# CHAPTER 5
# WATER TRANSPORT AND TERMINAL OPERATIONS

Terminal operations and water transport, which includes strategic sealift and the logistic support provided by Army watercraft, are essential to projecting and sustaining forces engaged in a range of military operations worldwide. This chapter contains detailed information on all aspects of port operations and terminal planning, strategic sealift requirements and vessel types, and Army vessels and equipment.

## WATER TRANSPORT AND TERMINAL UNITS

The transportation terminal battalion is generally the senior terminal activity in the theater of operations. Battalions are normally assigned to a transportation composite group. Assigned or attached units vary from command to command depending on the mission. The composite group is a combination of units most commonly assigned to the theater. It is among the "first in and last out." The 7th Transportation Group (Composite) from Fort Eustis, VA, deployed during Operations Restore Hope (Somalia), Restore Democracy (Haiti), and Vigilant Warrior (Saudi Arabia). In accomplishing its mission, the composite group–

- Operates common user APODs/SPODs for reception, discharge, and clearance of unit equipment, sustainment supplies, and retrograde cargo.
- Provides theater local and line-haul truck transportation support.
- Establishes and operates coastal and inland waterways.
- Supervises and/or conducts rail operations and maintenance of rail lines.

See Appendix A for water transport and terminal unit TOE data.

## MANAGEMENT AND OPERATION OF STRATEGIC, COMMON-USER CONTINGENCY SEAPORTS

The MTMC is generally considered DOD's expert on seaport operations and capabilities. A USTRANSCOM component command, it manages and operates 10 CONUS and 15 OCONUS common-user seaports. MTMC performs the following activities on a routine or ongoing basis:

- Opens, manages, and operates contingency ports supporting military exercises.
- Books DOD cargo with commercial carriers.
- Contracts for terminal services.
- Interfaces with HNs on port-related issues.
- Prepares ship manifests and other documents.
- Develops and operates seaport management systems.
- Conducts surveys of seaport capabilities throughout the world.

Despite this acknowledged expertise in port management, theater CINCs do not always call on MTMC to assist in planning SPOD operations. MTMC's supporting role in implementing these plans may be inconsistent or ill-defined. Lacking specific doctrine and CAAs, theater port management has been arranged on an ad hoc basis. The following deployments confirm this point:

- Desert Shield/Desert Storm (Saudi Arabia). MTMC was not responsible for managing SPODs during deployment. Gradually, MTMC was assigned theater responsibility and eventually took over port management during the redeployment and retrograde phases.
- Restore Hope (Somalia). MTMC deployed three personnel temporarily to conduct port assessments. They were not assigned a port management role.
- Rwanda Relief Effort. MTMC deployed to Mombasa, Kenya, and performed the full range of port management functions.
- Uphold Democracy (Haiti). MTMC was among early deployers but did not have full responsibility for port management.
- Vigilant Warrior (AWR3 discharge). MTMC was among the first on the ground; providing the CINCCENT with predeployment planning for port operations, contracting for facilities and commercial stevedore support, and performing the full range of port management activities.

Experience gained in these operations demonstrates the need for and value of more consistent port management doctrine and seaport organization similar to that employed at aerial ports by AMC. DOD has a substantial investment in the CONUS port infrastructure. However, there is no similar deployable management force structure and doctrine for operating overseas port facilities.

A port management organization with a family of port and cargo management systems is needed to incorporate advances in information processing and communication technologies. Reduced inventory levels and increased dependence on direct vendor support, as envisioned by the BD concept, also require such an organization. To support the ITV/TAV elements of BD, a strategic distribution system must be effectively managed. Movements must be documented at every echelon in an accurate and timely manner.

A set of responsibilities has been defined that will capitalize on MTMC's expertise and core competencies at contingency SPOEs/SPODs. It solidifies MTMC's role in all scenarios as an early deployer to any theater to provide the CINC with expert port management, transportation engineering, and transportation systems support. The result will be synchronized intertheater movement between strategic and common-user SPOEs and SPODs. In laying the groundwork for the port management concept, the following must be considered:

- Military capability is required to manage, and may be required to operate, the port(s) in the theater of operations.
- The supported CINC determines command and control relationships between units with responsibilities at theater ports.
- The specific responsibilities and command relationships normally detailed in the CAA will be followed.
- Force structure, command relationships in the operational theater, and some aspects of port management and operation functions vary from one operation to the next and will be METT-T driven based on each scenario.
- Army doctrine will designate MTMC as the port manager and the transportation group (composite) the port operator.
- Where discrepancies exist between Army doctrine and an individual CAA, METT-T and the CAA will govern.

Under the port management concept, the port manager and the port operator each have specific, clearly-defined roles and functions.

### Port Manager

As port manager, MTMC supports the JTF/CTF/CINC staff. The MTMC performs the following functions:

- Participates in the CINC OPLAN development and analysis.
- Conducts assessments of contingency ports to include a transportation engineering assessment.
- Advises the CINC as to the appropriate mix of military and civilian port operating capability required for a given contingency based on METT-T.

- Establishes liaison with designated HN port authorities for acquiring water terminal facilities and related services.
- Develops statements of work and contracts for stevedoring and related terminal services where such services are commercially available.
- Operates WPS, ICODES, IBS, and other theater water terminal transportation/logistics ADP systems.
- Books intertheater and intratheater surface cargo on MSC controlled common-user ships and liner service.
- Provides common-user container management services.
- Administers MSC ocean carrier contracts and vessel charters.
- Arranges for transition of military operating capability to a commercial contract or HNS.
- Participates in planning and execution of redeployment.
- Work loads the port (i.e., provides vessel discharge priorities, ship schedules, and manifest data to the port operator based on the theater commander's intent).
- Provides intertheater documentation oversight, documentation services for MSC negotiated commercial liner contracts, and other documentation services as determined by METT-T.
- Provides communication/ADP technical support for transportation/logistic ADP systems related to theater water terminals.

## Port Operator

As port operator of a contingency SPOD, the transportation group (composite) or transportation battalion (terminal) will perform various functions. These functions include the following:

- Beach and port preparation and improvement.
- Cargo discharge and upload operations.
- Harbor craft services.
- Ship-to-shore movement of cargo and lighter control.
- Heavy lift services.
- Beach and port clearance command and control.
- Cargo documentation for reception, staging, and onward movement of personnel, equipment, and supplies to provide ITV to the supported CINC.

## Concept of Operations

The following actions/steps are key to properly executing the port management concept:

- During the TPFDD development/refinement phase of the planning process, MTMC will provide planners to the supported CINC to develop port management and port operations requirements.
- In crisis action scenarios, MTMC will provide planners to the supported CINC for SPOD assessment and TPFDD development.
- At the request of the supported CINC and at USTRANSCOM direction, MTMC will deploy an advance party to conduct port assessments, establish contact with local port authorities, and determine availability of HNS in terms of both labor and equipment. Based on the advance party assessment and other METT-T factors, MTMC will recommend the appropriate mix of military, HNS, and civilian port operating capability required to support the contingency.
- Prior to the arrival of the first vessel, the tailored port opening package – to include the balance of the MTMC Management Cell – will deploy to the theater to support SPOD management and operations.
- MTMC will perform the theater port manager function using management cells with elements located with the CINC/JTF/CTF staff and at each designated common-user SPOE/SPOD. These organizations will perform the functions necessary to control the strategic flow of cargo and information between SPOE and hand-off to the theater.
- MTMC's port management organizations will be provisionally staffed by preselected military and civilian personnel with the basic skills needed to perform contingency port management functions. These organizations will have a rapid transition-to-war capability since most of the assigned personnel will be performing functions similar in nature to their daily peacetime activities.

• Besides the personnel and skills needed to ensure port management success, port management organizations will have and be able to use high quality information management tools including WPS, ICODES, and IBS. The MTMC management cell will deploy with and operate the C3I port management center.

• A tailored transportation group or transportation battalion (terminal) will normally perform port operations functions requiring US military capability. In all cases, this organization should be operational in theater before the first vessel arrives. The port operator executes the reception, staging, and onward movement of equipment and supplies and ensures the expeditious, well-documented transfer of deploying unit equipment into the theater of operations as directed by the theater MCA.

• In keeping with the goal of freeing military units for other possible contingencies, the supported CINC should seek to transition from a military port operation to a commercial port operation as soon as tactical conditions permit. Possible alternate port operators include HNS, third country commercial contractors, or LOGCAP. While port operators may transition between different organizations during the contingency, MTMC will perform the port manager function throughout the predeployment/deployment/redeployment process.

• Where HNS and/or commercial contractors can support all port operations requirements, there will be no requirement to deploy military units to perform these functions. In this scenario, only the MTMC management cell will deploy to establish and administer actual operations through commercial contracts.

## DEFINITIONS FOR MARINE TERMINAL PLANNING

Terminal operations have a major impact on the entire transportation system. Vessel discharge and port clearance are often influenced by the capabilities of the transportation system and the receiving activities. During the planning phase of any operation involving water transport and terminal operations, these factors must be given the utmost attention. The planner should be familiar with and understand the concepts and definitions listed in this section.

### Marine Terminal Operations

Operations that involve the loading, unloading, and in-transit handling of cargo and personnel between elements of the various modes of transportation in an ocean terminal environment. The five operating functions of a marine terminal are: reception, discharge, storage, transfer, and clearance.

### Fixed Port Facility

The fixed port facility accommodates cargo discharge or backload operations. Sophisticated equipment and procedures characterize this type facility. It has extensive hardstand areas, transit sheds, shore cranes, and access to well-established, well-defined railnets and roadnets. Most modern fixed ports are designed to handle a specific type of cargo or combination of cargo.

### Unimproved Port Facility

The unimproved port facility is not specifically designed for cargo operations. An example is a pier facility frequented by fishing vessels. This type facility is characterized by its lack of sophisticated facilities and equipment. It may have a hardstand or hard surface alongside a shallow body of water and some type of simple shore crane used for loading and discharging fishing boats. The water depth and pier length are generally inadequate for oceangoing vessels. It has sparse roadnets. Railnets are probably nonexistent. Facilities may be adaptable for cargo operations; however, upgrades needed to support these operations would include MHE, transit sheds, a marshaling area, and communications.

### Bare Beach Facility

A bare beach facility has no facilities, equipment, or infrastructure available for discharging a vessel. A LOTS operation would be conducted here. The area requires considerable engineer support to develop a facility suitable for cargo operations.

### Specialized Terminals

Marine ocean terminals can be broken into categories. The type of cargo loaded or discharged determines the appropriate category. These include:

- General cargo terminal – specializes in breakbulk operations. Cargo is handled as individual pieces, making operations labor-intensive.
- Container terminal – designed for an uninterrupted, high-volume flow of containers between the vessel and land transportation. A container ship can usually be discharged within 24 to 48 hours.
- RORO facility – handles cargo on wheels. Complete discharge and backloading can be accomplished in 18 to 36 hours.
- Combination terminal – handles containers and conventional cargo in the same area.

See FM 55-60 for more information on types of terminals.

### LOLO Operations

Operations that involve loading equipment onto vessels using either shore or ship cranes.

### RORO Operations

Operations involving the loading or discharge of a ship by driving wheeled vehicles directly onto or off of the vessel.

### Administrative Loading

Administrative loading maximizes use of troop and cargo space without regard to tactical considerations. Equipment and supplies must be unloaded and sorted before they can be employed. Administrative loading is not suitable for amphibious assault operations.

### Combat Loading

Combat loading involves arranging personnel and stowing equipment and supplies in a configuration that conforms to the organization's anticipated tactical operation. Individual items must be positioned so that they can be readily unloaded at the time and in the sequence that most effectively supports the planned scheme of maneuver. The three types of combat loading are as follows:

- Combat unit loading. The loading of an assault troop organization – with its essential combat equipment and supplies – onto a single ship, in such a way that it will be available to support the tactical plan upon debarkation.
- Combat organizational loading. This system allows units and equipment to debark and assemble ashore prior to tactical employment. Its use of ship space is more economical than combat unit loading.
- Combat spread loading. The loading of troops, equipment, and supplies from a single organization onto two or more ships. This system is used to deploy organizations equipped with numerous vehicles and/or large amounts of heavy equipment. One of its key objectives is to preserve the tactical capability of the force in the event of loss or diversion of a single ship. Critical CS units such as artillery and armor are often loaded this way.

### Non-Self-Sustaining Ship

A non-self-sustaining vessel is one that is incapable of off-loading without cranes from external sources.

### Self-Sustaining Ship

A self-sustaining vessel is capable of off-loading with organic cranes.

### Supercargo Personnel

Supercargo personnel are designated (on orders) by deploying units to supervise, guard, and maintain unit cargo loaded on deploying vessels. Specific responsibilities of supercargo personnel include–

- Controlling access to cargo.
- Documenting items that cannot be repaired en route.
- Briefing the port commander at the SPOD on vehicle conditions and any unusual circumstances concerning the cargo.

For supercargo team rules and responsibilities, see FM 55-65 and Redeployment and Port Operations, Leader's Safety Guide.

### Logistics Over-the-Shore

Traditionally, LOTS has been defined as operations wherein a vessel anchored in open water was discharged into lighters, with the cargo subsequently discharged over a bare beach. The current definition of LOTS encompasses not only the capability to provide initial sustainment for early entry forces over an unimproved beach, but also the following:

- Discharge through major or minor ports inaccessible or denied to deep-draft shipping.
- Intratheater sealift of cargo and equipment.
- Support of normal fixed port operations (i.e., berthing ships, providing heavy lift floating crane service, shuttling LASHs).

The scope of a LOTS operation depends on METT-T and geographic, tactical, and time considerations. The scope extends from the acceptance of ships for off-load through the arrival of equipment and cargo at inland staging and marshaling areas. See FM 55-50 for more information.

### Joint Logistics Over-the-Shore

JLOTS is a LOTS operation conducted jointly by forces of two or more service components or by a unified commander. It involves the loading and discharge of vessels using lighters through major and minor ports not accessible to deep-draft ships or across beaches where there is no direct opposition by the enemy. JLOTS will exist in all but limited support operations.

### Port Support Activity

The PSA is a temporary military augmentation organization. Its staff consists of personnel with specific skills who assist the port commander in receiving, processing, and clearing cargo at both the SPOE and SPOD. Stateside installations are assigned specific ports to which they must provide PSAs and other logistic support for deploying units. At the SPOD, the support group designated to support the theater and combat units provides PSA personnel. The PSA is under the operational control of the port commander while ships are being discharged.

### Sea Emergency Deployment Readiness Exercise

A SEDRE is a FORSCOM fort-to-port exercise designed to train brigades on strategic deployment with the emphasis on sealift. The units are trained and evaluated on their ability to move equipment and load it onto ships within the 96-hour ASMP guideline.

## ELEMENTS OF TERMINAL PLANNING

Terminal planning elements are interrelated and interdependent. They include selecting types and numbers of vessels along with port facilities, determining terminal throughput capacity, and evaluating terminal facilities on their suitability to mission requirements.

### Vessel and Port Selection

Responsibility for selecting the types and numbers of vessels used to support a theater of operations is shared by MTMC and MSC. Vessel selection is based on the anticipated availability of ocean terminals and the type and volume of cargo that will be handled. MTMC, in coordination with MSC, recommends the SPOE for all CONUS ocean terminals (commercial and military). The following factors form the basis for recommendation:

- Required delivery date of the supported/supporting commander.
- Vessel transit time.
- Estimated load time.
- Port/berth availability.

MTMC mandates the cargo arrival times at SPOEs in the port call. The SPOE is selected by the supporting commander; the SPOD, by the supported command based on the MTMC and MSC recommendation.

The Army's principal management tool for terminal operations is FM 55-60. Other sources of information used in the initial phases of port selection and water terminal planning include:

- World Port Index Pub 150, published by the DMA. The World Port Index includes location, characteristics, known facilities, and available services for over 7,200 ports, shipping facilities, and oil terminals worldwide. It lists all ports by their present and former names, sailing direction number, and port index number. It also has charts showing the sequence of ports and examples of harbor types.
- Sailing Directions Fleet Guides, also published by DMA. Of the 47 volumes of Sailing Directions, 37 are Sailing Directions En Route and 10 are Sailing Directions Planning Guides. Each Sailing Directions Planning Guide covers one of the world's great land-sea areas.
- Guide to Port Entry, published by Shipping Guides Ltd. This British publication includes location, characteristics, known facilities, and available services for every major deep draft port in the world. It is divided into sections by country and lists alphabetically all the ports within that country. Also available from this publisher are The Ships Atlas and The Shipping Worlds Map.

For information on ordering these publications, see the References section of this manual.

## Terminal Capacity

Twenty-four hours is generally considered a complete, round-the-clock workday for terminal and related water transport operations. The workday consists of two l0-hour shifts with 4 hours taken up by meals, shift changes, and maintenance. For planning purposes, a transportation terminal service company is capable of discharging two ships at the same time. The time it takes to discharge a vessel depends on the commodity being discharged and the facility being used.

The terminal commander estimates what is needed (in terms of construction, equipment, and personnel) to increase the terminal capacity to handle the anticipated tonnage. The terminal's actual capability is based on its sustained ability to receive and clear the daily capacity over time. The following elements are key to planning a terminal operation:

- Existing terminal capacity – total tonnage and personnel that can be received, processed, and cleared through the terminal in a day.
- Terminal workload required to support the operation – target cargo tonnage and number of personnel per day.
- Base development requirements – construction, equipment, and personnel needed to increase terminal capacity to meet target tonnage.
- Terminal reception capacity – number and type of ships that can be moved into the terminal working area.
- Terminal discharge capacity – amount of cargo and personnel that can be discharged per day.
- Transfer capacity – amount of cargo and personnel that can be moved from the discharge point to the in-transit storage areas.
- Storage capacity – amount of cargo that the in-transit storage areas can hold, based on the average dwell time of the cargo.

See Figure 5-1, page 5-8, for a checklist to use in determining throughput capacity. For more information, see FM 55-60; MTMCTEA Report SE90-3D 50; and DIAM 57-2.

## Terminal Facilities

In evaluating facilities for possible use, planners should consider the availability and suitability of harbor berths and anchorages. Other considerations include wharf capacity, lighter discharge, and storage facilities. Berths and anchorages are evaluated according to the size of the vessels they can accommodate. Port capacity estimates are based on all available berthing facilities. Estimates should include all facilities suitable for handling cargo. This section discusses the factors that materially impact berthing capacity.

| Factors | Evaluation | |
|---|---|---|
| __ Channel depths<br>__ Obstructions<br>__ Enemy air activity<br>__ Enemy surface activity<br>__ Enemy submarine activity<br>__ Climate and seasons<br>__ Weather<br>__ Minefields or contaminated areas<br>__ Capabilities in combating obstacle | Evaluate to determine water terminal reception capacity | Water terminal throughput capacity |
| __ Tactical dispersion requirements<br>__ Wharf facilities<br>__ Beach capabilities<br>__ Discharge rates ashore<br>__ Discharge rates in the stream<br>__ Anchorage area<br>__ Extent of destruction or contamination<br>__ Climate and seasons<br>__ Weather and tide characteristics<br>__ Cargo-handling equipment available<br>__ Floating craft and equipment available<br>__ Transit sheds and in-transit storage areas<br>__ Availability of local harbor<br>__ Space reserved for local economy<br>__ Enemy activity | Evaluate to determine water terminal discharge (input) capacity | |
| __ Capability of rail facilities<br>__ Capacity of highway facilities<br>__ Capacity of inland waterway facilities<br>__ Capacity of pipeline facilities<br>__ Capacity of air facilities<br>__ Enemy activity<br>__ Capability of data processing facilities | Evaluate to determine water terminal clearance (output) capacity | |

Figure 5-1. Terminal throughput capacity checklist

Layout. Facility layout incorporates a number of features that affect the suitability of a terminal. Planners should evaluate facilities with these factors in mind:

- Adequacy of approaches.
- Stacking space on the landward side.
- Raised or depressed tracks.
- Stuffing and stripping sheds.
- Truck backup for stuffing and stripping sheds.
- Open storage space.
- Transit shed space.
- Number and size of transit shed doors.

Other important considerations are curbs, fences, surfacing material, depth of water alongside at high and low water, and location of on- and off-loading ramps.

Weather. Weather has a direct bearing on berth use and capacity, especially under extreme conditions.

Alignment. Excessive angle points or curvatures along the wharf face reduce usable linear footage.

Wharf construction. Deck strengths of piers, wharves, and transit shed floors are extremely important. To determine if load capacity is adequate, look at the current use of the area. If a certain cargo is normally handled, a fair load capacity evaluation can be made. The ideal load capacity is 800 or more pounds per square foot; 500 or fewer pounds per square foot is considered marginal to unacceptable. Compare the height of the wharf or pier deck to the rise and fall of the tide. This factor is significant when considering ramp use on RORO ships.

Several factors limit the use of the stern or side ramp on RORO vessels. One is the distance between the top of the pier and the water at MLW. If the distance exceeds the angle limitations of the ramps, the side or stern opening may be below the top of the pier. On certain vessels, the ramp angles may be excessive because ramp openings are too far above the pier. Vessel draft and range of tidal change also contribute to this problem. The decision as to whether a ship can use its stern or side ramps for loading during a specific period should be made on a case-by-case basis.

Work space must be sufficient to allow the unloading and clearing of cargo without delay. Work space is determined by type of wharf, length and width of the apron, exits and decking, type of cargo handled, and anticipated tonnage.

While other considerations may cause variations in berth dimensions, the loaded draft of the ship is always the controlling factor. Besides their measured LOA, vessels need 60 to 70 feet of wharf space for their mooring lines to be properly extended. See Table 5-1, page 5-10, for berth specifications.

Lighter discharge. Wharves used by lighters should be within a reasonable distance of adequate anchorages and moorings. Lighter berths are assigned in units of 100 feet for each lighter (to the nearest 100 feet). The unit measurement must be used realistically. Disregard wharf length that exceeds 100 feet but is less than the next l00-foot unit. A 350-foot wharf accommodates three lighters at the same time. All alongside berths with depths less than 18 feet are considered lighter berths.

Temporary storage. Break-bulk cargo can be temporarily stored in open or covered areas. To determine usable square footage, allow for fire lanes as well as center, intersecting, and working aisles. To determine usable cubic footage, allow for lost height in stocking odd-shaped items and for height restrictions caused by lighting and sprinklers. The following formulas enable planning for open or closed storage:

$$\text{Usable square feet} = A \times .55$$
$$\text{Usable cubic feet} = A \times B \times .45$$
$$\text{Measurement ton capacity} = \frac{A \times B \times .45}{40}$$

where:
A = available square feet
B = height available in feet of storage areas.

Open storage. Allowing 50 percent space for surge and security, about 10,000 square feet are needed for each 1,000 MTONs of cargo (10 square feet per MTON). Average stock height is 6 feet or two pallets high.

Covered storage. Approximately 7,500 square feet are required for each 1,000 MTONs of cargo (8 square feet per MTON), allowing 50 percent space for surge and security. Average stock height is 8 feet or two pallets high. Ten percent of each day's target tonnage will require covered storage.

Long-term (open or covered) storage. In a port area where temporary storage will extend for more than five days, the following formula is used to compute the storage area required:

$$\frac{\text{MTON/mo}}{2} \times \text{sq ft/MTON} \times \frac{\text{days storage}}{30} = \frac{\text{sq ft}}{\text{space}}$$

For open storage requiring 10 square feet per MTON:

$$\frac{\text{MTON/mo}}{2} \times 10 \times \frac{\text{days}}{30} = \frac{\text{sq ft open storage}}{\text{space}}$$

For covered storage requiring 8 square feet per MTON:

$$\frac{\text{MTON/mo}}{2} \times 8 \times \frac{\text{days}}{30} = \frac{\text{sq ft covered storage}}{\text{space}}$$

Cargo clearance. Cargo clearance is the act of moving cargo from shipside or temporary storage to its first destination outside the terminal area. Prompt clearance enhances the efficiency of the total theater logistic system. Cargo dwell time affects storage area capacity and is detrimental to terminal throughput capacity.

See Figure 5-2, page 5-11, for a typical terminal facility layout. For more information on terminal facilities, see FM 55-60.

## LOAD AND DISCHARGE OPERATIONS

Thorough planning is crucial to the expeditious loading and unloading of strategic sealift vessels. Experience in military operations such as Operation Desert Storm and REFORGER provides a basis for determining realistic load, discharge, and port times.

### Loading Operations

The amount of cargo that can be placed in a vessel varies according to the skill and compactness with which it is stowed. Proper stowage ensures that the cargo arrives at its destination undamaged and that as much cargo as possible is loaded in the available space.

Vessel load planners at MTMC use CODES, a stand-alone minicomputer system, to produce RORO prestow plans during wartime surge situations. This system replaces the time-consuming manual process. The program builds an electronic prestow plan by interfacing a data base of RORO cargo received at the port (supplied by the TSM) with a ship characteristics file of the vessel to be loaded. The vessel load planner uses CODES to distribute cargo throughout the ship and automatically calculate critical loading information. FM 55-17 explains prestowage planning and the steps for formulating stow plans.

The amount of containerized cargo, break-bulk cargo, and rolling stock greatly influences transportation planning. During peacetime about 80 percent of DOD-sponsored cargo is containerized. Wartime movements will temporarily reverse this trend because of the vast amount of unit equipment moving into the theater. However, as the theater matures, containerization will pick up.

Also, planners should consider that packaging and loading operations need special equipment and trained personnel. Cargo handlers will be handling large amounts of ammunition and may also be required to build special slings and bridles to move heavy or outsize cargo.

Table 5-1. Berth specifications

| GENERAL BERTHS | | |
|---|---|---|
| Class | Length (ft) | Water Depth (ft)[1] |
| A | 1,000 | 32-36 |
| B | 850 | 30-34 |
| C | 700 | 22-30 |
| D | 550 | 17-22 |
| E | 400 | 13-17 |
| F | 100 | 6-13 |

| TANKER BERTH 9 | | |
|---|---|---|
| Class | Length (ft) | Water Depth (ft)[1] |
| T-A | 1,200 | 50-75 |
| T-B | 800 | 35-50 |
| T-C | 400 | 20-35 |
| T-D | 250 | 14-20 |

[1] Depths are computed for MLW.

Use the following formulas to calculate diameter of anchorage berths:
Offshore anchorage (diameter)= 2 (7D + 2L)
In-the-stream anchorage (diameter) = 4D + 2L x R

Where:
D = depth of water at MLW
L = overall length of ship
R = reserve factor of 1.4

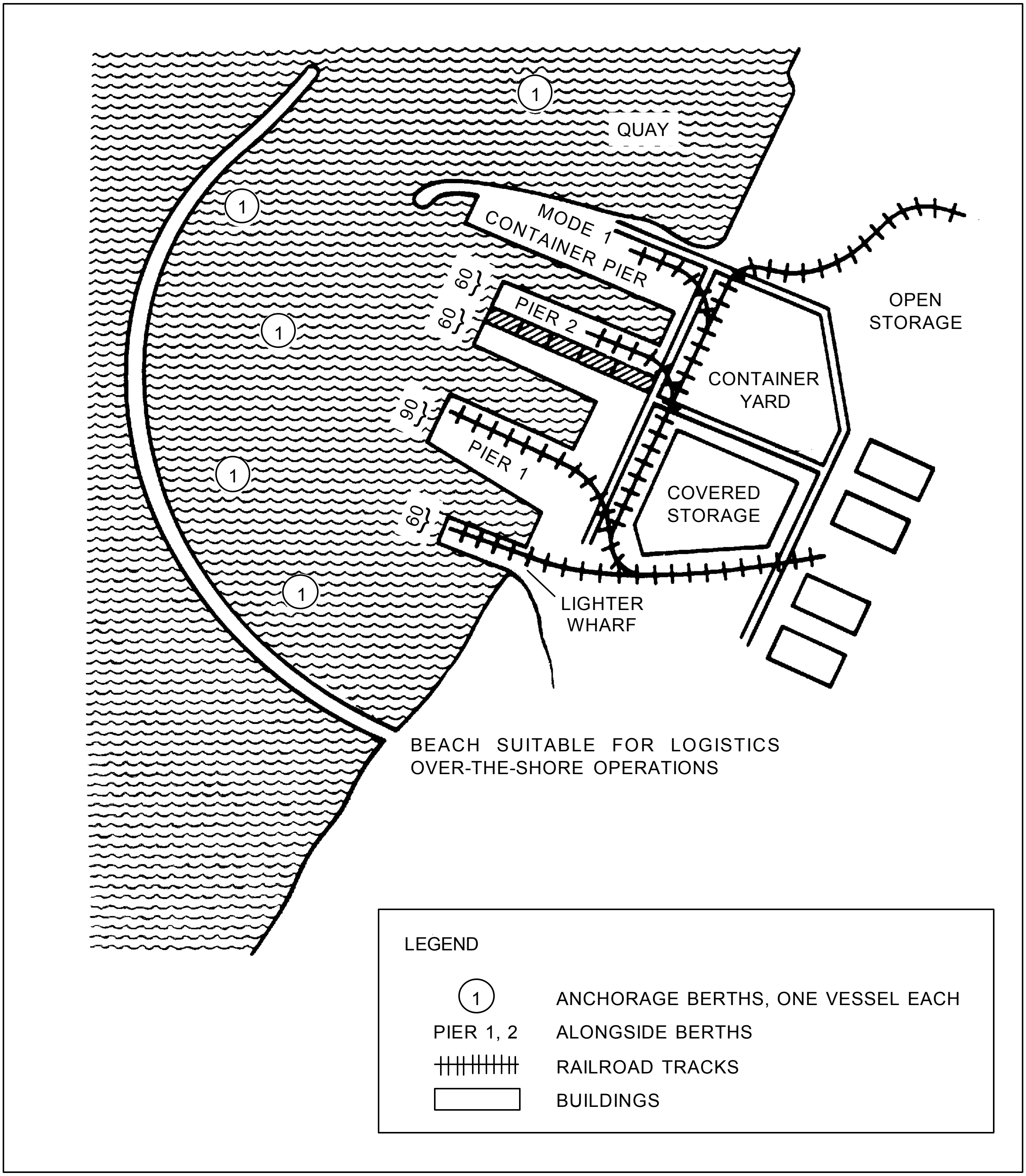



Figure 5-2. Typical terminal facility layout

### Discharge Operations

The terminal battalion plans the discharge of individual ships before their arrival. Planning is based on the vessel manifests and cargo disposition instructions. Each discharge plan specifies the location within the terminal to be used, method of discharge, and units to work each vessel.

Before the discharge process begins, a ship's meeting is held aboard the vessel. The members of the boarding party may include the battalion operations officer, the company commander, the platoon leader, and an MSC representative. The boarding party coordinates the discharge plan, heavy lifts, and any other pertinent matters with the vessel master. The vessel master usually names one or two of his officers to handle operational matters. See FMs 55-17 and 55-60 for detailed coverage of ship discharge operations.

Discharge can begin with receipt of the ship's paperwork, stowage plan, ocean manifest, and cargo disposition instructions. Cargo handlers unload cargo from the vessel, segregate it, and place it aboard the mode of transportation that will either move it or put it into storage. Cargo handlers should make maximum use of berthing space.

### Vessel Loading and Discharge Times

Tables 5-2 through 5-4, pages 5-12 and 5-13, list average cargo loading and discharge times for Operation Desert Storm. They are the result of an extensive analysis of Desert Storm vessel cargo operations. These tables in no way reflect the total time a ship is in port. Factors other than loading and discharge affect the total port time of a vessel. These include piloting and docking, tides and weather, bunkering, receiving ship's stores, and castoff. In planning the port time of a vessel, add one day to the vessel loading or discharge time.

Table 5-2. Desert Storm average ship loading and unloading times, deployment (unit equipment)

| SHIP TYPE | AVAILABLE SQUARE FEET | PERCENT STOW | USABLE SQUARE FEET | LOAD TIME (Days) | SQUARE FEET PER HOUR | NUMBER OF PIECES | PIECES PER HOUR | UNLOAD TIME (Days) |
|---|---|---|---|---|---|---|---|---|
| Break-bulk | 52,081 | 84 | 43,748 | 3 | 583 | 366 | 5 | 3 |
| Break-bulk/ Container | 71,676 | 71 | 50,890 | 3 | 719 | 435 | 6 | 3 |
| FSS | 200,906 | 73 | 146,661 | 2 | 2,834 | 850 | 16 | 3 |
| Barge carrier- LASH | 127,256 | 56 | 71,263 | 10 | 309 | 757 | 3 | 11 |
| Barge carrier- SEABEE* | 95,109 | 68 | 64,674 | 3 | 812 | 400 | 5 | 6 |
| RORO (small) | 37,265 | 90 | 33,538 | 1 | 1,761 | 227 | 12 | 1 |
| RORO (medium) | 75,650 | 83 | 62,789 | 2 | 1,569 | 392 | 9 | 2 |
| RORO (medium/large) | 124,282 | 73 | 90,726 | 2 | 2,244 | 539 | 13 | 2 |
| RORO (large) | 183,788 | 70 | 128,652 | 2 | 2,701 | 709 | 15 | 2 |
| MPS | 152,200 | 71 | 108,062 | 3 | 1,659 | 692 | 10 | 5 |
| Auxiliary crane (T-ACS) | 45,500 | 89 | 40,495 | 13 | 134 | 270 | 1 | 3 |

*Loading times reflect LOLO cargo operations of vehicles and combination cargoes – not barge operations.

Table 5-3. Desert Storm average ship loading and unloading times, redeployment (unit equipment)

| SHIP TYPE | AVAILABLE SQUARE FEET | PERCENT STOW | USABLE SQUARE FEET | LOAD TIME (Days) | SQUARE FEET PER HOUR | NUMBER OF PIECES | PIECES PER HOUR | UNLOAD TIME (Days) |
|---|---|---|---|---|---|---|---|---|
| Break-bulk | 59,769 | 64 | 38,252 | 4 | 404 | 254 | 3 | 1 |
| Break-bulk/ Container | 76,095 | 61 | 46,418 | 4 | 478 | 293 | 3 | 2 |
| FSS | 200,090 | 73 | 146,066 | 4 | 1,642 | 788 | 8 | 2 |
| Barge carrier- LASH | 177,670 | 30 | 53,301 | 11 | 200 | 344 | 1 | 4 |
| Barge carrier- SEABEE [1] | 95,109 | 76 | 72,283 | 4 | 865 | 478 | 6 | 10 |
| RORO (small) | 37,821 | 88 | 33,282 | 1 | 1,142 | 190 | 6 | 1 |
| RORO (medium) | 74,274 | 87 | 64,618 | 2 | 1,162 | 324 | 6 | 1 |
| RORO (medium/large) | 127,258 | 73 | 92,898 | 3 | 1,368 | 484 | 7 | 1 |
| RORO (large) | 187,408 | 64 | 119,941 | 3 | 1,720 | 590 | 9 | 2 |
| MPS | 152,200 | 82 | 124,804 | 5 | 1,407 | 1,153 [2] | 9 | 3 |
| Auxiliary crane (T-ACS) | 45,500 | 95 | 43,225 | 4 | 456 | 305 | 3 | 3 |

[1] Loading times reflect LOLO cargo operations of vehicles and combination cargoes – not barge operations.

[2] Marine Corps equipment only.

Table 5-4. Desert Storm average ship loading and unloading times, deployment/redeployment (ammunition)

| SHIP TYPE | AVAILABLE MTON | LOAD PERCENT STOW | TIME (Days) | MTON PER HOUR | UNLOAD TIME (Days) |
|---|---|---|---|---|---|
| Deployment: | | | | | |
| Break-bulk | 9,349 | 70 | 9 | 30 | 8 |
| Break-bulk/Container | 8,800 | 64 | 9 | 27 | 8 |
| Barge carrier-LASH | 23,500 | 66 | 13 | 49 | 9 |
| Redeployment: | | | | | |
| Break-bulk | 9,750 | 83 | 16 | 38 | 12 |
| Break-bulk/Container | 9,000 | 80 | 21 | 14 | 9 |

The ship load/unload times in Table 5-5 are based on a 20-hour workday. The RORO and sea train times were computed from experience in past REFORGER exercises. This experience with MSC RORO ships is sufficient to place a high reliability on the times shown.

Loading helicopters onto RORO vessels is a LOLO operation. Since placing helicopters in their final stow position requires added effort, load and discharge times should be increased when a significant number of helicopters are transported. REFORGER experience shows that for each six helicopters, 1 hour should be added to normal load/unload times.

## Documentation

During the movement process, the physical possession of cargo changes hands and possibly locations several times. Responsibility is transferred from one party to another until the consignee/unit accepts and takes receipt of the goods. The automated cargo detachment in a terminal battalion provides the documentation needed during the upload, discharge, and staging of personnel, equipment, and supplies.

Transportation Control and Movement Document. DD Form 1384 serves as a dock receipt, a cargo delivery receipt, an accountability document during temporary holding, and a record of all cargo handled. The form for each transportation unit is originated by the shipper and accompanies the cargo to the ultimate consignee. It can be prepared manually or mechanically as a punch card. DOD Publication 4500.32-R, Volume 1, and FM 55-17 contain detailed instructions for preparing and processing the TCMD.

Table 5-5. Load/unload times for basic cargo

| TYPE OF SHIP | TIME IN DA YS[1] Load | Unload |
|---|---|---|
| RORO [2] | 1.0 | 0.7 [5] |
| RORO SL-7 [2] | 1.5 | 1.0 |
| Seatrain | 3.0 | 2.0 |
| Break-bulk: | | |
| Ammunition | 4.0 | 4.0 |
| Unit equipment | 4.0 | 2.0 |
| General cargo | 4.0 | 4.0 |
| Container [3] | 1 or 2 [4] | 1 or 2 [4] |
| LASH [5, 6] | 1 or 2 [4] | 1 or 2 [4] |
| SEABEE [5, 7] | 1 or 2 | 1 or 2 |

[1] Assumes 20-hour workday; excludes weather and mechanical delays.

[2] Refer to following paragraph on helicopter loading.

[3] Assume availability of at least two gantry cranes per berth. Load/unload time is exclusive of container stuffing/unstuffing time.

[4] One day required for less than 900 containers, 2 days for more than 900 containers.

[5] These are general planning times; refer to following paragraphs for loading LASH and SEABEE ships.

[6] One day to load or unload ships and two days (four for ammunition) to load or unload lighters; load/unload times for lighters should be increased to three days for a unit move involving helicopters. The ship and lighter operations may run concurrently. In any event, allow a minimum of two days for load/unload operations (including lighters) involving unit equipment or resupply.

[7] One day to load or unload ship and two days to load or unload barges when barges are loaded or unloaded at SPOE. Allow a minimum of two days for concurrent operations, depending on barge berthing and terminal throughput capabilities.

Transportation Control Number. The TCN is a 17-digit number/letter code group. It consists of the unit identification code and a six-digit shipment unit number. It appears in Block 10 of the TCMD, in the LOGMARS bar code, on the first line of the address on a cargo shipping label, on the front and rear bumpers of vehicles, and on all other Army equipment (such as MHE, aircraft, floating craft, construction equipment). The TCN identifies and controls shipment throughout the transportation system. It is the single most important piece of information in the address because it is the reference point for all MILSTAMP documents, shipping actions, and tracer actions. See Figure 5-3 for the data contained in a MILSTRIP TCN.

Logistics Applications of Automated Marking and Reading Symbology. LOGMARS is an electronic computer hardware and software system used to document all types of cargo. LOGMARS bar coded labels contain the TCN and other data needed to match labels and equipment (Figure 5-4, page 5-16). Two identical bar code labels are affixed to each piece of cargo, equipment, or container. A handheld portable bar code reader scans the LOGMARS labels as cargo comes aboard the vessels or lighters. The cargo is scanned again as it is discharged.

Worldwide Port System. Currently being fielded, the WPS is a single-standard AIS. It is designed to support cargo documentation and tracking at common user ocean terminals associated with MTMC, FORSCOM ACDs, and Reserve TTUs. This system transmits and receives ocean cargo data via electronic communications, plans the receipt and load/discharge of the vessel, and supports the discharge and routing of cargo out of the POD.

The WPS will replace four cargo documentation AISs: TERMS-Import and Export, DASPS-E, MED prototype, and the TSM with a single integrated AIS. It will support worldwide peacetime and wartime operations of common water terminals and the requirements of the water terminal units designed to support the contingency mission. The WPS will operate off of a super microcomputer file server with multiple printers and work stations.

## Container Operations

Containerization is the preferred method of moving military cargo. As indicated previously in this chapter, 80 percent of peacetime military cargo is transported in containers. In either peace or war, the terminal planner can anticipate handling a large number of containers.

Terminal layout. A typical container terminal consists of the ship berth, container cranes, entry facilities, marshaling area, container inspection garage, container packing shed, and equipment storage.

Containership berths require a minimum length of 1,000 feet to handle the size of vessels in use today. A maximum length of 1,100 feet will take the largest container ship currently afloat or projected. Unless local conditions dictate otherwise, container berths should be along a quay rather than a finger pier. Placing containers along a quay allows some flexibility in berth lengths.

| AT4015 | 7250 | 2026 | X | X | X |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |

1. Activity address code
2. Year and Julian date of requisition
3. Requisition serial number
4. Suffix to requisition when filled by more than one supply agency
5. Partial shipment indicator
6. Split shipment indicator

AT401572502026XAX – 1st Increment

AT401572502026XBX – 2nd Increment

AT401572502026XZX – Last Increment

Figure 5-3. Example of MILSTRIP TCN

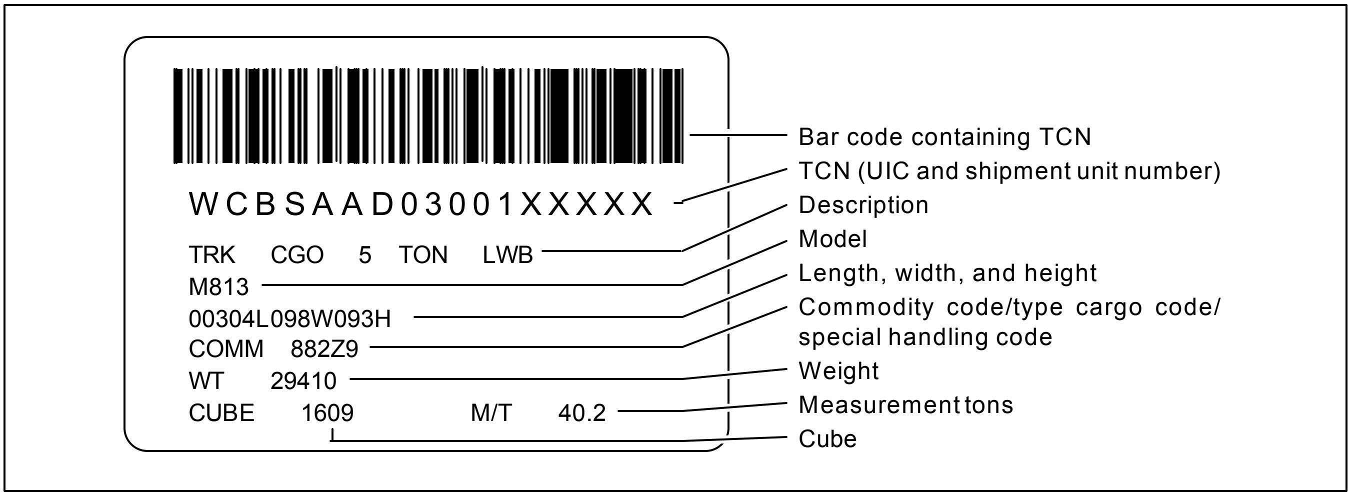



Figure 5-4. LOGMARS label

Since most container vessels have no shipboard cranes to handle containers, container cranes are required. Two or more cranes working simultaneously can load and unload a container ship. The truck entrance to a terminal should have two or three entry lanes with an equal number of departure lanes. A truck scale to weigh containers in or out should be located in each lane. A building is usually located at the entry/ exit point for processing paperwork and assigning positions in the marshaling yard to incoming containers. Approach roads to the terminal should be generous. Container operations generate substantial truck traffic, peaking on days when ships are in port. This peak requires truck-holding lines at the terminal entrance.

Located near the entry building and next to the marshaling area is a small garage for the physical inspection of arriving or departing containers. Inspection is required because responsibility for the containers changes as they enter or leave the terminal. Also, a maintenance garage is usually provided for stevedoring devices used to handle containers in the marshaling yard.

A less-than-container-load packing shed (i.e., a “container freight station”) is usually provided. The building need not be next to the marshaling area and definitely should not assume the location of a transit shed. Any structures near the string piece tend to impair movement of containers to and from the cranes during loading and unloading operations. The size of packing sheds varies, but the general configuration resembles a typical truck terminal. Delivery trucks arrive at one side of the building. Cargo is moved from these trucks directly into waiting containers on the opposite side with a minimum flooring of cargo. The packing shed, therefore, tends to be long and narrow with emphasis on the necessary number of truck and container doors.

Storage and retrieval systems. A number of storage and retrieval systems and combinations of systems are used at container terminals. Of these, the most common are chassis storage, the straddle carrier, and the travel crane. Where space is limited, a vertical storage and retrieval system is employed.

With the chassis storage system, a container discharged by a ship is placed on a semitrailer chassis. A yard tractor hauls the chassis to an assigned terminal position. The chassis remains there until picked up by a highway tractor. Highway tractors similarly store chassis-carrying export containers. Yard tractors later haul these containers to the ship. Since containers are stored one-level high, this system requires more terminal storage space than any other container storage system. Handling efficiency is 100 percent because every container is immediately available to a tractor unit, and all required handlings are productive. This system requires more chassis than any other system.

The straddle carrier stacks containers two or three levels high. The carrier straddles the containers and moves them between shipside and storage areas or onto trucks or railroad cars. This system requires less storage space. Handling efficiency, however, is reduced to 50 percent or less because an upper container must be moved to reach a lower container. In some cases the tractor-chassis system is used between shipside and stacking area.

The traveling bridge crane stacks containers up to four high. It can stack higher than the straddle carrier, increasing the capacity for a given area. However, the many nonproductive handlings required to retrieve containers can significantly reduce handling efficiency. Tractor-chassis units deliver containers to and from the cranes.

Materials-Handling Equipment. Proper use of MHE – large, mechanically powered equipment used to lift, transfer, and stack cargo – greatly increases operational efficiency. The equipment discussed here is representative of the types of MHE.

The yard tractor, M878A1 (Figure 5-5) is used primarily to provide a capability to shuttle semitrailers loaded with containers or break-bulk cargo within fixed ports, on prepared beaches during LOTS operations, and in trailer transfer areas.

The 50,000-pound container handler, rough terrain (Figure 5-6) is a rough terrain truck designed to operate on soft soil conditions such as unprepared beaches. It has four-wheel drive and can ford in up to 5 feet of salt water. The RTCH is a modified commercial design vehicle procured to military specifications. It is capable of handling the 8-foot-wide family of containers weighing up to 50,000 pounds. Top handlers are placed on the forks of the RTCH to allow handling of the three different lengths of ISO containers.

The 4,000-pound capacity rough terrain forklift truck (Figure 5-7, page 5-18) is capable of stuffing and stripping the 8-foot-wide family of ISO containers under field conditions. It is sized to effectively operate within the ISO container including two pallet loads side-by-side and two high. The 4K RTFLT weighs about 10,000 pounds, is 79 inches wide, 80 inches high, and 165 inches long, excluding forks. The diesel engine-powered vehicle is four-wheel drive for rough terrain operation and has free-lift and side shift capabilities for operating within the confines of a container.

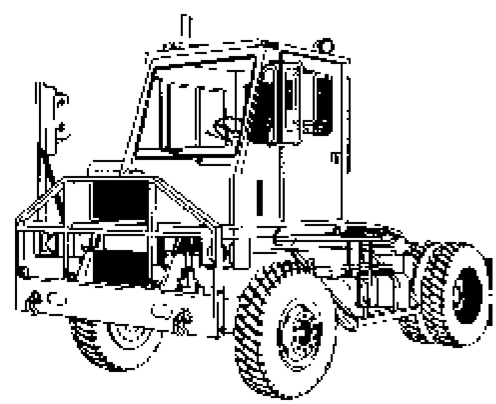


Figure 5-5. Yard tractor

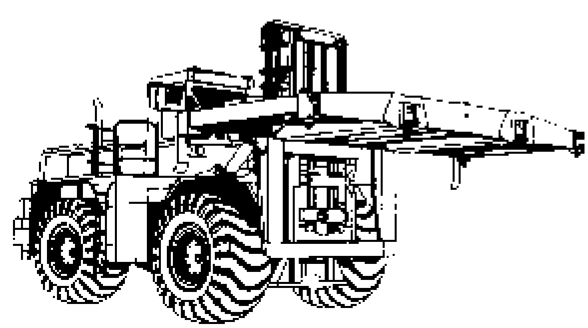


Figure 5-6. Rough-terrain container handler, 50,000-pound

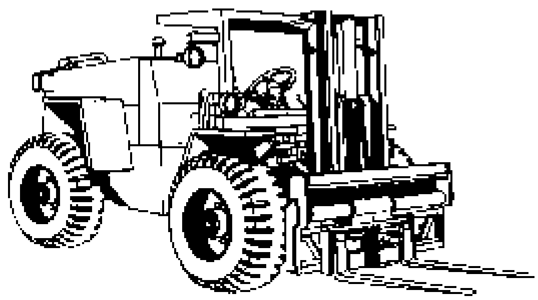


Figure 5-7. Rough-terrain forklift truck, 4,000-pound

The rough terrain container crane (Figure 5-8) is a commercially designed wheel-mounted crane. The RTCC can lift a 20-foot container weighing 44,800 pounds at a radius of 27 feet and a 35-/40-foot container weighing 67,200 pounds at a radius of 22 feet.

General support ammunition units use the RTCC from a "fixed position" for transfer of 20-foot ANSI/ISO containers from one mode of transportation to another or to ground/load containers from or to waiting transportation in the theater and corps ammunition storage areas. Transportation units use this crane to augment the 50,000-pound RTCH in the transfer and handling of 20-, 35-, or 40-foot containers and other cargo between transportation modes and in storage areas.

The 140-ton, truck-mounted container handling crane (Figure 5-9) is a commercially designed crane mounted on an 8-by-4-foot truck chassis. It has a 140-ton maximum capacity at a reach of 12 feet. Its 50-foot basic boom can be extended up to 130 feet with the use of various lengths of lattice boom. The 140-ton crane is used to load and unload containers from ships in fixed port operations and to handle containers at marshaling areas and terminal sites. Also, in LOTS operations, it is used on causeway sections to transfer containerized cargo from displacement craft to transport vehicles; and on the beach, to transfer containerized cargo from Hovercraft to the beach.

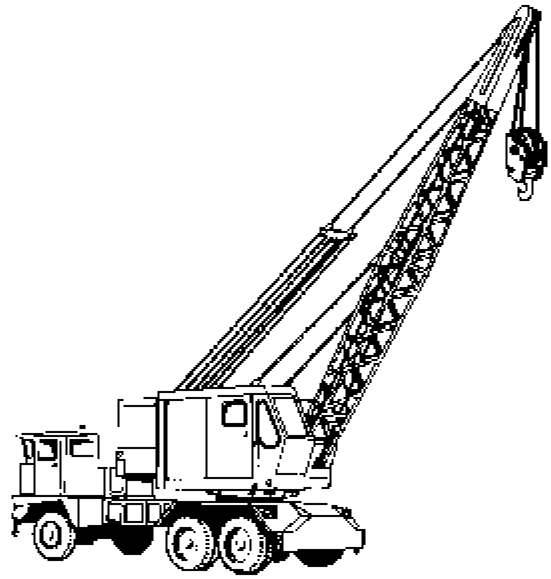


Figure 5-8. Rough-terrain container crane, 20-ton

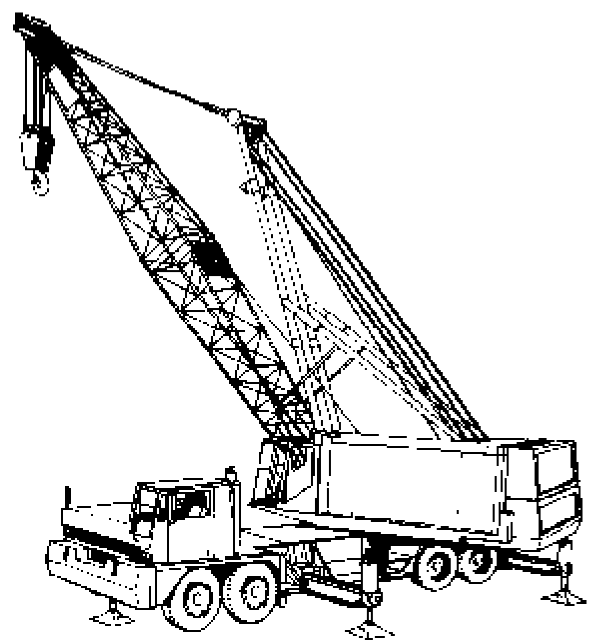


Figure 5-9. Truck-mounted crane, 140-ton

Spreader bars, intermodal container handling. Spreader bars are connected by slings to the hook of a crane (such as the RTCC or the 140-ton truck-mounted container handling crane). They handle ISO and other intermodal containers. The Army has two types of spreader bars: one type handles 20-foot containers and the other handles 40-foot containers. Both have a fixed-frame design and manually locking twist locks.

See Tables 5-6 through 5-10, pages 5-19 through 5-20, for data on gasoline-powered forklifts, rough-terrain forklifts, wheeled warehouse tractors, electric-powered forklifts, and truck-mounted cranes.

Table 5-6. Gasoline-powered forklifts

| MODEL NUMBER | LENGTH (in) | WIDTH (in) | HEIGHT (in) | WEIGHT (lb) | LIFT HEIGHT (in) | FREE LIFT (in) | CAPACITY (lb) | TIRE TYPE [1] |
|---|---|---|---|---|---|---|---|---|
| FB 20-24 (131) | 63 3/4 | 32 | 83 | 4,304 | 130 | 12 | 2,000 | S |
| KC 51T20H-RS53 (156) | 70 | 32 1/2 | 83 | 4,134 | 130 | 66 | 2,000 | S |
| MY40RS (170) | 97 1/2 | 60 1/2 | 90 1/2 | 8,500 | 144 | 57 | 4,000 | P |
| MY40 (170) | 94 1/2 | 60 1/2 | 90 1/2 | 8,500 | 144 | 57 | 4,000 | P |
| G54P-4024RS (166) | 92 3/4 | 63 1/2 | 91 | 8,420 | 144 | 57 | 4,000 | P |
| 540 RS (160) VI | 89 3/4 | 44 | 83 | 10,500 | 127 | 57 | 6,000 | S |
| Yardlift 60 RS (115) | 113 | 68 | 115 | 9,705 | 168 | 6 3/4 | 6,000 | P |
| MY 60 RS (171) | 110 1/4 | 70 | 110 1/2 | 9,720 | 168 | 18 1/2 | 6,000 | P |
| GLF 100- (163) | 110 1/4 | 53 | 68 | 13,200 | 100 | 43 | 10,000 | S |
| Yardlift 150-53RS (151) | 152 | 96 | 150 | 22,000 | 210 | 2 1/2 | 15,000 | P |
| H 150C (178) | 145 | 81 | 152 | 19,050 | 210 | 2 | 15,000 | P |

[1] Tire types:
S – solid rubber
P – pneumatic

Table 5-7. Rough-terrain forklifts

| MODEL NUMBER | LENGTH (in) | WIDTH (in) | HEIGHT [1] (in) | WEIGHT (lb) | LIFT HEIGHT (in) | POWER | CAPACITY (lb) | TIRE TYPE [2] |
|---|---|---|---|---|---|---|---|---|
| Baker RPF060M02 (164) | 204 | 84 | 96 | 8,000 | 78 | Gasoline | 4,000 RT | P |
| Anthony MLT6 | 229 1/2 | 86 | 94 | 16,800 | 144 | Gasoline | 6,000 | P |
| MR 100 (173) | 228 | 102 | 124 [4] | 23,800 | 144 | Diesel | 6,000 RT | P |
| — | 138 [3] | — | — | — | — | — | — | — |
| Millicin | 244 | 103 | 100 | 30,000 | 144 | Gasoline | 10,000 | P |
| — | 252 | — | 133 [4] | — | — | — | — | — |
| RTL-10 | 203 [3] | 106 | — | 34,500 | 142 | Diesel | 10,000 RT | P |

[1] With mast collapsed
[2] P – pneumatic
[3] Less forks
[4] With guard

Table 5-8. Wheeled warehouse tractors

| MODEL NUMBER | LENGTH (in) | WIDTH (in) | HEIGHT (in) | SHIPPING WEIGHT (lb) | NUMBER OF WHEELS | DRAWBAR PULL (lb) | TIRE TYPE [1] | POWER |
|---|---|---|---|---|---|---|---|---|
| TSSA | 89 1/2 | 41 7/8 | 62 | 2,740 | 3 | 2,000 | S | Electric |
| MTT-W | 79 | 42 | 48 1/2 | 3,500 | 4 | 3,500 | S | Electric |
| MW-4-SE | 86 | 42 | 59 | 3,545 | 4 | 4,000 | S | Electric |
| Clarktor-40-RS | 110 | 65 1/2 | 56 | 4,700 | 4 | 4,000 | P | Gasoline |
| J-217-E | 116 | 66 | 62 | 5,800 | 4 | 4,000 | P | Gasoline |
| Clarktor-75 | 119 | 69 | 56 1/2 | 9,940 | 4 | 7,500 | P | Gasoline |

[1] Tire types:
S – solid rubber
P – pneumatic

Table 5-9. Electric-powered forklifts

| MODEL NUMBER | LENGTH (in) | WIDTH (in) | HEIGHT [1] (in) | WEIGHT (lb) | LIFT HEIGHT (in) | FREE LIFT | CAPACITY (lb) | TIRE TYPE [2] |
|---|---|---|---|---|---|---|---|---|
| FSHEYG20/48 | 69 1/2 | 34 1/4 | 83 | 3,808 | 130 | 5 | 2,000 | S |
| Clipper ECE2024SE | 64 7/8 | 34 1/2 | 83 | 3,900 | 130 | 64 | 2,000 | S |
| RAT 30 Type E | 37 1/4 | 13 | 31 1/4 | 5,130 | 144 | 44 | 3,000 | S |
| FTHEG 40/48 | 81 | 41 1/2 | 91 | 6,950 | 144 | 7 1/2 | 4,000 | S |
| Carloader SE ELL 4024 | 77 1/4 | 41 | 91 | 6,613 | 144 | 70 | 4,000 | S |
| FT 60/48 | 88 | 47 1/2 | 83 | 8,000 | 127 | 61 | 6,000 | S |
| EUT 6024 SE 50 | 92 1/4 | 43 | 133 | 8,550 | 168 | 6 | 6,000 | S |

[1] With mast collapsed
[2] S – solid rubber

Table 5-10. Truck-mounted cranes

| ITEM | CAPABILITY (STONs) | LENGTH (in) | WIDTH (in) | WEIGHT (lb) | BASIC BOOM LENGTH (ft) |
|---|---|---|---|---|---|
| 20-ton crane | 20 @ 10-ft radius | 326 | 119.0 | 59,860 | 30 |
| 140-ton crane | 140 @ 12-ft radius | 873 w/50-ft boom | 132.5 | 195,000 w/120-ft boom | 50 |
| 250/300-ton crane | 250 @ 18-ft radius | 570 | 144.0 | 370,000 w/160-ft boom | 70 |

### Flatracks and Sea Sheds

The majority of merchant ships are container ships, and their carrying capability is limited to containerized cargo. The Navy developed sea sheds and flatracks to enhance this capability.

Sea sheds (Figure 5-10) provide temporary multiple decks for transporting large military and outsize break-bulk cargo that will not fit into containers. Sea sheds for commercial ships are 40 feet long, 25 feet wide, and 12 feet 5 inches high. Each FSS has eight 35-foot sea sheds.

Flatracks (Figure 5-11, page 5-22) are portable open-sided 20- and 40-foot units that fit into existing below-deck container cell guides. Their purpose is to make better use of space on container ships and FSSs when transporting heavy or outsized cargo. See Figure 5-12, page 5-23, for an illustration of sea sheds and flatracks in a containership hold. See FM 55-17 for more information on these systems.

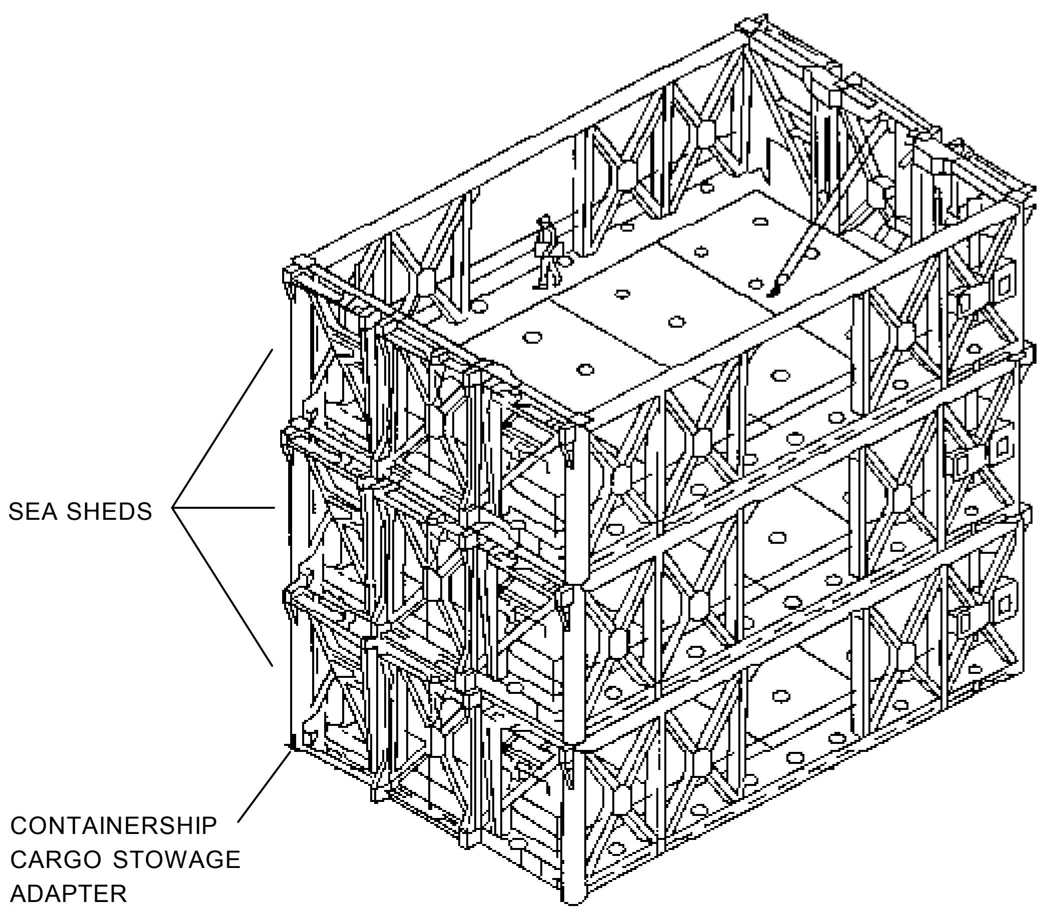
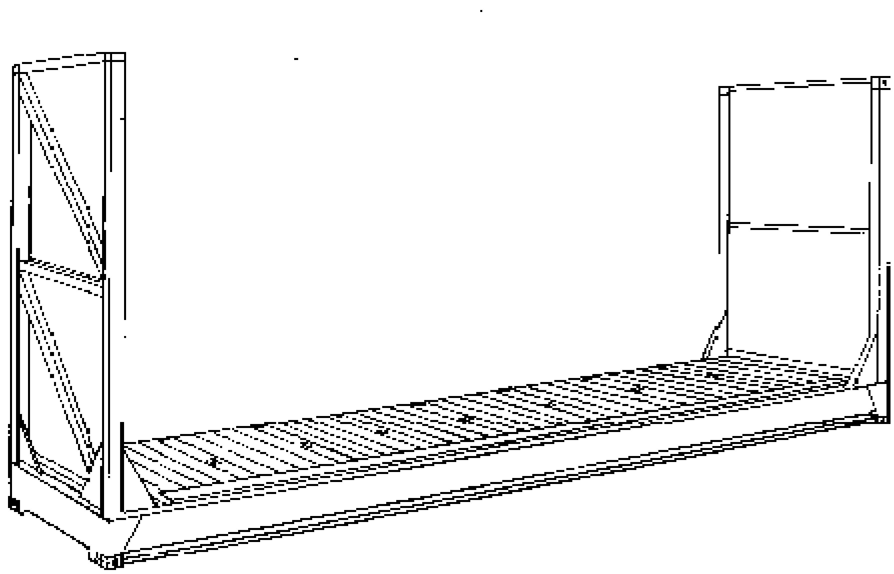
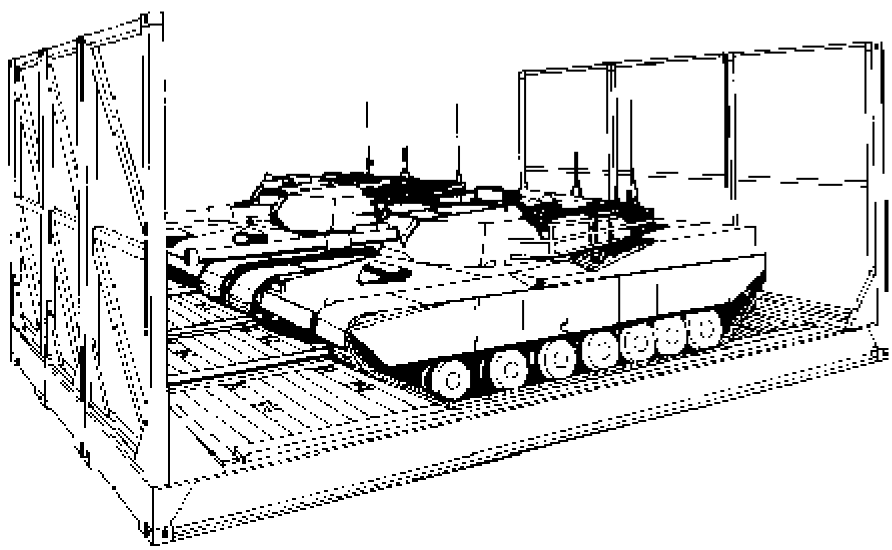



Figure 5-10. Sea shed system



OPEN-TOP, OPEN-SIDED FLAT RACK



FLAT RACKS LOADED WITH M-1 TANKS

NOTE: For illustration only, flat racks are shown outside the cargo cell

Figure 5-11. Flat racks

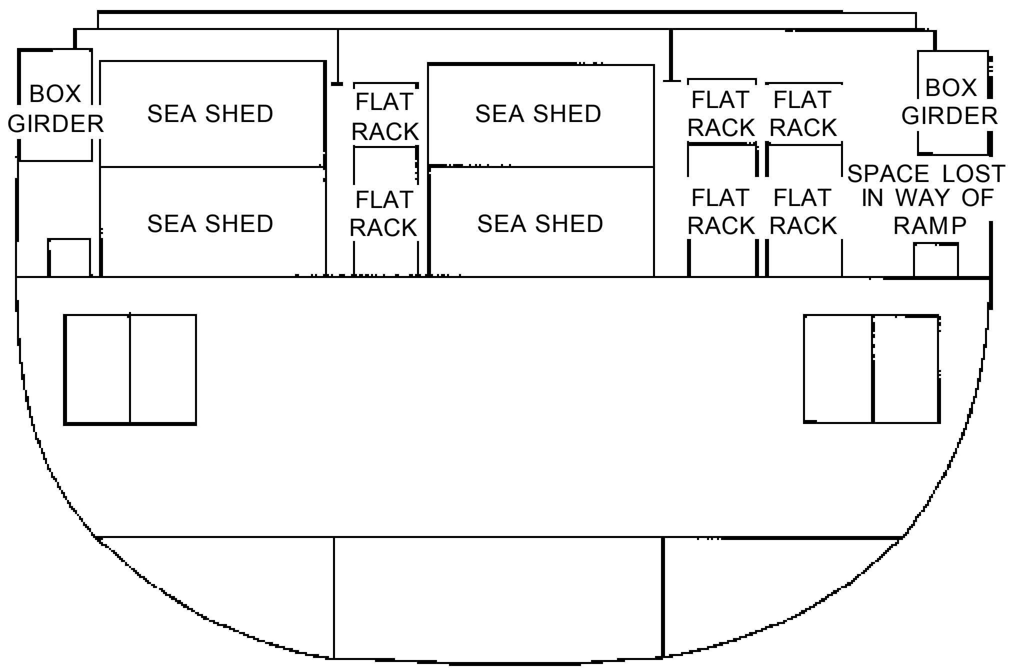



Figure 5-12. Sea sheds and flat racks in containership hold

## Equipment Deployment and Storage Systems

Part of the Army containerization master action plan, EDSS are standardized unit deployment/storage systems capable of strategic and tactical delivery by both surface and air transport. The two types of EDSS modules are the ground dominant system (QUADCON) used by units to deploy by sea and the air dominant system (ISU) used by units to deploy by air.

The QUADCON (Figure 5-13, page 5-24) is the primary surface/sea deployment system. It is a lockable, weatherproof, reusable, prefabricated container with a cargo capacity of 8,000 pounds. The QUADCON has a structural steel welded frame. Its top sides and door panels are made of plywood coated with plastic laminate. The floor is of high density plywood covered on both sides with sheet steel. It has double doors on each end and ISO corner fittings for lifting and restraint. The QUADCON base allows four-way forklift entry. It can be shipped as a single unit or divided into four components for transport by unit organic assets. Four containers locked together have the same dimensions as a standard 20-foot intermodal ANSI/ISO container and are compatible with the 20-foot cell guides of a container-ship. For information on the ISU, see Chapter 2 of this manual.

LENGTH: 96"
WIDTH: 57"
HEIGHT: 82"
CARGO CAPACITY: 8,000 LB
GROSS WEIGHT: 10,000 LB

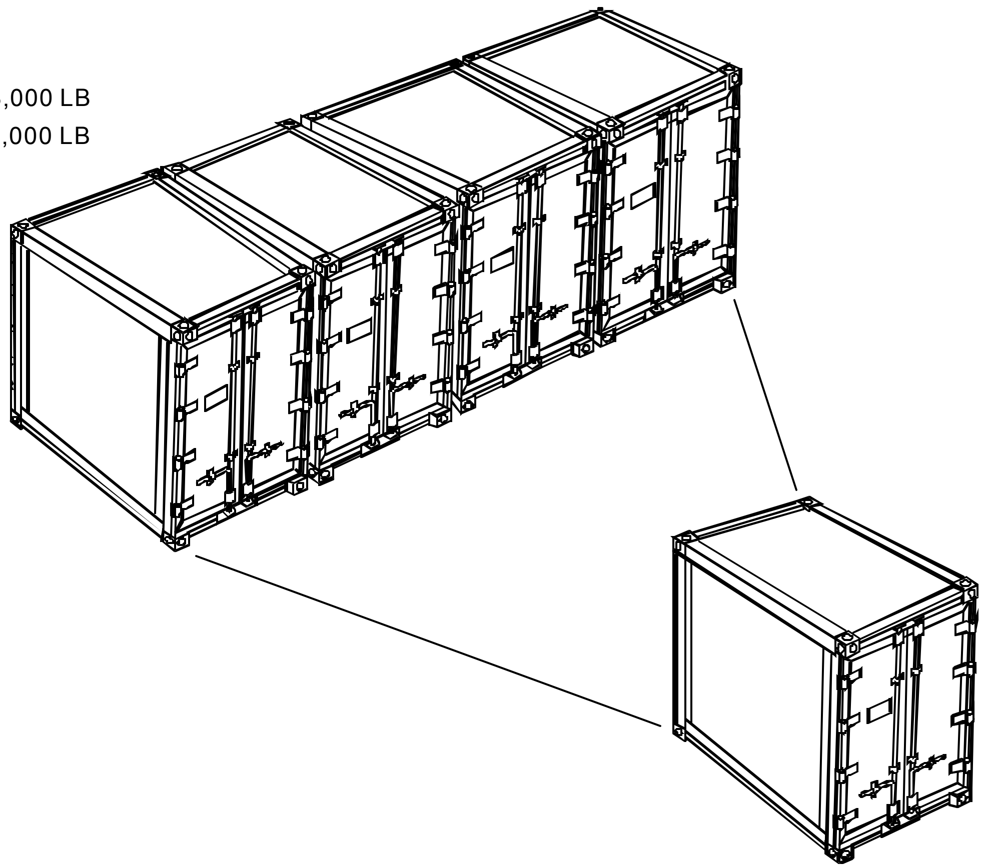


Figure 5-13. QUADCON surface/sea deployment system

MILVAN. The 8- by 8- by 20-foot MILVAN (Figure 5-14, page 5-25) is used to transport and temporarily store military cargo. It is of steel construction with hardwood floors and walls lined with plywood. This demountable container has a significant weight and cube capacity and can be moved by all modes of transportation. However, it cannot be handled by forklift. MILVAN containers can be obtained through the ITO, and any movement of these containers must be coordinated with the ITO.

Pallets. Four basic types of pallets are used for loading cargo into containers and for other cargo handling operations. They are the general purpose pallet, sled pallet, stevedore pallet, and warehouse pallet.

The general-purpose pallet (Figure 5-15, page 5-25) is a four-way-entry wooden pallet. It is 48 inches long by 40 inches wide by 5 1/2 inches high. It is used primarily to ship palletized cargo and often accompanies cargo from shipper to consignee. The four-way-entry feature facilitates easy entry by forklift.

The sled pallet (Figure 5-16, page 5-25) is a heavy, timbered platform with runners and cables attached to allow towing. Up to 3,000 pounds of supplies and equipment can be secured to the pallet with steel bands. The pallet alone weighs about 200 pounds. Sled pallets may be moved through any surf or over any beach accessible to landing craft or equipment.

OUTSIDE
LENGTH: 20' 0"
WIDTH: 8' 0"
HEIGHT: 8' 0"

INSIDE
LENGTH: 19' 4"
WIDTH: 7' 6"
HEIGHT: 7' 1"
CARGO CAPACITY: 41,300 LB
EMPTY WEIGHT" 3,500 LB

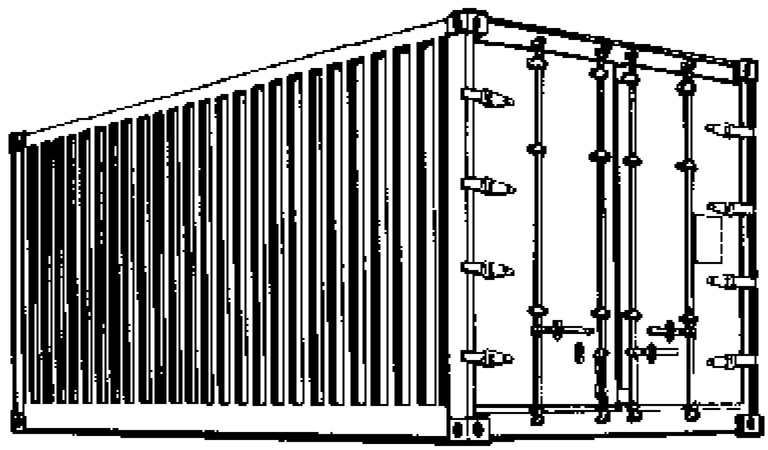


Figure 5-14. MILVAN characteristics

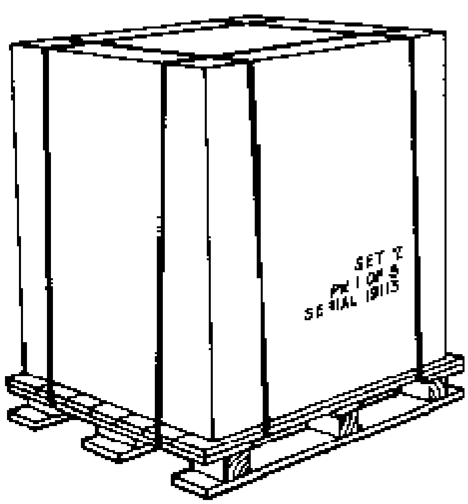


Figure 5-15. General-purpose pallet

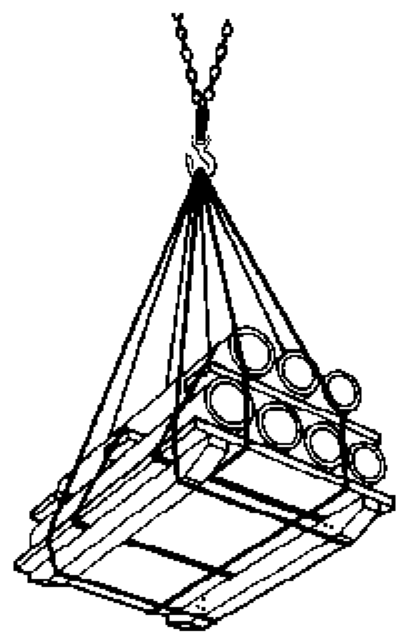


Figure 5-16. Sled pallet

The stevedore pallet (Figure 5-17) is a reversible pallet used to handle loose cargo at water terminals. The standard stevedore pallet is 4 feet wide by 6 feet long by 8 inches high. The stringers are made of 3- or 4-inch lumber. The deck boards are made of 2-inch-thick lumber. The outside or end boards should not be less than 6 inches wide. The inside boards may be random widths. The outside stringers are set in 4 to 6 inches from the ends so that a pallet bridle may be inserted. The inside stringers are arranged to allow easy entrance of forks for movement by forklift trucks.

The warehouse pallet is used to handle cargo in warehouses. It is much lighter than the stevedore pallet. The most common size of warehouse pallet is 48 by 48 inches, but a 40- by 48-inch size is also made. It is either of the open-end type (moved by a forklift or hoisted by a pallet bridle) or the closed-end type (moved by forklift only).

When items of cargo are palletized, the tiers are laid so that they tie together with each other to give stability to the entire load. This method keeps the cargo from falling off the pallet while in transit. Building the load in a definite pattern facilitates maximum use of the pallet area. Rations, water, fuel in 5-gallon containers, and ammunition are the supplies most suitable to pallet loading.

## INLAND WATERWAY PLANNING

An IWW is usually operated when there is an established system of connecting rivers, lakes, inland channels, protected tidal waters, and canals that can extend the theater transportation system from deep-draft ports to inland discharge points. IWWs complement existing transportation networks and reduce congestion and work loads of other transport modes. They are principally used by the civilian economy. Factors governing the military use of IWWs include:

- Degree of waterway development.
- Rehabilitation required.
- Tactical situation.
- Impact on civilian economy.

Watercraft most commonly used on an IWW include the LASH and SEABEE; locally available self-propelled barges; and US Army barges, tugs, and landing craft (Figure 5-18, page 5-27). Use of HN craft should be strongly considered since these vessels are tailored to the country's waterway system.

### Inland Waterway Service

When needed, an IWW service can be formed to control and operate a waterway system, plan and coordinate the use of IWW transport resources, and to integrate and supervise local civilian facilities that support military operations. This organization may vary in size from a single barge crew to a complete IWW service. It may be composed entirely of military personnel or staffed by local civilians supervised by military units of the appropriate transportation staff.

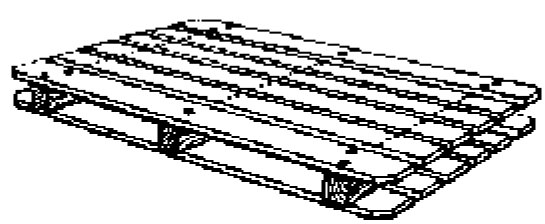


Figure 5-17. Stevedore pallet

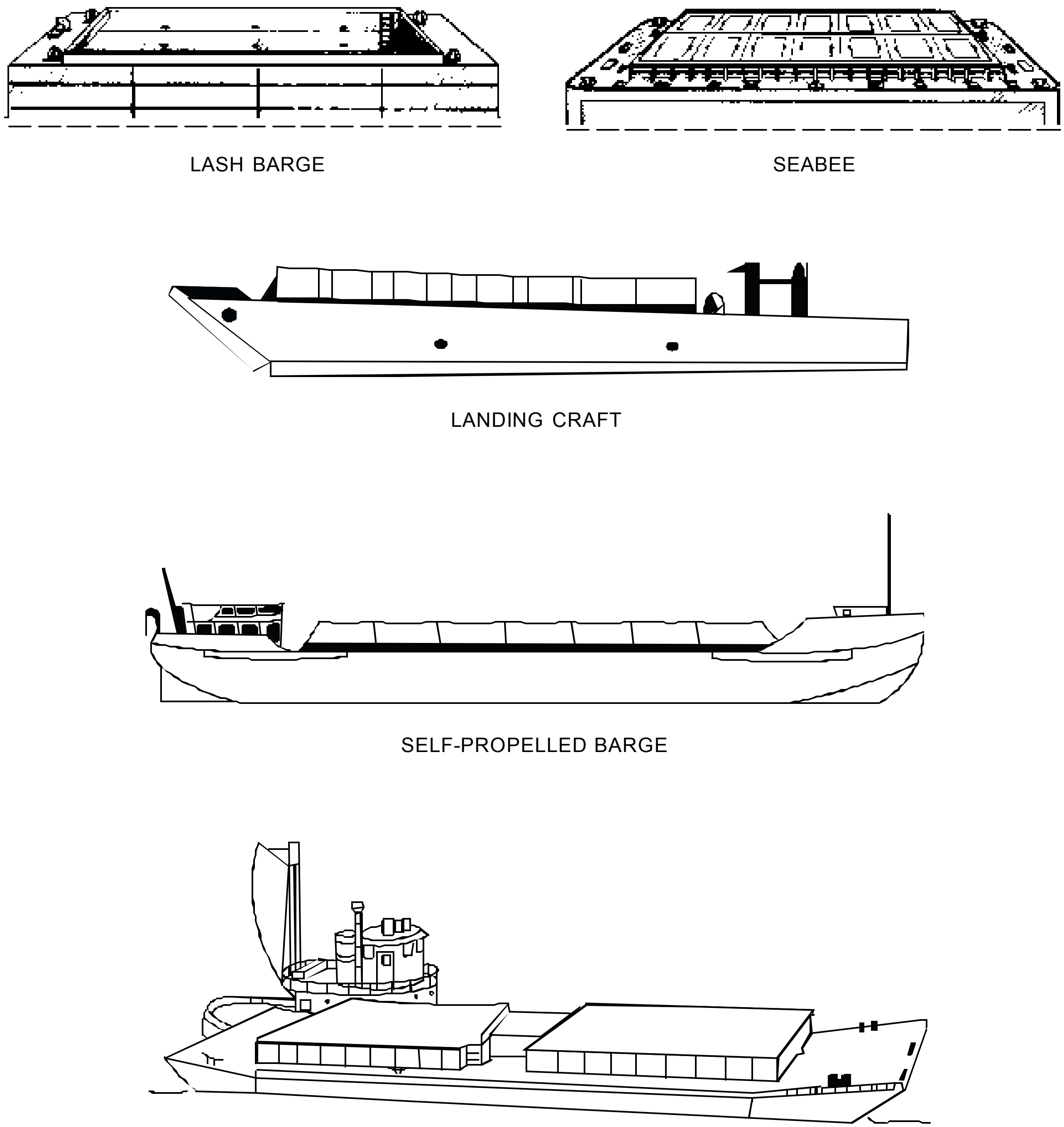



Figure 5-18. Lighters used on an inland waterway

### Inland Waterway System

Three separate functional components – the ORP, the IWW, and the IWW terminal – make up the IWW system (Figure 5-19). The US Army Corps of Engineers operates and maintains the IWW in a generic theater or CONUS. However, developed systems in overseas theaters are normally maintained and operated by the host country.

Ocean reception point. The ORP consists of mooring points for ships, a marshaling area for barges, and a control point. At least two stake barges should be at each ORP – one for import cargo and one for export. LASH, SEABEE, container, and general cargo vessels may discharge at an ORP.

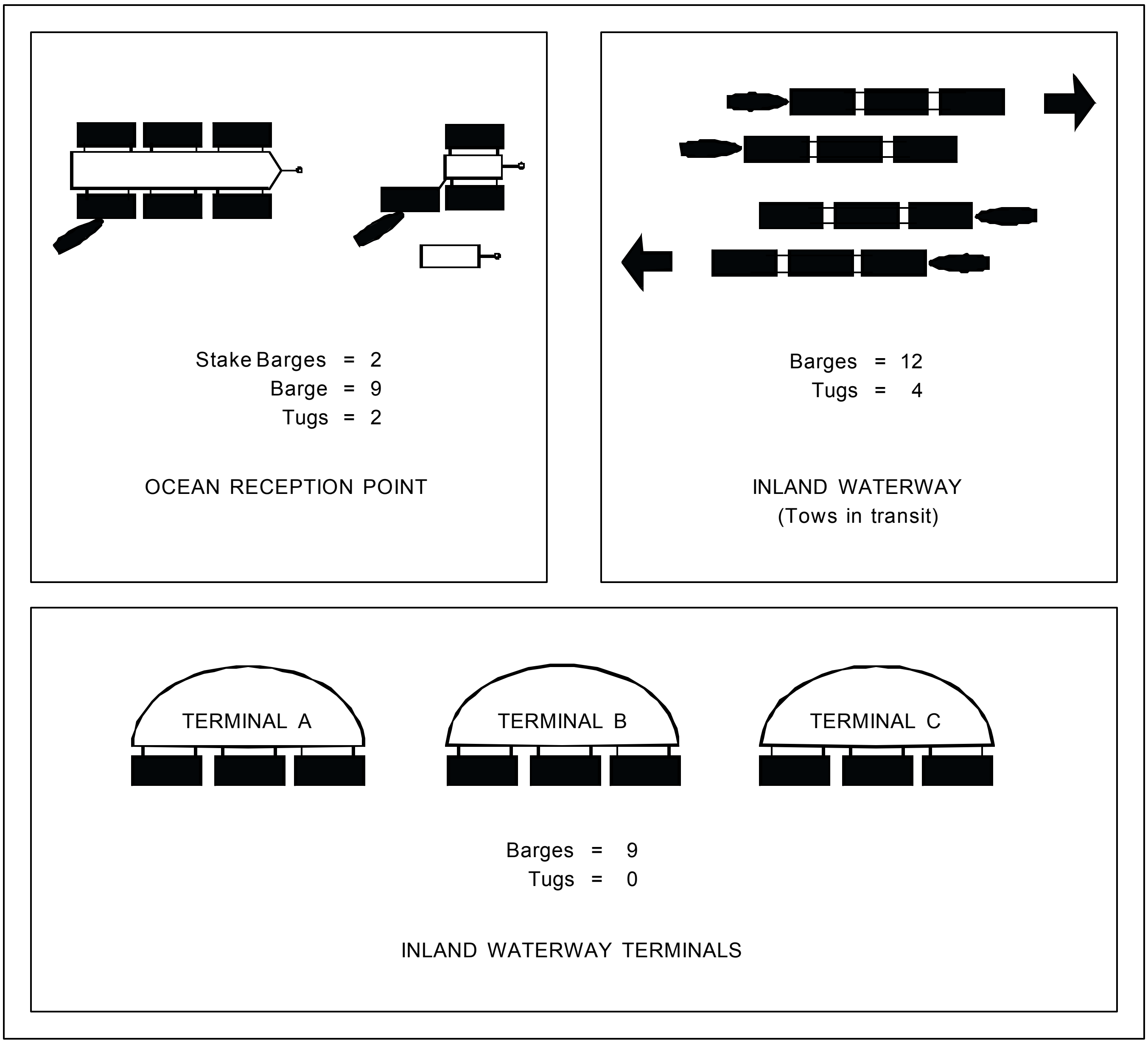



Figure 5-19. Inland waterway system

Inland waterway terminal. At the IWW terminal, cargo is transferred between lighters and land-based transportation. Terminals are established at the origin and terminus of the inland water route. Intermediate terminals are located along the way wherever a change in transport mode is required. Terminals in an IWW system are classified as general cargo, container, liquid, or dry bulk commodity shipping points. With one exception (general cargo), terminals usually include special loading and discharge equipment that allows rapid handling of large volumes of cargo. See Figure 5-20 for types of IWW terminals and Figure 5-21, page 5-30, for a typical inland barge terminal.

## Planning Factors

Transportation planners are interested in the waterway's capability to move cargo. Physical features that affect this ability include the width and depth of the channel; horizontal and vertical clearance of bridges; and number of locks, method of operation, and time required for craft to clear them. Also, planners must know the type and duration of the area's seasonal restrictions (i.e., freeze-ups, floods, droughts). Other concerns are the speed, fluctuation, and direction of water current and the availability of craft, labor, facilities, and maintenance support.

To determine capacity for the entire system, planners compute the capacity of each functional component. The least of these is used as the estimated capacity. For example, if the capacity per day is 3,000 tons (ORP), 2,000 tons (IWW), and 2,500 tons (IWW terminal), the capacity for the IWW system is 2,000 tons. Once this is established, personnel requirements for each component can be determined. See FMs 55-50 and 55-60 when planning personnel and unit requirements for an IWW system.

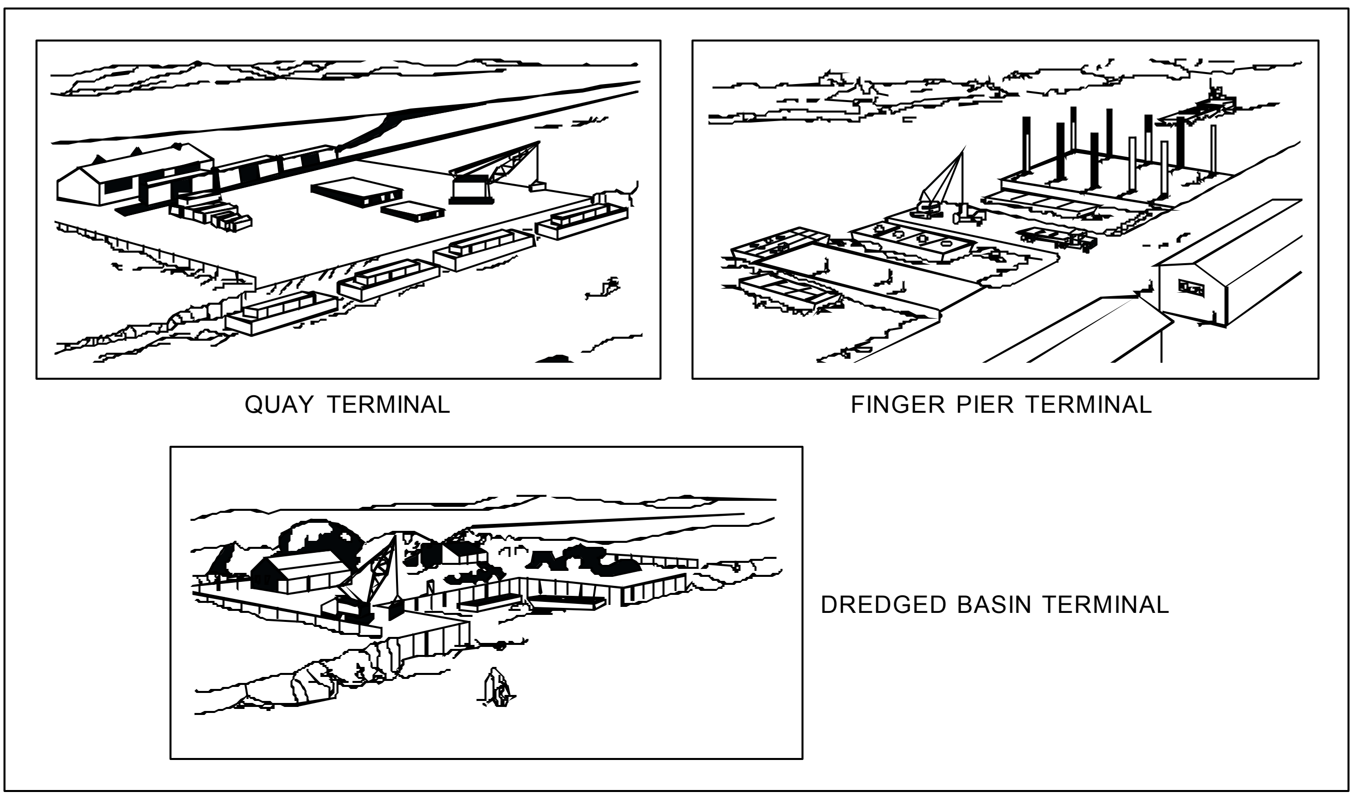



Figure 5-20. Types of inland waterway terminals

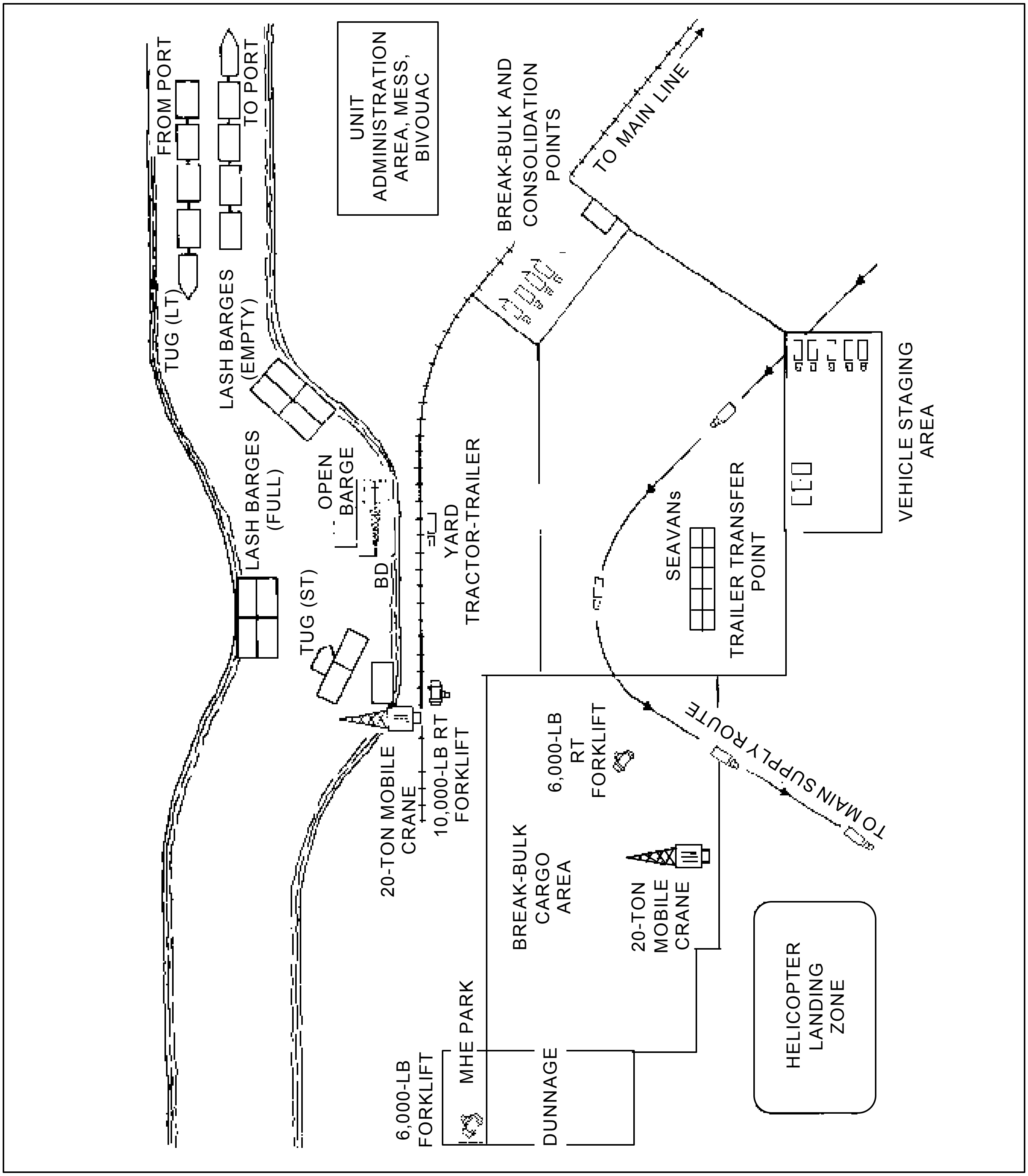



Figure 5-21. Typical inland barge terminal

## LOGISTICS OVER-THE-SHORE PLANNING

A LOTS operation may be conducted as part of the base, garrison, or theater development that immediately follows an amphibious operation or as a separate evolution when no amphibious operation precedes it. It can be supported by or coordinated with other services (JLOTS). During LOTS operations, supplies and equipment are moved ashore and transferred to a transportation agency for onward movement. Because LOTS operations are inherently dangerous, risk assessment and risk management are ongoing requirements. Planners should be familiar with the following terms:

- In-the-stream anchor – describes an operation where a deep-draft vessel is anchored in protected deep waters, such as a harbor.
- Offshore anchor – anchorage off the shoreline in unprotected deep water.

From either of these anchorages, ships can discharge to lighters for subsequent discharge to a fixed-port facility, unimproved facility, or bare beach. Figure 5-22, page 5-32, depicts a LOTS operation.

Major or Secondary Port Operations. Certain conditions require a LOTS operation through major or secondary ports. If, for example, port facilities are denied to deep-draft shipping as a result of enemy action, a LOTS operation would be the alternative. Other circumstances requiring LOTS include inadequate port berthing capability or inadequate port facilities due to shallow water depths and/or enemy action.

Bare Beach Operations. LOTS operations across a bare beach are the most resource-demanding in terms of the type and number of watercraft required. In many areas, the capacities of existing ports are not adequate to support theater tonnage requirements. This factor, along with the possibility of enemy insurgent activities, requires that plans favor widely scattered beach operations over large port complexes. Nearly 40 percent of all cargo entering a theater by surface means is delivered through dispersed beach terminals. Therefore, the theater's senior terminal commander must continually plan for and open new beaches. These sites accommodate increased tonnages and replace the tonnage capacity of a port or unimproved facility that has been made untenable by enemy actions. Plans should include–

- Proposed location and layout of the area.
- Type of lighters to be used.
- Task organization required to attain the desired tonnage capacity.
- Route and methods of movement to the area.
- Construction effort required.
- Communication requirements and logistical support procedures.

Site selection. The first step in planning beach operations is to determine the areas available. It is hard to find beaches that are ideally suited to LOTS without preparation or modification. Engineer support is usually required for landing craft to beach and to provide exits from the beach to discharge areas and the clearance transportation net. The degree of dispersion that can be attained relates directly to daily tonnage requirements and the size and nature of the assigned area. The existing capability to accommodate desired tonnage should be the basis for site selection. Major factors to consider when selecting beach discharge sites include:

- Beach characteristics.
- Tidal range.
- Weather.
- Surf.
- Topographic features.

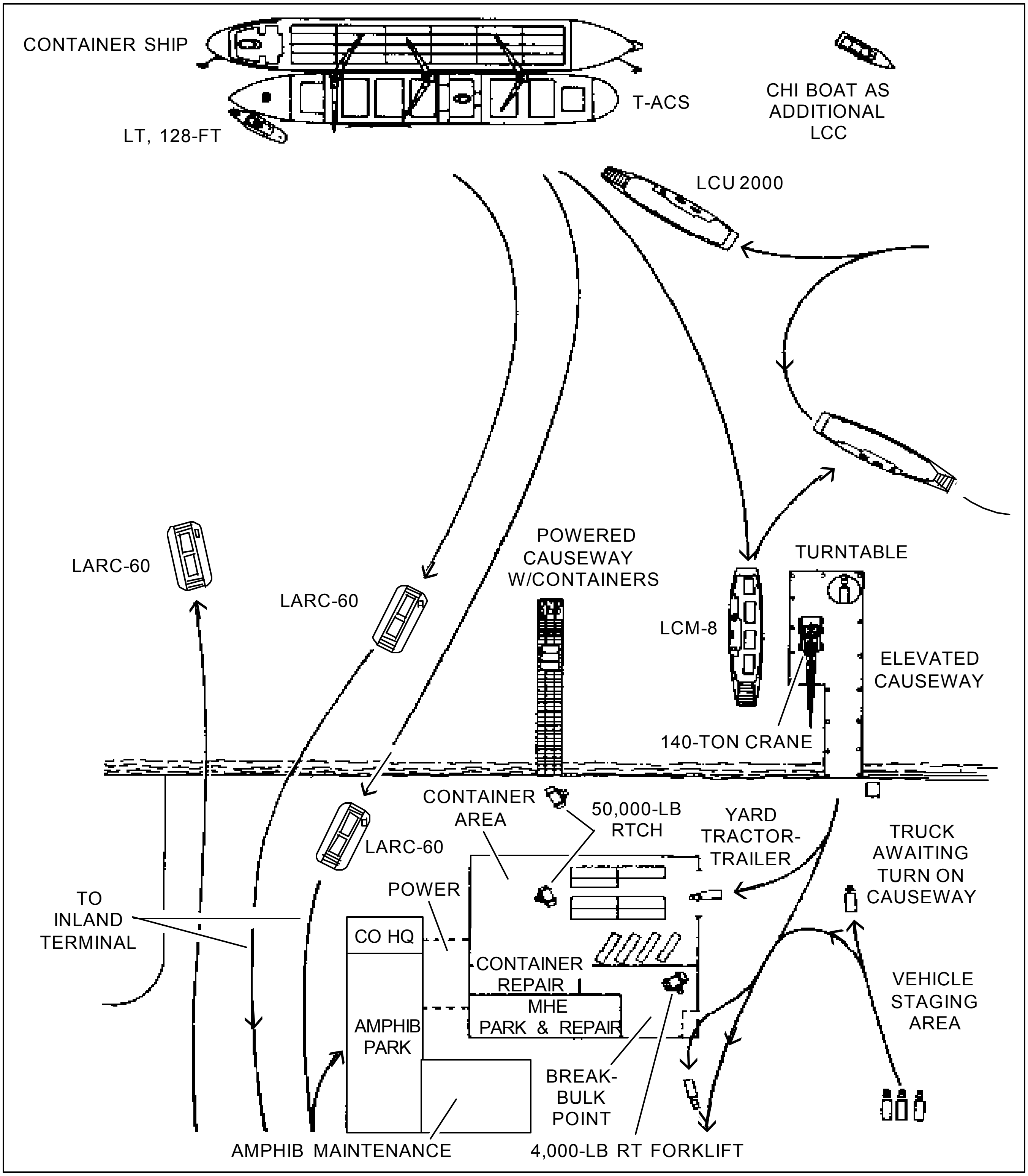



Figure 5-22. Typical LOTS operation

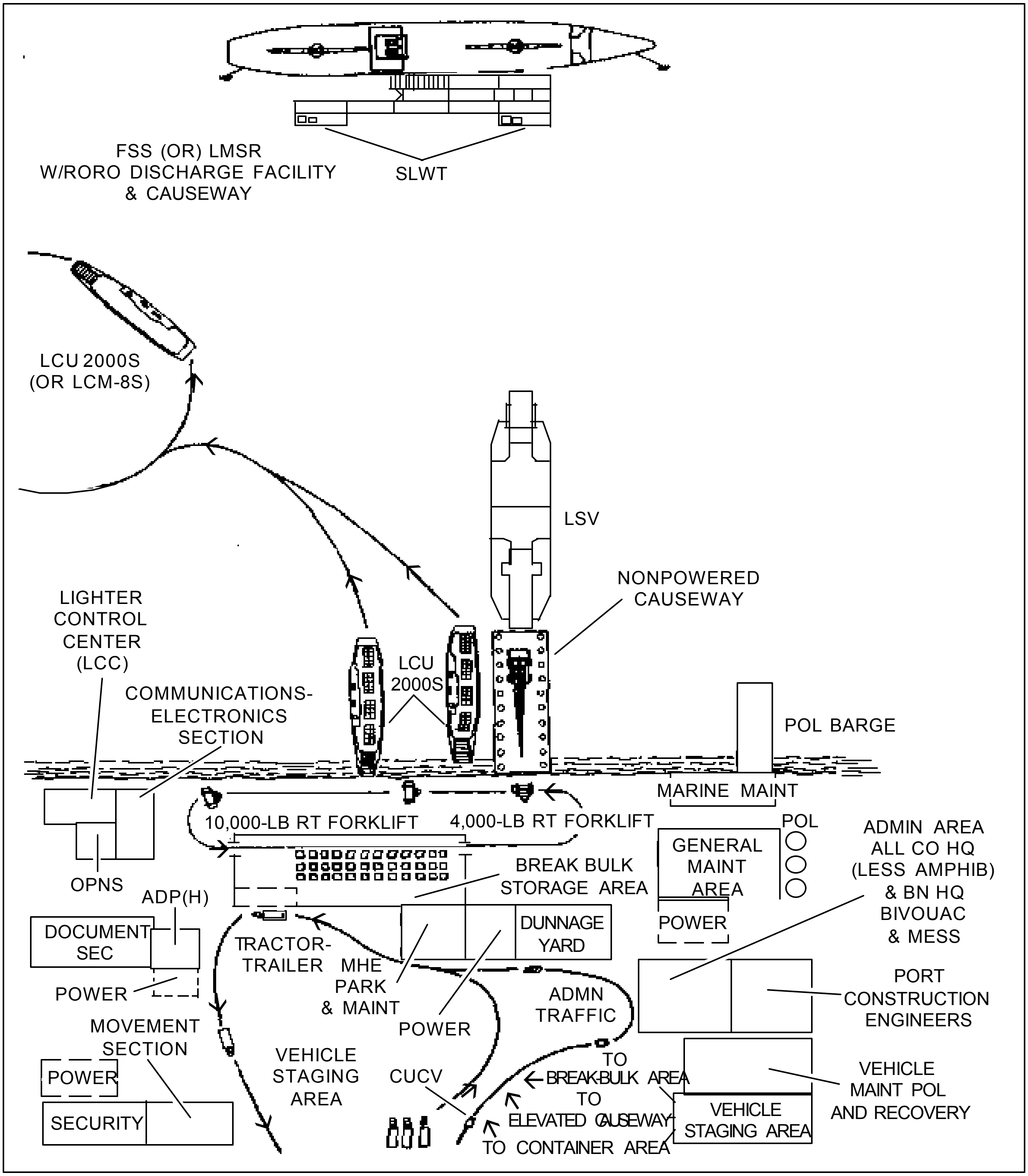



Figure 5-22. Typical LOTS operation (continued)

The terminal group or brigade commander, in coordination with the Navy and MSC, generally selects possible beach sites for LOTS operations. Selection is based on extensive study of maps and hydrographic charts and analysis of aerial reconnaissance reports. Aerial reconnaissance verifies information obtained from maps and charts. For example, roadnets shown on maps may have been destroyed or made impassable, and new roads may have been built. Bridges may have been destroyed, or structures may have been built on the beach. A detailed ground and water reconnaissance of the selected area also aids in determining site feasibility. The reconnaissance should be as thorough as time and circumstances allow. It is crucial that naval authorities be consulted early in the study. This ensures that advice about possible anchorage areas, along with difficulties and hazards to navigation, are available as early as possible.

Reconnaissance. Personnel who conduct ground and water reconnaissance must be qualified to advise the terminal group commander on the following:

- Engineering effort required to prepare and maintain the area.
- Signal construction and maintenance required for communication within the beach area and between the beach and terminal group headquarters.
- Need for and location of beach dumps, transfer points, and maintenance areas.
- Type of lighters that could be most effective.
- Need for and location of lighter safe-haven facilities.
- Location and desirability of anchorage areas.
- Possibility of using modular causeway system, RRDF, and other special equipment.
- Vulnerability of terminal area to enemy attack, its seaward approaches, and its connections with the interior.

To meet these requirements, the reconnaissance party should include:

- Representatives of the terminal group (to coordinate or supervise the reconnaissance team and to recommend task organization).
- Military police representative (to plan support for traffic control and beach management).
- Terminal battalion commander and operations officer (to select and assign company areas and frontages, indicate areas of defense responsibility, and organize area of operations).
- Engineer and signal officers (preferably from supporting engineer/signal units).
- Representatives of terminal service, boat, and amphibian companies involved (to advise and recommend on factors and conditions that affect their units' use).
- Representatives from the US Navy (to advise on anchorage areas and naval support required).

When NBC operations are suspected, the reconnaissance party conducts radiological monitoring, surveys, and chemical agent detection activities to determine possible contamination of prospective beach sites.

Beach characteristics. By gauging beach characteristics, the reconnaissance party can determine if the selected area has adequate anchorage for the number and types of ships needed to support operations. Also, lighters must be able to cross from the anchorage areas to the beach without confronting obstacles. For example, sandbars or reefs just offshore may preclude the use of LCMs, LCUs, or barges. Such conditions may require the use of amphibians until a channel is cleared. Important features to consider are depth, size (including length and width of beach), underwater obstacles, and beach gradient and materials.

Depth. Large cargo ships require a minimum depth of 30 feet and a maximum depth of 210 feet. Minimum depth is determined by the maximum draft of ships to be discharged, the ground swell discharged, and ground swell conditions. The length and weight of the anchor chain determine maximum depth.

Size. To provide a safe, free-swinging area for the standard five-hatch vessel, the anchorage area should be a circle with an 800-foot radius. If larger vessels are anticipated, use the following formula:

$$2\,(7D + 2L) = R \text{ (diameter in feet)}$$

where:

$D$ = depth of water in feet
$L$ = length of vessel in feet

Bow and stern mooring is not considered desirable in tidal areas because athwartship currents cause excessive strain on mooring gear. Also, appreciable changes in depth require continuous watching of the anchored vessels.

Underwater obstacles. Sandbars, shoals, reefs, rocks, ship wrecks, and enemy installations can be a serious menace and interfere with the passage of vessels to and from the area. Consider the potential for interference and the amount of work needed to clear channels.

Beach gradient and materials. Beach gradient, or the underwater slope of the beach, is usually expressed as a ratio of depth to horizontal distance. A gradient of 1 in 50 indicates an increase in depth of 1 foot to every 50 feet of horizontal distance. For landing and amphibious craft, usually only the gradient from the water's edge seaward to a depth of 3 fathoms (18 feet) must be determined. A gradient slightly steeper than 1 in 50 is considered suitable for a loaded LST; a gradient of 1 in 20 suitable for a LCM-8. Beach gradients are classified as follows:

- Steep – More than 1 in 15 feet
- Moderate – 1 in 15 to 1 in 30 feet
- Gentle – 1 in 30 to 1 in 60 feet
- Mild – 1 in 60 to 1 in 120 feet
- Flat – Less than 1 in 120 feet

See Figures 5-23 and 5-24 for profile views of beach sites.

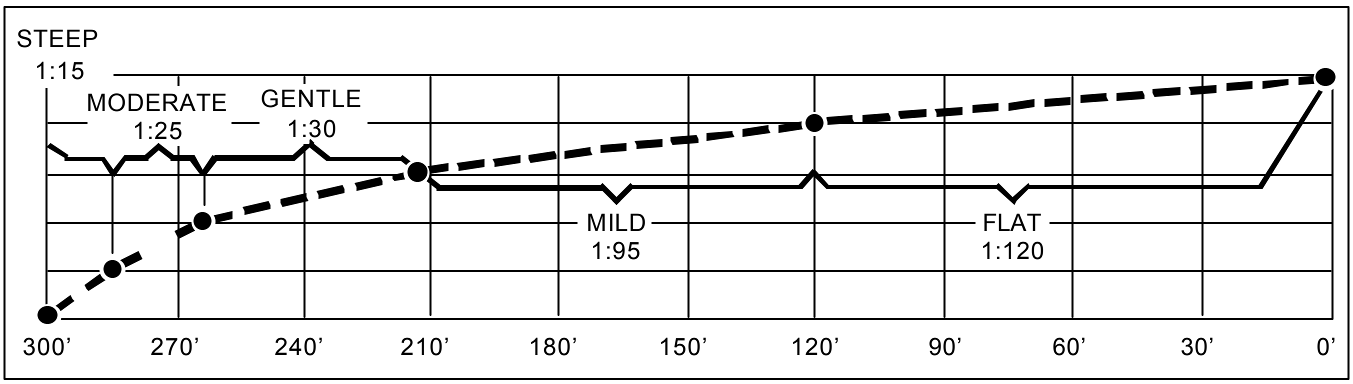



Figure 5-23. Profile view of typical underwater gradient

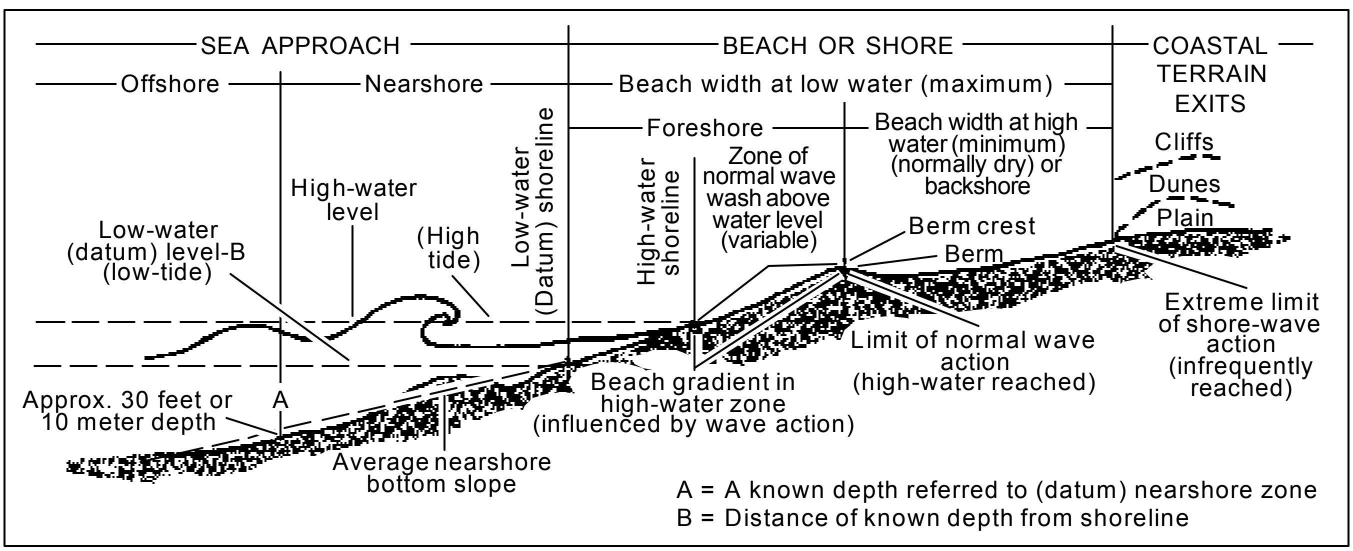



Figure 5-24. Marine beach profile diagram

Beaches are classified by their predominant surface material. The ideal composition for beaching landing craft and amphibians is a combination of sand and gravel. Silt, mud, or fine sand may clog watercraft cooling systems. Rock, coral, or boulders may damage the hull or the underwater propulsion and steering mechanism.

Firm sand provides good beach trafficability for personnel and vehicles. A beach is usually firmest when it is damp and the material is of small size. Gravel has good bearing capacity but poor shear strength. As a rule, the coarser the material, the poorer the trafficability. See Table 5-11 for classifications of beach materials.

Tidal range. The tidal range, the difference in height between consecutive high and low waters, should be considered when selecting a beach site. Other considerations include the strength and direction of tidal stream (rip and littoral currents).

Weather/surf. Favorable weather is critical to a LOTS operation. Rough seas restrict the speed and maneuverability of watercraft. Normal control and coordination problems become more complex. Lighter operations alongside a vessel are particularly hazardous if more than a moderate sea is running. Heavy surf reduces the amount of cargo that lighters can carry and can cause an operation to be suspended. Wind velocity, the distance spanned by the wind, the duration of the wind, and decay distance influence swell and surf functions.

Topographic features. The useful capacity of the beach can never exceed roadnet capacity. If an early and detailed analysis of the existing roadnet reveals that the roadnet capacity is inadequate, new roads must be built. This requires added engineering support for construction and maintenance.

Beach exits. The number of exits needed varies according to physical characteristics of the roads, the type and amount of cargo, and the type of conveyance used in beach clearance. Different types of equipment require separate routes. The adjacent area may limit the number of possible exits from the beach. An otherwise ideal beach may be backed by sand dunes, seawalls, swamps, or other obstacles that hamper endurance operations.

Table 5-11. Beach material classifications by particle diameter

| MATERIAL | PARTICLE DIAMETER In Microns* | PARTICLE DIAMETER In Inches |
|---|---|---|
| Boulder | 256,000 and over | 10.24 and over |
| Cobble | 256,000 - 64,000 | 10.24 - 2.56 |
| Stone | 64,000 - 4,000 | 2.56 - 0.16 |
| Pebble | 4,000 - 2,000 | 0.16 - 0.08 |
| Very coarse sand | 2,000 - 1,000 | 0.08 - 0.04 |
| Coarse sand | 1,000 - 500 | 0.04 - 0.002 |
| Medium sand | 500 - 250 | 0.002 - 0.001 |
| Fine sand | 250 - 125 | 0.001 - 0.0001 |
| Very fine sand | 125 - 62.5 | 0.0001 - 0.0000625 |
| Silt | 62.5 - 3.9 | 0.0000625 - 0.0000156 |

* Micron is approximately 0.00003937 inch.

Hinterland. Besides the beach and its exits, a number of factors should be considered when selecting a beach for unloading cargo. These other factors include:

- Existing roadnet or railnet.
- Physical characteristics of existing roads.
- Strength and width of bridges in the existing roadnet.
- Possibility of building a roadnet (if none exists).
- Existing lines of communication.
- Suitable area for heliport (if needed).

Landmarks. Landmarks, especially those assisting navigation and location of beaches (such as prominent hills) are helpful.

Beach transfer points. Beach transfer points are locations where cargo is transferred from amphibians to a clearance mode for delivery to destination. The requirement for beach transfer points is identified and their locations designated during reconnaissance.

Cargo clearance. The problems of cargo clearance in beach operations are generally the same as in conventional port terminals. Physical differences in the operating areas, however, may require different procedures and equipment. Ideally, clearance transportation capacity is balanced with discharge capability. This balance ensures that cargo is moved through and out of the terminal area as fast as it is unloaded from the ships. Generally, however, some cargo backlog must be anticipated, creating the need for temporary in-transit storage areas.

In-transit storage areas should be established near transfer points to accommodate cargo that cannot be immediately transferred to clearance conveyances. Cargo unloaded from landing craft that cannot be immediately cleared should also be brought to in-transit storage areas. This avoids congestion and cargo pileup on the beach.

When clearance transportation becomes available to move cargo from the in-transit storage areas, an additional burden is imposed on the terminal service companies that unload lighters. Any effort by these units to handle cargo in the in-transit storage areas only impairs their ability to keep the lighters moving. Eventually, the entire operation stagnates. The problem can be solved by assigning terminal transfer elements (squads, platoons, or companies) to load the backlogged cargo onto clearance transportation. Cargo will then flow out of the terminal without disrupting vessel discharge operations.

Temporary in-transit storage areas should be located away from main clearance roads to minimize road congestion and present less lucrative targets. Roads leading from main clearance roads to in-transit storage areas must be kept in good condition. Each area should have a separate entrance and exit. If tracked vehicles are used as well as trucks and amphibians, separate traffic nets may be needed. The ground should be level, firm, and dry. The surrounding area should be large enough to allow in-transit storage facilities to expand to meet the maximum requirements anticipated.

Traffic control is vital to prevent congestion in the terminal area and to promptly clear cargo to its initial destination. Careful planning to control vehicular traffic in the beach area includes scheduling enough drivers, MHE, and supervisors for around-the-clock operations.

FMs 55-50 and 55-60 discuss LOTS operations in detail.

### Shore-to-Shore Operations

Shore-to-shore operations use Army landing craft and amphibians to transfer cargo from one beach terminal to another along the same coastline. See FM 55-50 for information on shore-to-shore operations.

## STRATEGIC SEALIFT REQUIREMENTS

Today's Army is a CONUS-based force with global responsibilities. Strategic sealift is critical to meeting the significant mobility challenges of projecting and closing the force within ASMP required time lines. Responsibility for strategic sealift is shared by MSC, MTMC, and MARAD. More than 70 strategic sealift ships transport military equipment, supplies, and POL to support US forces overseas. This number is expandable and includes both government and privately owned vessels, mainly tankers, and dry cargo ships. In peacetime, more than 95 percent of DOD cargo is transported on US flag ships. The Army's strategic sealift requirements fall into three categories: surge, prepositioned, and sustainment.

### Surge Ships

During the initial phases of a contingency operation, surge ships transport critically needed equipment such as tanks, trucks, armored vehicles, and helicopters. Our current surge capability includes 8 FSSs and 22 RRF RORO ships. The RORO ships are maintained in either a 5-, 10-, or 20-day readiness status by MARAD at RRF sites or designated outports. This force was established in 1984-85 when DOD recognized that the demand for surge sealift exceeded MSC availability, voluntary charter, and US flag ships.

### Prepositioned Ships

The elements of our ASMP triad are sealift, airlift, and prepositioned afloat. Prepositioned afloat is the expanded reserve of equipment and supplies for an armored brigade aboard forward deployed prepositioned ships. The equipment on these ships is designated AWR-3. The program's concept is to forward deploy the equipment and link it up with its complement of troops at the SPOD. The following vessels (14 total) currently make up the PREPO fleet:

- RORO ships from the RRF (7).
- Auxiliary crane ship (1).
- Barge carriers (3).
- Heavy lift ship (1).
- Container ships (2).

LMSRs are scheduled to replace the current RORO ships by 1998. The end state for AWR-3 is 16 ships. The equipment stowed on the PREPO ships includes:

- Combat equipment (with required support and 15 days of supplies) comprising a combat force of a heavy brigade tailorable to a theater commander's need.
- Limited port opening capability.
- Thirty days of sustainment supplies to support the contingency force until the sea lines of communication are established.

Every PREPO ship has a battle book that provides an overview of the AWR-3 program, detailed information on the ship, and the stow plans. PREPO operations may consist of the employment of one ship to support a humanitarian assistance mission to the employment of all ships. FM 100-17-1 is the Army manual for prepositioned afloat operations.

### Sustainment Ships

Sustainment ships maintain the supply pipeline with arms, equipment, POL, food, and other materials needed for continued presence in overseas areas. This requirement is filled by ships from US/foreign flag ships and the RRF. Presently, US flag ships number 255 and foreign flag ships, 114. Under a voluntary charter, US flag ships are expected to be available when notified of a contingency.

### General Vessel Types

The MSC publishes a semiannual "Ship Register," short title MSC-P504. This unregistered document provides a by-name listing of each US Navy ship operated by MSC and each US flag oceangoing merchant ship, over 1,000 gross tons, owned by the United States or its citizens. It includes information such as class, speed, gross tonnage, draft, and range. Ships are referenced in three main groups:

- Alphabetical listing of US Navy ships.
- Alphabetical listing of merchant ships in operating status including ships undergoing repair or temporarily out of service.
- Nonoperational ships in the NDRF maintained and preserved for purposes of national defense by MARAD.

Anyone needing this document should write to Commander, Military Sealift Command (COMSC), Washington DC 20398-5100; or call the Requirements and Analysis Branch (N3113), 202-433-0087/0092, DSN 288-0087/0092.

The ships discussed in this section are those most commonly used by DOD.

Fast sealift ship. During the 1980s, the US Navy acquired eight large container ships from the SeaLand Corporation. These ships could operate on any major trade route at an unusually fast, sustained speed of 33 knots. They could carry more than a thousand 35- and 40-foot containers and had an in-port turnaround time of 24 hours. To enhance their military sealift capability, the Navy had the ships converted to a combination RORO/container configuration. This process included installing decks midship for RORO, adding a flight deck for helicopter operations, and retaining existing container cells. The converted SL-7 capabilities included both LOLO and RORO operations and rapid transport of military vehicles and equipment, including tanks and helicopters. Originally designated T-AKRs and identified as MSC RORO vessels, these ships have since been designated as FSSs.

The FSS transports, loads, and off-loads its cargo without nonorganic MHE. Although the vessel is largely self-sustaining, it requires longshoremen, vehicle drivers, and aircraft handlers to perform cargo operations. FSS characteristics include a draft of 34.5 feet, a speed of 27 knots, and a range of 12,200 nautical miles. It has 185,000 square feet of stowage and can transport 1,100 HMMWVs. FSS missions include:

- Rapid deployment of equipment and supplies of heavy combat units to locations around the globe.
- Rapid reinforcement of NATO and other commands worldwide.
- Rapid resupply/sustainment of deployed forces.

See Figure 5-25, for an illustration of an FSS.

Break-bulk ships. Break-bulk vessels fall under the category of general cargo (boxed, palletized, refrigerated, and limited containerized). Cargo operations on a break-bulk ship consist of LOLO operations. Each hold on the ship is serviced by ship's gear, booms, cranes, and winches. These vessels are considered to be self sustaining. They are labor-intensive and not the preferred method for moving tracked and wheeled vehicles.

Container ships. Container ships are designed to carry their entire cargo load in containers (usually 20- or 40-foot). The full cellular stowage within their holds allows containers to be secured without using dunnage. Container ships are configured for the stacked stowage of containers, both in the space below the main deck and on the main deck. Most of these vessels are non-self-sustaining and require the use of shoreside cranes or T-ACS.

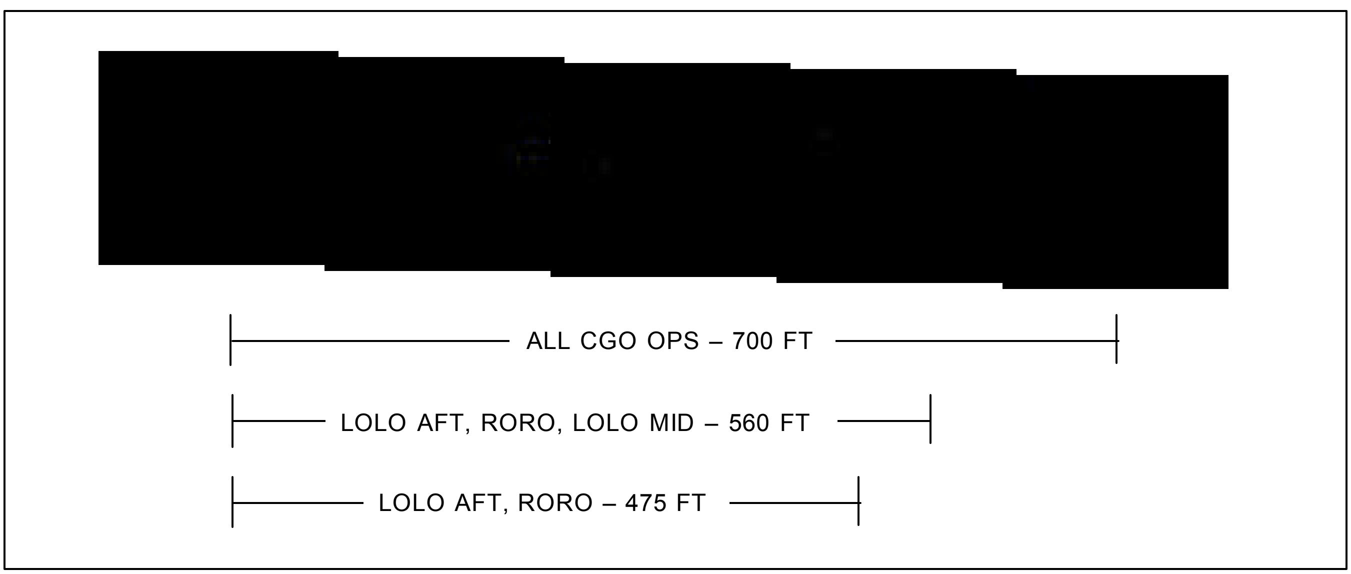



Figure 5-25. Fast sealift ship

Barge carriers. Barge carriers transport barges on which cargo has been loaded. These barges are loaded or discharged at berths by shore-based cranes. When cargo operations are complete, the barges are pushed or towed to the barge carrier and brought aboard. The LASH and the SEABEE are the two types of barge carriers used by the Army.

RORO ships. RORO ships are designed primarily to transport vehicles. Their cargo includes helicopters and wheeled, tracked, self-propelled and towed vehicles. RORO vessels are characterized by large cargo capacities and rapid cargo loading and discharge rates. The rapid movement of cargo is accomplished by a series of external and internal ramps. The cargo holds are typically large, open bays where equipment is driven into, parked, and lashed down. Most RORO ships have external stern ramps that rest on the apron of the berth, allowing access to the cargo holds. For this reason, RORO ships are considered to be self-sustaining. The RORO ship is considered ideally suited for the movement of unit equipment.

Large medium speed RORO. The LMSR (Figure 5-26) is a new class of strategic sealift ship designed to upgrade lift capability and expand the Army's prepositioned afloat program. In 1992, the Mobility Requirements Study identified a shortfall of 3 million square feet of surge capability and 2 million square feet of prepositioned sealift capability. To satisfy this shortfall, 19 LMSRs are either being built or converted. The first ship was scheduled for delivery in FY 96. The LMSRs are MSC-owned and will be operated under commercial contract.

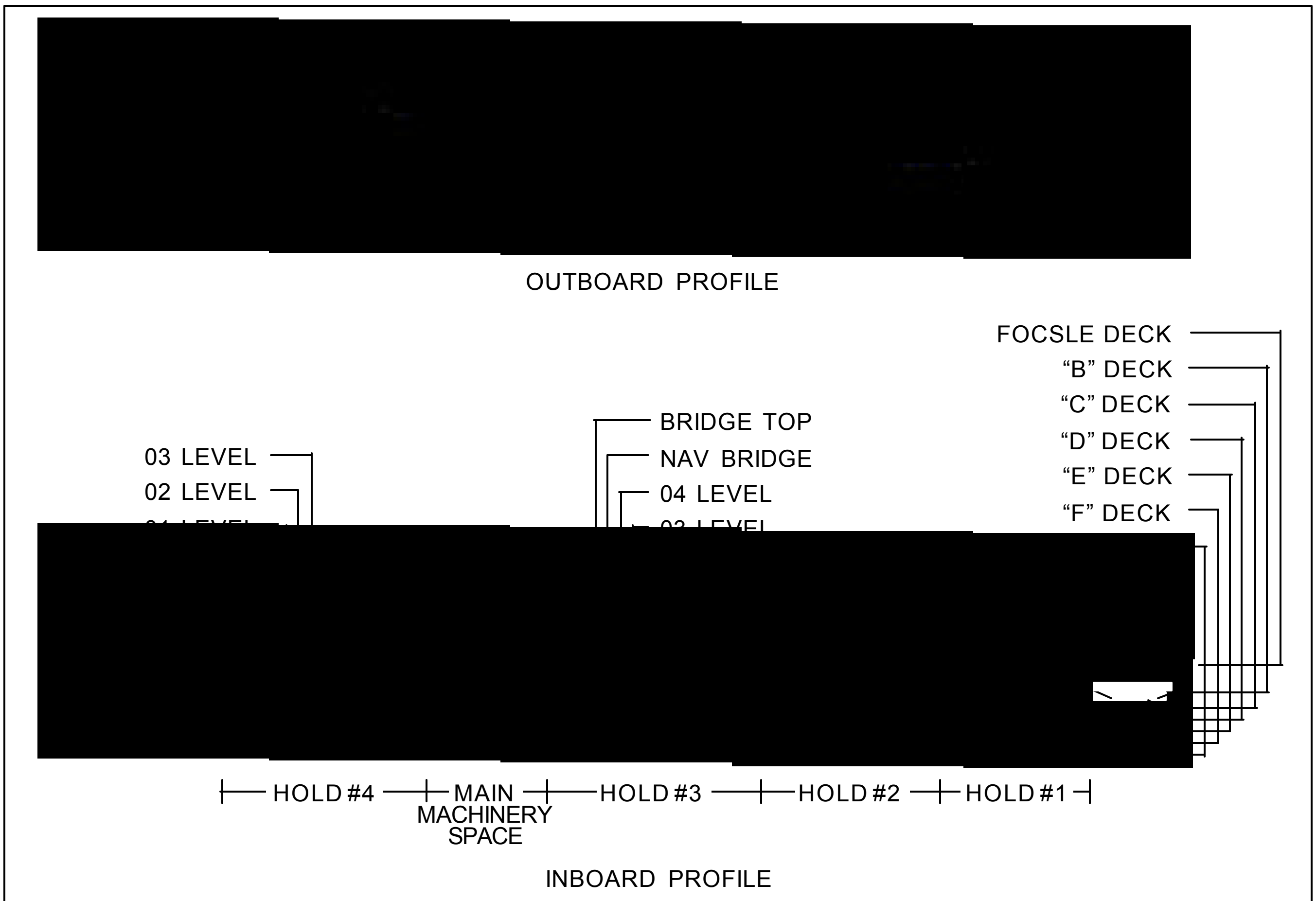



Figure 5-26. Large medium speed RORO

Along with FSSs, the LMSR will enable the Army to surge two heavy divisions to any theater in 30 days and then return to pick up follow-on forces. LMSRs have 380,000 square feet of stowage and can transport 1,998 HMMWVs. They have a speed of 24 knots. Other features include a slewing stern ramp, a side ramp, twin cranes, and an emergency heliport. The ship's draft is 35 feet. Eight of the 19 LMSRs are scheduled to replace RORO ships in the AWR-3 program.

Auxiliary crane ship. The T-ACS (Figure 5-27) is a converted container ship from the MARAD Reserve Force. It has been modified by the installation of twin booms, marine heavy-lift cranes used to off-load non-self-sustaining ships. The T-ACS can discharge its own cargo. It can also discharge another vessel in areas where port facilities are inadequate or nonexistent.

## US ARMY WATERCRAFT FLEET

While strategic sealift delivers over 95 percent of the tonnage required by operating military forces, Army watercraft become the critical link when that tonnage is projected over the shore, through fixed ports not accessible to deep-draft vessels, or through fixed ports not adequate without the use of watercraft (all classified as LOTS operations). Army watercraft units execute all functions required for successful theater opening, reception, and sustainment of the deployed force.

A proper mix of Army watercraft must be prepositioned for availability during the early phases of force closure. Army watercraft can be prepositioned on FLOFLO ships, SEABEEs, and/or on the decks of other large vessels.

### Vessel Designations

Each vessel in the Army's marine fleet bears an individual serial number, preceded by an applicable prefix. Vessel prefixes are as follows:

- Barge, dry-cargo, 1 nonpropelled, medium (100 through 149 feet) – BC
- Conversion kit, barge deck enclosure – BCDK
- Barge, dry-cargo nonpropelled, large (160 feet and over) – BCL
- Crane, floating – BD
- Lighter, beach discharge – BDL
- Barge, liquid cargo, nonpropelled – BG
- Barge, dry cargo, nonpropelled – BK
- Barge, pier, nonpropelled – BPL
- Barge, refrigerated, nonpropelled – BR
- Ferryboat – FB
- Dry dock, floating – FD
- Repair shop, floating, marine craft, nonpropelled – FMS
- Freight and supply vessel large (140 feet and over) – FS
- Boat, utility – J
- Lighter, amphibious – LARC
- Landing craft, mechanized – LCM
- Landing craft, utility – LCU
- Logistics support vessel – LSV
- Tug, large, seagoing – LT
- Tug, small, harbor – ST
- Boat, passenger and cargo – T
- Temporary crane discharge facility – TCDF
- Vessel, liquid cargo – Y

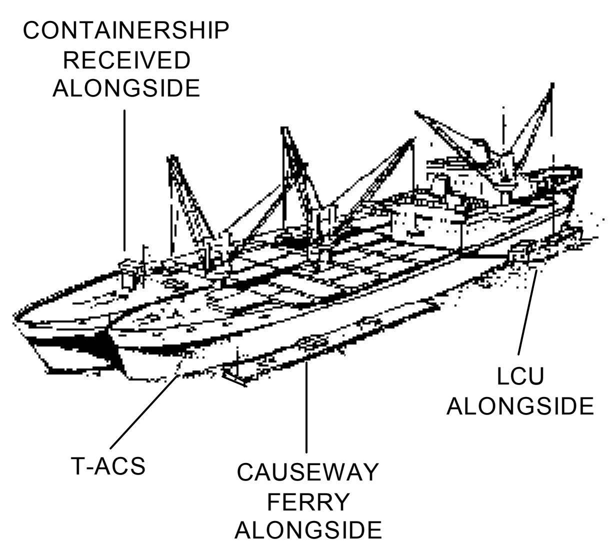



Figure 5-27. Auxiliary crane ship in operation

## Traditional Army Watercraft

This section contains information on various Army vessels, including mission, transportability, and characteristics and capabilities. See Figure 5-28, page 5-44, for illustrations of the water craft discussed in the following paragraphs.

Landing craft mechanized-8. The LCM-8 transports cargo, troops, and vehicles from ship to shore or in retrograde movements. It is also used in lighter and utility work in harbors. The LCM-8 is designed for use in rough or exposed waters and can be operated through breakers and grounded on the beach. The bow ramp allows RORO operations with wheeled and tracked vehicles. Its small size allows for use in confined areas.

The LCM-8 can be transported by LSVs, LCU 2000s, LSTs, commercial bulk carriers, and heavy lift ships. Characteristics and capabilities include the following:

- Length overall: 74 feet.
- Beam: 21 feet.
- Displacement (weight): 58 LTONs (light); 111 LTONs (loaded).
- Deck area: 620 square feet.
- Payload: 53 tons.
- Range: 332 nautical miles at 11 knots (light); 271 nautical miles at 9 knots (loaded).
- Draft: 3.5 feet (light); 5 feet (loaded).

Lighter, amphibious, resupply, cargo, 60-ton. The LARC-60 transports wheeled and tracked vehicles, including beach preparation equipment and general cargo from ship to shore or to inland transfer points. It is the only amphibian in the Army inventory, and the only vessel capable of landing on a beach through a breaking surf. The LARC-60 can be deck-loaded on a commercial vessel or heavy lift ship for transport overseas. It can be transported on a semi-submersible vessel, in the well deck of an LSD, or aboard a SEABEE. Characteristics and capabilities include the following:

- Length overall: 63 feet.
- Beam: 27 feet.
- Displacement (weight): 88 LTONs (light).
- Deck area: 527 square feet.
- Payload: 60 tons.
- Range: land, 60-ton load, 150 statue miles at 14 MPH; water, 60-ton load, 75 nautical miles at 6 knots.
- Draft: 7.5 feet (light); 9 feet (loaded).

Landing craft, utility, 1600 class. The LCU-1600 transports wheeled and tracked equipment and general cargo from ship to shore, shore to shore, and in retrograde operations. RORO missions are accomplished using the vessel's bow and stern ramps. It is valuable in LOTS operations and intratheater transport using harbor and IWW routes. The LCU-1600 is not capable of self-deployment over open oceans. It is deployed aboard vessels such as HLPSs, barges, and FLOFLO ships. It can also be loaded on Navy LSTs, LSDs, or commercial bulk carriers. Characteristics and capabilities include:

- Length overall: 135 feet.
- Beam: 30 feet.
- Displacement (weight): 205 LTONs (light); 390 LTONs (loaded).
- Deck area: 1,785 square feet.
- Payload: 184 tons.
- Range: 1,200 nautical miles at 12 knots (light); 1,100 nautical miles at 11 knots (loaded).
- Draft: 6 feet (light); 7 feet (loaded).

Small tug, 65-foot. The 65-foot tug moves non-propelled barges in harbors and IWWs. Secondary functions include general utility uses, fire fighting, salvage, and assisting in the docking and undocking of large vessels. Overseas deployment is by deck loading aboard a heavy lift ship or by towing by a larger vessel. Characteristics and capabilities include:

- Length overall: 71 feet.
- Beam: 19.5 feet.
- Displacement (weight): 100 LTONs (light); 122 LTONs (loaded).
- Bollard pull: 8.75 tons.
- Range: 1,700 nautical miles at 12 knots (light); variable with tow (loaded).
- Draft: 7.5 feet (light); 8.5 feet (loaded).

Large tug, 100-foot. The 100-foot tug is used to berth and unberth large oceangoing vessels and for heavy towing within harbor areas. Secondary functions include general utility uses, fire fighting, and salvage operations. It may also be used for limited off-shore towing between terminals. Depending upon distance, weather, sea conditions, and crew training, the 100-foot tug can self-deploy or be transported by FLOFLO. Characteristics and capabilities include:

- Length overall: 107 feet.
- Beam: 27 feet.
- Displacement (weight): 295 LTONs (light); 390 LTONs (loaded).
- Bollard pull: 13.8 LTONs/31.5 LTONs.
- Range: 3,323 nautical miles at 12.8 knots/ 2,245 nautical miles at 12.8 knots (light); variable with tow (loaded). NOTE: Higher fuel consumption of larger engines in ESP tugs reduces range.
- Draft: 11.5 feet (light); 12.5 feet (loaded).

Floating machine shop. The FMS consists of 14 repair shops, an onboard 9-LTON crane, and an internal monorail trolley system. The shops are battery, blacksmith, carpentry, electrical, engine, fuel injection, machine, sheet metal, paint, pipe fitting, radar and radio, refrigeration, shop fitting, and welding. The FMS can accomplish DS/GS level maintenance, repair, rebuild, and overhaul. The FMS can support the sustainment phase of operations. It is not self-propelled; therefore, it must be towed to overseas locations. Characteristics and capabilities of the FMS include:

- Length overall: 210 feet.
- Beam: 40 feet.
- Displacement (weight): 1,160 LTONs (light); 1,525 LTONs (loaded).
- Draft: 6 feet (light); 8 feet (loaded).

Crane, barge, 89-ton. The BD 89T is used to load and discharge heavy lift cargo that is beyond the capacity of ship's gear. It is commonly called the 100-ton crane which is the short ton capacity rating. The BD 89T is not self-propelled; it can be towed overseas or deck-loaded aboard a semi-submersible ship for transport. Its characteristics and capabilities include:

- Length overall: 140 feet.
- Beam: 70 feet.
- Displacement (weight): 1,630 (loaded).
- Boom length: 123.5 feet.
- Capacity: 89 LTONs at 80-foot radius.
- Draft: 6.3 feet (loaded).

Barge, deck or liquid cargo, BG 231C (fuel). The BG 231 transports liquid or general cargo in harbors and inland waters. It can transfer liquid products from off-shore tankers to shore facilities. The BG 231 can also serve as a refueling point for watercraft operating in the area. The barge is equipped with two skegs aft; this improves its towing capability by helping to keep it tracking on course. It can be towed overseas or deck-loaded aboard an HLPS. Characteristics and capabilities include:

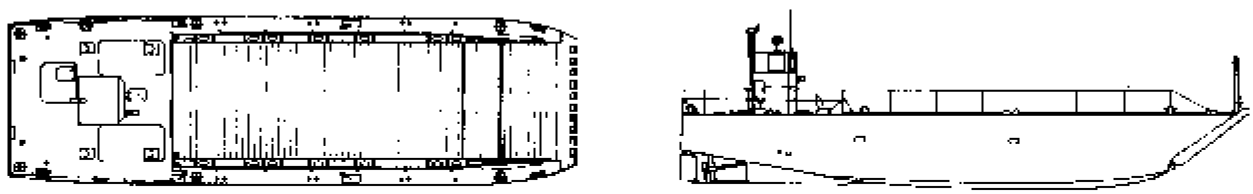
- Length overall: 120 feet.
- Beam: 33 feet.
- Displacement (weight): 185 LTONs (light); 763 LTONs (loaded).
- Cargo capacity: deck, 578 LTONs; liquid, 4,160 barrels (188,416 gallons).
- Cargo pump capacity: 1,050 gallons per minute.
- Draft: 3 feet (light); 9 feet (loaded).

Barge, deck cargo, BC 231A. The BC 231 transports containers, general cargo, and wheeled and tracked vehicles in harbors and IWWs. It is particularly suited for transporting tracked and wheeled vehicles. It is equipped with two skegs aft, thereby improving its towing capability by helping to keep it tracking on course. The BC 231 can be loaded aboard ships or towed overseas. Characteristics and capabilities include:

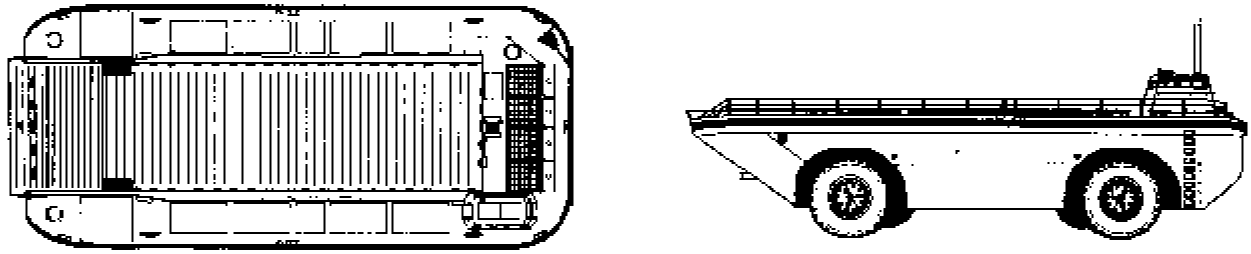
- Length overall: 120 feet.
- Beam: 33 feet
- Displacement (weight): 175 LTONs (light); 760 LTONs (loaded).
- Cargo capacity: 585 LTONs.
- Draft: 2.5 feet (light); 8 feet (loaded).

Barge, deck cargo, BC 7005. The BC 7005 transports containers, general cargo, and wheeled and tracked vehicles in harbors and IWWs. Because of its flush deck without fore and aft sheer, it is particularly suited for transporting vehicles. The BC 7005 was built without skegs, making it easy to maneuver at port terminals where piers are in close proximity. The BC 7005 can be deck-loaded aboard ships or towed overseas. Characteristics and capabilities include:

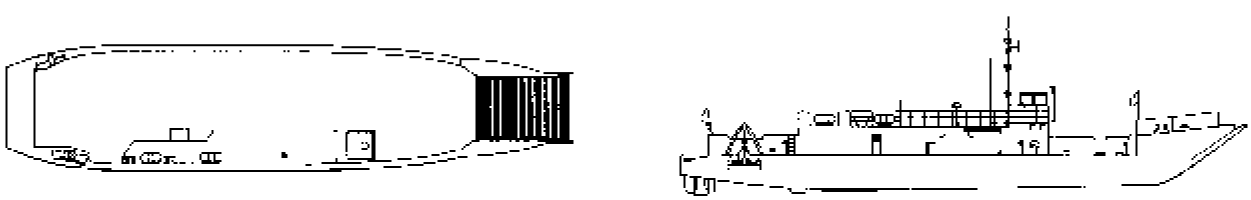
- Length overall: 110 feet.
- Beam: 32 feet.
- Displacement (weight): 120 LTONs (light); 690 LTONs (loaded).
- Cargo capacity: 570 LTONs.
- Draft: 1.75 feet (light); 7.5 feet (loaded).



LANDING CRAFT, MECHANIZED, LCM-8

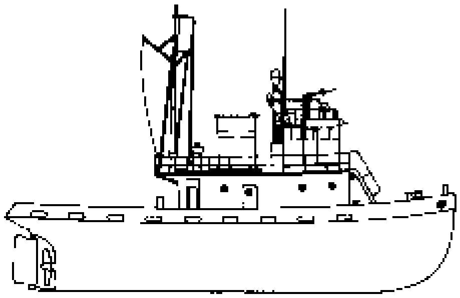


LIGHTER, AMPHIBIOUS, RESUPPLY, CARGO, 60 TON, LARC-60

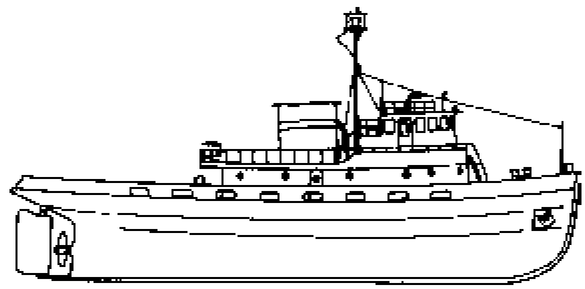


LANDING CRAFT, UTILITY, 1600 CLASS

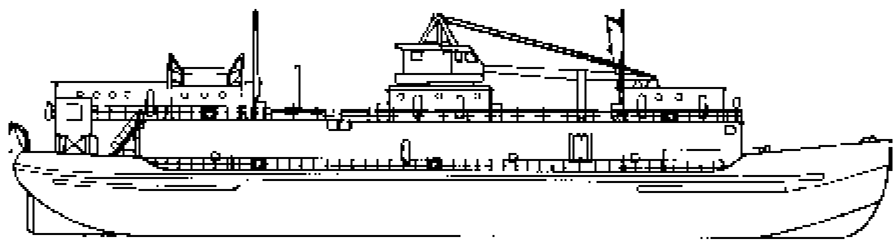
Figure 5-28. Army watercraft



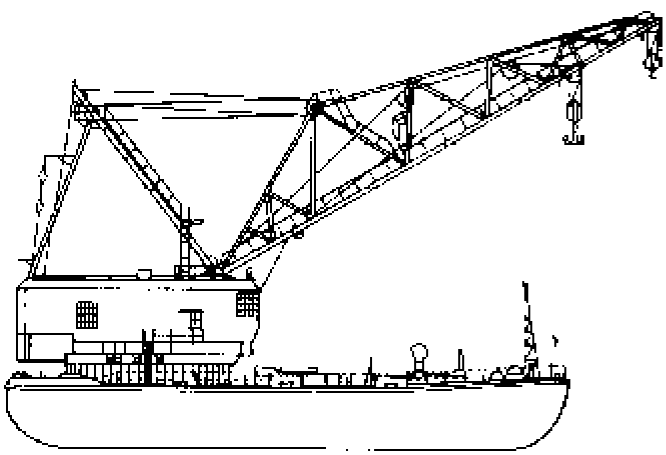
TUG, HARBOR, 65-FOOT, DESIGN 3004



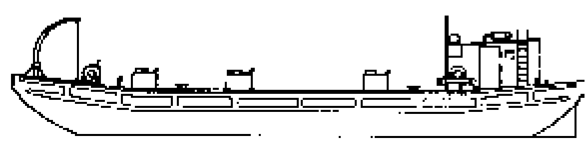
TUG, HARBOR, 100-FOOT, DESIGN 3006



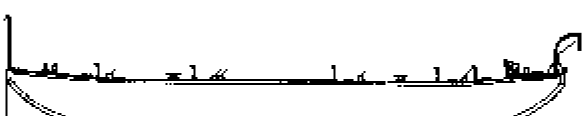
FLOATING MACHINE SHOP, DESIGN 7011



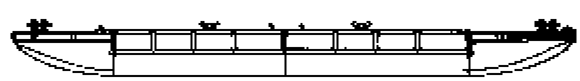
CRANE, BARGE, 89-TON



BARGE, DECK OR LIQUID CARGO,
BG 231C (FUEL)



BARGE, DECK CARGO, BC 231A



BARGE, DECK CARGO, BC 7005

Figure 5-28. Army watercraft (continued)

## Fleet Modernization

Recent watercraft modernization efforts have significantly enhanced the Army's capability to project and sustain America's military force. The following watercraft are representative of the modern Army fleet.

Landing craft, utility 2000. The LCU 2000 (Figure 5-29, page 5-47) transports rolling and tracked vehicles, containers, and outsized and general cargo from ships offshore to shore (LOTS), as well as to areas that cannot be reached by oceangoing vessels (coastal, harbor, and IWWs). It can be self-deployed or transported aboard a FLOFLO vessel. It is classed by the ABS for full ocean service and one-man engine room operations and is built to USCG standards. The LCU 2000 succeeds the 1646 Class LCU and replaces the 1466 Class in both the Army's Active and Reserve inventories. The Army has 35 LCU 2000s. Characteristics and capabilities of the LCU 2000 include:

- Length (overall): 174 feet.
- Beam: 42 feet.
- Displacement: 575 LTONs (light); 1,087 LTONs (loaded).
- Deck area: 2,500 square feet (5 M1 main battle tanks or 12 [24 double-stacked] 20-foot ISO containers.
- Bow ramp: 16 feet wide x 22 feet long.
- Payload: 350 STONs (15 C-141 loads).
- Range: 10,000 nautical miles at 12 knots (light); 6,500 nautical miles at 10 knots (loaded).
- Draft: 8 feet (light); 9 feet (loaded).
- Beaching draft: 4 feet at the bow.
- Carries up to thirty 20-foot containers or twelve 40-foot containers.
- Sustains crew of 2 warrant officers and 11 enlisted personnel for up to 18 days.
- Equipped with latest navigation, communications, and electronic equipment including an automatic pilot and steering system.

Logistics support vessel. The LSV (Figure 5-30, page 5-47) provides worldwide transport of general and vehicular cargo. LSV missions include intratheater line-haul in support of unit deployment or relocation; tactical and sustained resupply to remote, undeveloped areas along coastlines and on IWWs; and support to the discharge and backload of ships in RORO or LOTS operations. Six LSVs are in the Army inventory. LSV characteristics and capabilities include:

- Length (overall): 273 feet.
- Beam (molded): 60 feet.
- Displacement (weight): 4,199 LTONs.
- Deck area: 10,500 square feet (21 to 24 M1 main battle tanks or 25 [50 double-stacked] 20-foot ISO containers).
- Bow ramp opening: 26 feet wide.
- Payload: 2,000 STONs (86 C-141 loads).
- Range: 8,200 nautical miles at 12.5 knots (light); 6,500 nautical miles at 11.5 knots (loaded).
- Draft: 6 feet (light); 12 feet (loaded).
- Drive-through capability (bow and stem ramps).
- Self-delivery range: 6,500 nautical miles.
- Sustains crew of 6 officers and 23 enlisted personnel for up to 30 days.
- Transports heavy, outsized cargo including rolling stock, general cargo, and ISO containers.

Large tug, 128-foot. The 128-foot LT (Figure 5-31, page 5-48) is designed for ocean and coastal towing operations. All six LTs were fielded in 1994. LT missions include: assisting bulk and special cargo ships to berth or anchorage; shuttling non-self propelled barges and other floating equipment from location to location during LOTS operations; and providing ocean, coastal, and inland waterway tow service for Army logistic support. The LT is self-deployable worldwide. Characteristics and capabilities include:

- Length overall: 128 feet.
- Beam (molded): 36 feet.
- Displacement (weight): 786 LTONs (light); 1,057 LTONs (loaded).
- Bollard pull: 58 tons.
- Range: 5,000 nautical miles at 13.5 knots (light); 5,000 nautical miles at 12 knots (loaded).
- Draft: 14.5 feet (light); 17 feet (loaded).

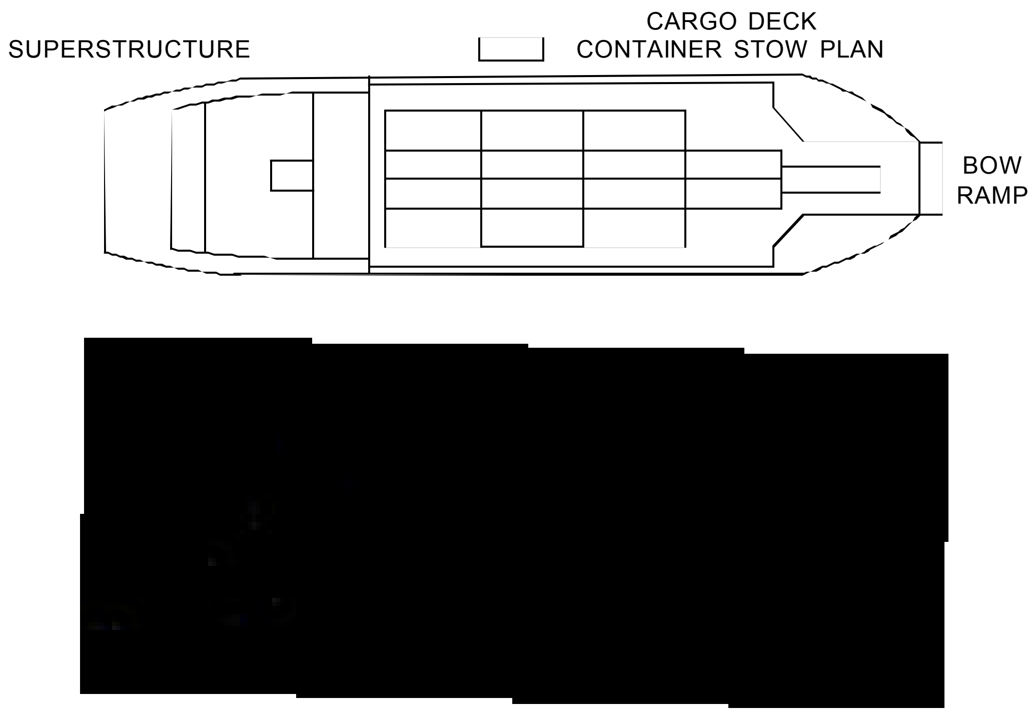



Figure 5-29. Landing craft, utility, 2000 class

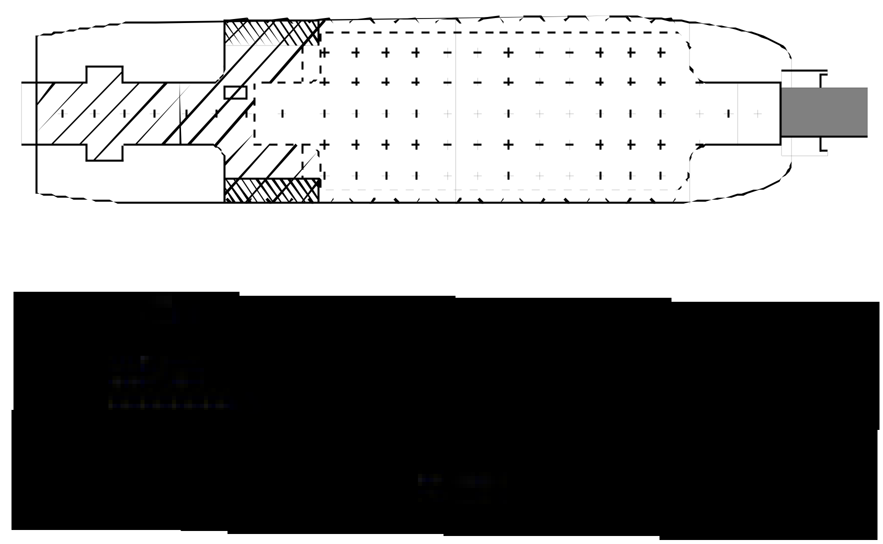


Figure 5-30. Logistics support vessel

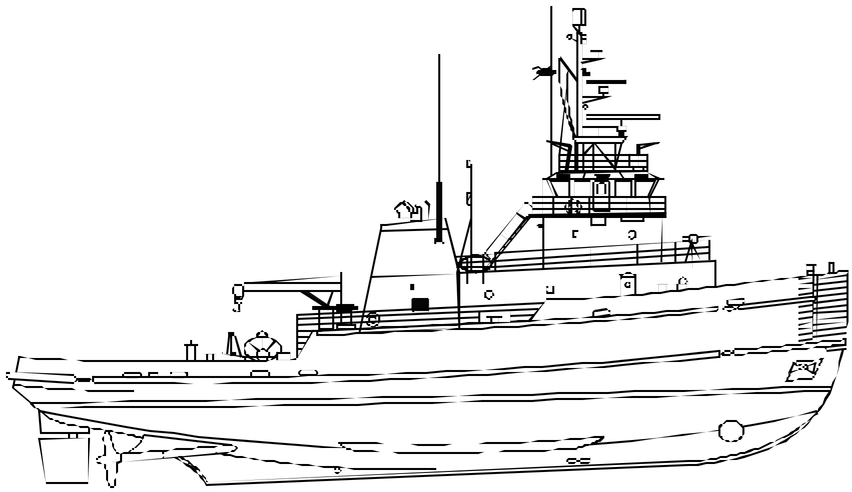


Figure 5-31. Large tug

Modular causeway system (causeway ferry). The CF consists of a powered section, made up of powered modules with internal propulsion and control components connected to the non-powered modules; two non-powered intermediate sections; and a non-powered combination beach/sea end section joined end-to-end. Characteristics and capabilities of the CF include:

- Loaded capacity of 100 STONs per non-powered section; approximately 50 STONs for the powered section.
- Total cargo capacity of 350 STONs with about 12 inches of freeboard.
- State-of-the-art equipment for pilot-to-operator, operator-to-commercial ship, and operator-to-command and control communications.
- Deployable aboard container ships and other cargo vessels.

Upon arrival in the operational area, CF components will be off-loaded and assembled for use. The CF is used to move rolling, break-bulk, and containerized cargo from oceangoing vessels directly to the shore-side logistic operation or to a fixed or semi-permanent pier. Also, it can operate in the JLOTS environment supporting RORO and LOLO operations.

RORO discharge facility. The RRDF (Figures 5-32 and 5-33, page 5-49) provides interface between Army lighters and RORO ships. It supports both self-sustaining and non-self-sustaining RORO ships. The RRDF has the following components:

- RORO platform – about 65 feet wide by 180 feet long.
- “B” or Sea End section with provisions for “Rhino” horn – provides interface between the RORO platform and displacement craft.
- CWR – used with non-self-sustaining ships.
- Fendering system – used with non-self-sustaining ships.
- Lighting system – used during generation and distribution.
- Emergency anchoring system – used when the ship being serviced is required to depart due to enemy actions or adverse weather conditions.

The RRDF is tendered by two SLWTs (Figure 5-34, page 5-50). The SLWT is an ASIOE for the RRDF. The SLWT has a deck-mounted A-frame and winch for hoisting/lifting and assembly of the RRDF hardware and components. The SLWT also has a stern anchor.

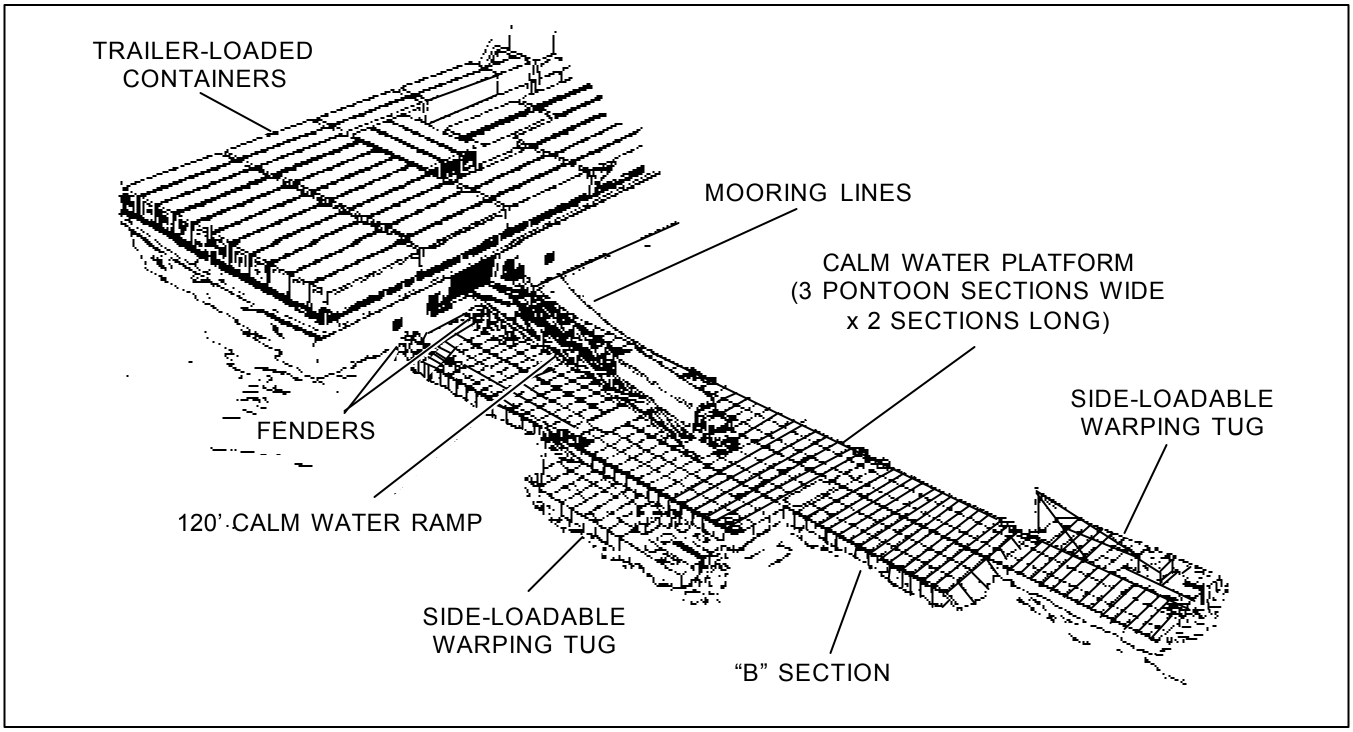



Figure 5-32. RORO discharge facility with ramp at side port

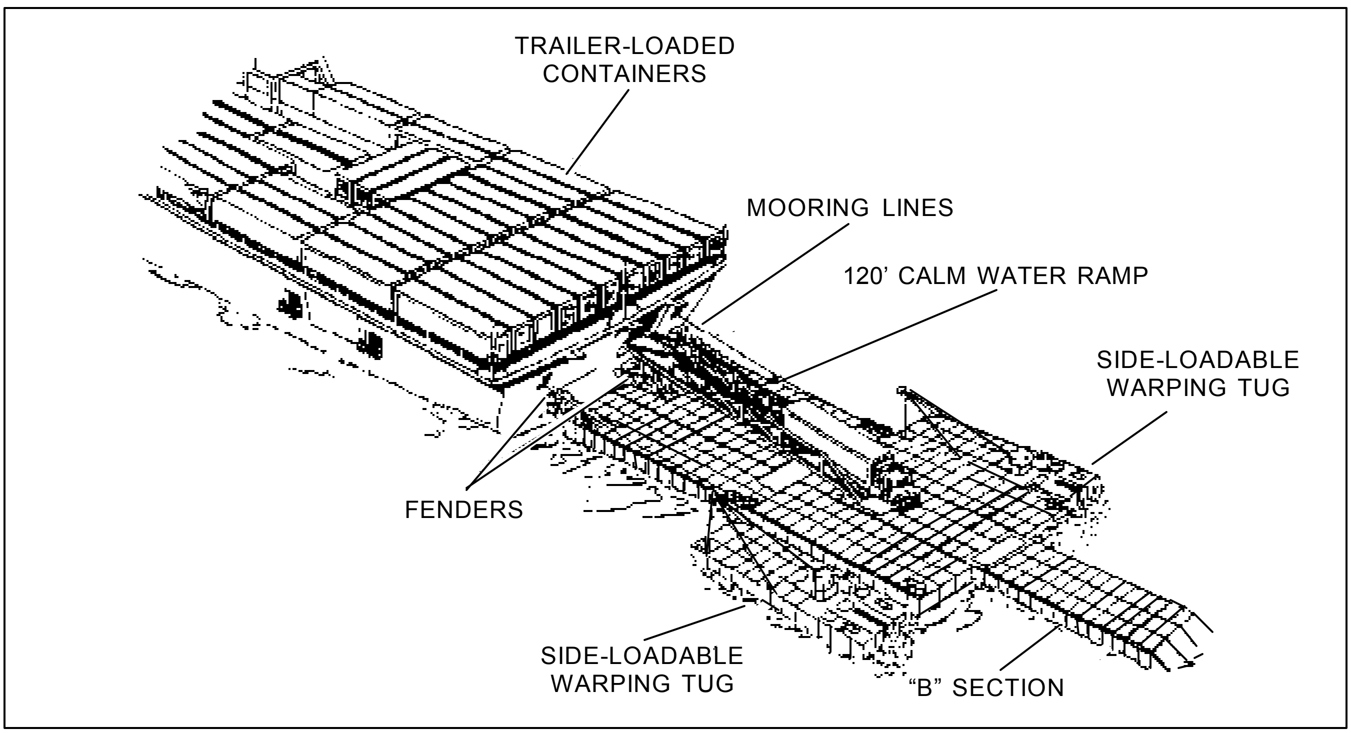



Figure 5-33. RORO discharge facility with ramp at stern port

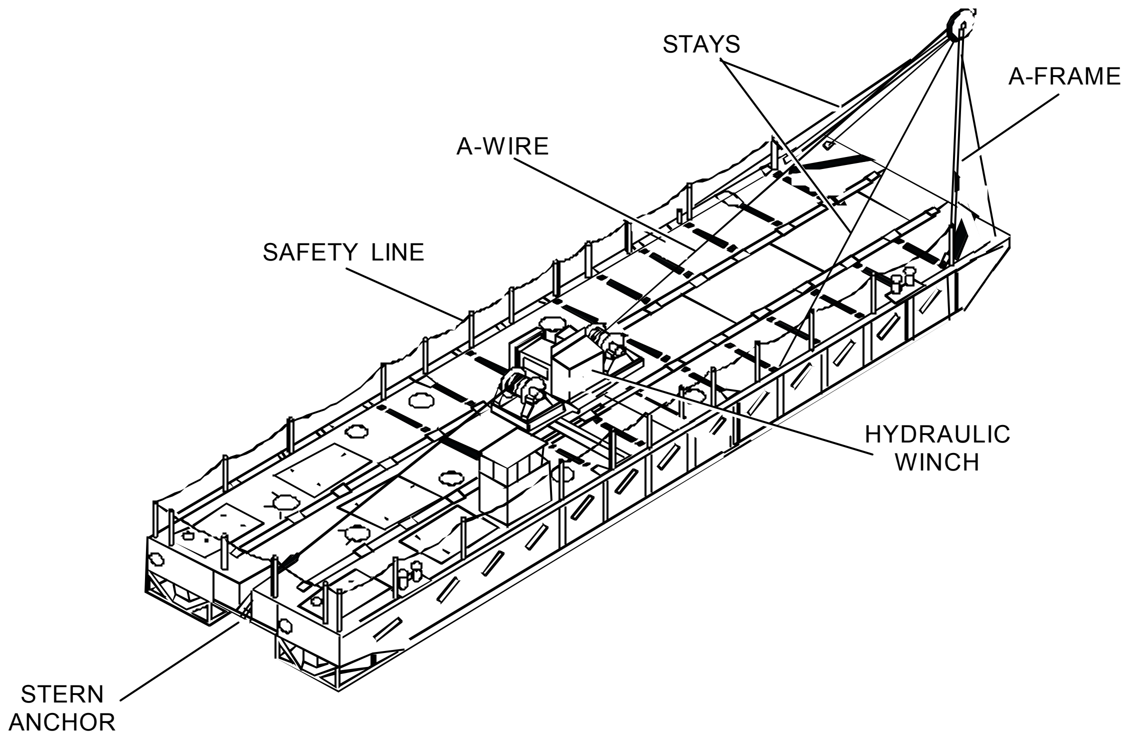



Figure 5-34. Side loadable warping tug, operational configuration

Modular causeway system (floating causeway). The FC provides a dry bridge for the transfer of cargo (primarily rolling cargo) from displacement lighters to the shoreside logistic operations. It includes the following components:

- 17 non-powered intermediate modular cause-way sections.
- 2 combination beach and sea-end sections.
- Anchor mooring system – the AMS is used to retain an in-place FC. Employs large marine anchors placed perpendicular to the roadway, offshore, and dry beach anchors to secure the FC to the beach.
- 2 SLWTs.

Characteristics and capabilities of the FC are as follows:

- Extends from the high water line out into the surf zone to a mean low water depth of 8 feet.
- Has maximum working length of approximately 1,500 feet.
- Offshore end incorporates an adapter end for the discharge of cargo from displacement lighters onto the roadway.
- Offshore end uses the “Rhino” horn to mate with lighters, so equipped.
- Two SLWTs are ASIOE. The SLWTs are used to insert, retract, and tender the FC and to in-place and remove AMS anchors.

The Army’s watercraft modernization program charts the course for continuous fleet moderniza-tion through 2011. Modernization efforts encompass the following: on-condition cyclic maintenance, material change, extended service program, research and development, and procurement.