates of availability to meet time-phased requirements are made. Chassis inventories presented. Classified conclusions address U.S. capability of meeting container requirement. Observations and recommendations for addressing additional issues that impact the conclusions are listed.

Military Traffic Management Command. DOD Container Delivery System. MTMC Pamphlet 55-13. 1983.

Description of the DOD peacetime container delivery system including operations, functions, management responsibilities, and relationships between MTMC and MSC.

Military Traffic Management Command, Transportation Engineering Agency. Korean Ports and Transportation Systems Capability Study (U), Volume I: Introduction and Intertheater Analysis (U). Newport News, VA: 1985. MTMC Report TE 83-3h-46. (Secret)

(U) Analysis of intra-CONUS and intertheater lift requirements for OPLAN. Examines outload capabilities compared to requirements. Containerization addressed in relation to installation and depot outloads and line-haul capabilities. Also addressed required capabilities for containerized ammunition outload. Recommendations based upon possible shortfalls.

Military Traffic Management Command, Transportation Engineering Agency. Korean Ports and Transportation Systems Capability Study (U), Volume II: The Ports of Korea, Part 1, (U). Newport News, VA: 1984. MTMC Report TE 83-3h-46. (Secret)

(U) Results of detailed survey of 22 Korean ports conducted in 1983. Reference guide to port characteristics that impact unit equipment, resupply and ammunition deliveries. Goal also to establish priority uses for each port based upon capabilities, identify alternative ports and berths and develop throughput estimates. Developed port ranking scheme based upon characteristics of the ports, including links to intratheater line haul infrastructure.

Military Traffic Management Command, Transportation Engineering Agency. Korean Ports and Transportation Systems Capability Study (U), Volume II: Port Throughput Capabilities, Part 2, (U). Newport News, VA: 1985. MTMC Report TE 83-3h-46. (Confidential)

(U) Provides estimates of throughput capabilities for ports described in Volume II, Part 1 of the report. Estimates based upon moving general cargo with existing MHE. Use of specialized units, e.g., US or ROK terminal service units, not considered.

Military Traffic Management Command, Transportation Engineering Agency. Korean Ports and Transportation Systems Capability Study (U), Volume III: Intratheater Mobility Analysis (U). Newport News, VA: 1985. MTMC Report TE 83-3h-46. (Secret)

(U) Analysis of the transportation systems in Korea for moving unit equipment, general resupply and ammunition to upcountry employment, reception and staging cites. Goal to evaluate the adequacy of the infrastructure and make recommendations for augmentations. Five (of sixteen) major findings relate to containerization as do seven (of fifteen) recommendations for action.

Military Traffic Management Command, Transportation Engineering Agency. Management and Stuffing of Containers. Newport News, VA: 1975. USATEA Pam 55-2.

Information pamphlet on container management and container stuffing techniques.

Military Traffic Management Command, Transportation Engineering Agency. Marine Terminal Operations. Newport News, VA: 1978. (DTIC - AD A055537)

Supplement to "Review, Derivations, and Procedure," Manual Procedures for Estimating Marine Terminal Throughput, Part One, MTMC Report 3-44. This document examines vessel types, concepts, and general terminal operations for breakbulk, containerized cargo, barge ships, and roll-on/roll-off operations. Examples of existing terminals and principle design features are given to aid in the comprehension on Marine Terminal Operations.

National Defense Transportation Association, Containers in Support of the National Defense, 1981.

Report in support of OSD and JSC by industry representatives to address concerns about the container fleet and how to meet the need for containers in peace, wartime and emergencies. Specific concern about perceived decline in the 20-foot fleet.

General conclusions include:

1. DOD is container-oriented but not container-organized.

2. Source to receiver logistics system must be designed.

3. Container system development efforts must be prioritized.

4. Amorphous condition of DOD's container "system" can cause dysfunction in wartime.

5. There must be a central container system command to cover all aspects of container movements.

6. Conversion from peace to war demands prepositioning of stocks in containers.

7. The majority of U.S.-owned 20-foot containers are leased to foreign carriers with no mechanism for legal recapture. DOD must have the legal right to commandeer and direct all U.S. intermodal container assets.

8. A standby intermodal container production base is essential for readiness.

9. Standby contracts should include container repair and maintenance.

Study made recommendations to solve problems.

Organization of the Joint Chiefs of Staff. A Report on Strategic Mobility Requirements and Programs (SMRP 82). Washington, DC: 1977. (Declassified 1986)

Comprehensive study of strategic mobility requirements and deployment alternatives for a NATO/Warsaw Pact conflict. Intra-CONUS analysis prepared by MTMC and intratheater analysis by J-4. These analyses will be gross assessments of overall CONUS and theater transportation systems to support strategic movements. Six major study areas: threat analysis, force analysis, movement requirements review, mobility resources review, policy review and mobility alternatives. Examines movement requirements vice current capabilities for unit equipment, resupply and ammunition. Findings pertinent to containerization:

Containership utilization and planning needs to consider balance between ammunition, resupply and UE. Containerization up to the level that will fit in a standard container is cost effective. Increased containerization of ammunition is required for effective use of sealift assets.

Organization of the Joint Chiefs of Staff. Strategic Mobility Requirements and Programs - 1983. (SMRP 83) Washington, DC: 1978. (Declassified 1986)

Follow-on to SMRP-82. Expanded review and analysis of alternative strategic mobility programs for a NATO central region - Warsaw Pact conflict.

Appendix Q contains an analysis of containerization options for ammunition and unit equipment. Goal of the analysis was to determine actions/programs that would improve utilization of containerships. Looked at optimum mix of containerization of UE and ammunition to guarantee earliest delivery of forces at lowest cost. Method was to vary the level of containerization of each, evaluated against using the fleet earmarked for deployments. Considered the use of standard containers, 20-foot flatracks and 40-foot flatracks.

Conclusions based upon containerization analysis:

1. Existing programs to increase amount of containerized ammunition should be supported. (Note: At the time of the study, MOTSU could handle 500 containers per day, with plans to upgrade to 1,000 per day). Also, should support expansion of CONUS west coast ammunition port through conversion of one of two VSSs at Concord to container-capable VSS to improve ammunition delivery and permit general purpose breakbulk ships for UE.

2. The Army should consider containerization of UE., especially that of combat service support units. Analysis showed this would improve force closure.

3. Improvements in force closure due to use of 20- and 40-foot flatracks do not appear to justify a DOD flatrack acquisition program. Needs further study.

Study also examined throughput capabilities of APODs and SPODs. Aerial ports came closest to meeting requirements. SPODs capability fell short of requirements for both container and breakbulk discharge. Forward movement capability was also far less than required except for medium truck companies organized in container version.

Organization of the Joint Chiefs of Staff. Strategic Mobility Requirements and Programs in a Persian Gulf Contingency (SMRP-84). Washington, DC: 1981. (Declassified 1986)

Persian Gulf in-depth analysis which examined transportation requirements From CONUS to PODs, but not to forward areas in theater.

Analyzed impacts of higher levels on containerization on cargo deliveries and ammunition port workloads. Used a base case and three alternatives cases which varied the containerization of Army UE, ammunition, resupply.

Containerization conclusions:

1. Containerization of Army UE decreased the payload efficiency of containerships causing ammunition and supply deliveries to lag compared to scenario when no Army UE is containerized.

2. Increased containerization of ammunition (above 25 percent) without containerizing Army UE improved closure. Increasing ammunition containerization beyond 50 percent was marginally effective in achieving improvements.

3. Increased containership berthing and port workload requirements resulting from increased ammunition containerization did not exceed planned (1984) improvement to east coast ammunition ports.

Identified need for accurate information on origins of resupply and ammunition, especially on actual containerized movements. Recommended review of installation outload report.

Policy and Management Associates. Double-stack Trains: Economic and Institutional Factors. Boston, MA: 1986.

Study for the Office of the Secretary of Transportation through the Transportation Systems Center. Description of the emergence of double-stack container service.

University of Florida. Unitization and Deunitization in Physical Distribution Systems: A Qualitative and Quantitative Analysis of Containerized Cargo. Gainesville, FL: 1970. (DTIC - AD710226)

Mathematical and economic analysis of general containerization. The report studies the following problems using analysis and algorithms: 1) determination of a loading pattern for packages inside a container; 2) determination of a trade route for all container service.

U.S. Army Materiel Command. Container System Hardware Status Report. Ft. Belvoir, VA: Annual publication.

Document contains description and status of container and container equipment under DOD development. In 1979, the JCSG directed that the status of Navy and Air Force as well as Army be included. Contains separate sections for each Service and is updated annually.

U.S. Army War College. Technology and Its Effect on Military Ocean Requirements. Carlisle Barracks, PA: 1973. (DTIC - AD779562)

This study examines how advances in technology, especially containerization, impacts the military. The study concludes that military planners must rethink procedures, organization, and equipment needs for each mission as new technological advances are utilized.

U.S. Department of Transportation, Transportation Systems Center, Container Management System - Functional Description. Cambridge, MA: 25 October 1985, Study Number: PM-46-U9-103.

Functional description (FD) of a Container Management System (CMS) for MTMC which would provide a single automated system to monitor DOD container movements in peace and war. CMS to provide access to consolidated database of origin-to-destination data derived from other-DOD and carrier systems. Includes description of capabilities required by MTMC to accomplish its wartime container management functions as DOD's single manager for containers.

FD describes relationship of CMS to other on-line and planned DOD systems. Describes current system for container information. Key feature will be incorporation of an Automated Carrier Interface (ACI) using Electronic data Interchange (EDI) standards between ocean carriers and MTMC.

Deficiencies in the current system, which CMS is expected to correct, are identified. Improvements are specified. Document describes flow of automated information when CMS is in full operation. Equipment, software, and interface requirements are addressed.

U.S. Department of Transportation, Transportation Systems Center, Preliminary Economic Analysis - Container Management System. Cambridge, MA: 20 September 1984. Study Number: PM-46-U9-101.

Accompanying document to Functional Description for MTMC's Container Management System. Analysis of four alternatives, based upon the current system and expected improvements. Considers worldwide impacts. Costs to develop, implement and operate CMS computed for preferred alternative. Quantifiable benefits for improvements to current operations are estimated. Non-quantifiable benefits are identified.

U.S. Department of Transportation, Transportation Systems Center. National Defense Transportation Model System: Functional Analysis and Economic Analysis, Draft Final Report. Cambridge, MA: 1988.

Analysis of a CONUS National Defense Transportation Model for the Military Traffic Management Command. Model to provide improved network analysis capabilities including these applications: identification of key strategic

transportation links, analysis of infrastructure problems and policy impacts, analysis of traffic management problems, provision of network analysis capability for MTMC's Headquarters Crisis Action Model System.

Document describes current capabilities, proposed future capabilities and detailed descriptions of applications. Also includes cost estimates for development of alternative systems.

*Not available for review, but cited in other works.