HEAVY-LIFT BREAKBULK SHIP PRETEST RESULTS OF THE JOINTLOGISTICS-OVER-THE-H H CASEY ET AL. 25 JUL 77 ORI-TR-1188 WDA903-75-C-0016 F/G 15/12
HEAVY-LIFT BREAKBULK SHIP PRETEST RESULTS OF
THE JOINT LOGISTICS-OVER-THE-SHOE (JLOTS)
TEST AND EVALUATION PROGRAM

25 JULY 1977

Prepared Under
Contract Number MDA-903-75-C-0016
For the Office of the Secretary of Defense
Deputy Director (Test and Evaluation)
Office of the Director, Defense Research and Engineering
Washington, D.C. 20310
The major objective of the Heavy-Lift Breakbulk Ship Pretest was to determine the capabilities of the Services to use such a ship for deploying selected Logistics-Over-The-Shore (LOTS) equipment to a site where fixed port facilities do not exist. This test was the third of five planned preliminary tests of the Joint LOTS Operational Test and Evaluation Program conducted under the sponsorship of the Deputy Director (Test and Evaluation), Office of the Director, Defense Research and Engineering. The pretest was conducted from anchorages off Sewells Point, Norfolk, Virginia, and Ft. Story, Virginia.
The protest, conducted 1-9 November, 1976, was part of an evaluation program leading to a major LOTS exercise in August, 1977. The heavy-lift ship was needed in order to verify the capabilities for deploying newly procured LCU equipment assembled in a near ready-to-use configuration. It was anticipated that a LCU beach and throughput system could be established more rapidly if equipment assembly requirements were minimized. Operational response time would be significantly improved because the detailed disassembly—required for embarkation aboard conventional breakbulk ships, containerships, and most barges—would not be required for the heavy-lift breakbulk ship.

A secondary objective, conducting a container-oriented throughput operation, was added to the protest by the Services. This objective was included for training purposes and for eliminating potential technical problems during the LOTS main test.

The results of the protest indicated that equipment could be deployed with minimal disassembly and emphasized the continuing need for the heavy-lift breakbulk ship. Anticipated time savings are on the order of 53 hr in deploying a 300-ton capacity crane with minimum disassembly. This is compared to the time needed for the more detailed disassembly required when only conventional breakbulk ships are available.

The heaviest item loaded was a 1466-class LCU that weighed 180 long tons. A 1444-class LCU was scheduled for loading but lacked an appropriate sling. A recommendation was made that such a sling be included as part of the ship's equipment. Except for the 300-ton crane, all equipment was loaded/unloaded without difficulty. Handling of the 300-ton crane was complicated by the fact that it was rigged incorrectly. Also it had to be placed in the LCU backwards so that the combined center of gravity of the LCU with the crane was far enough aft to be safe and seaworthy. Consequently, after it was backed out of the LCU, the crane had to be turned around on the beach, a move that delayed the crane's operational readiness for several hours.

During the container throughput phase a temporary containership discharge facility (TCDF), an Army 300-ton lifting capacity crane mounted on a DeLong barge, was used by military personnel to unload containers from a ship.
The final major test, the LCS II, proved the concept feasible in a real environment. The test provided an opportunity to evaluate the concept under real conditions and to determine the amount of iteration to the design. The test was conducted under the conditions expected in a later report to be submitted to the RDT&E. The test results will be utilized during the LCS main test.

The LCS II test was conducted at the beach, the beach, was launched, and was lifted up ramps lowered, to the pier with the 140-ton crane and containers.

The 140-ton crane lifted the containers onto the pier, and the crane was employed to lift containers in lighters. The containers—were successfully and con- tinuously lifted, was employed to load con- tainers in the LCS II, but wave motion and con- tinuous testing made this operation too time- consuming. An additional, was successfully used to lighten containers at the pier, where a front loader rapidly off-loaded the containers.

The service personnel, the capabilities for using}

...
The heavy-lift breakbulk ship pretest was to be used to evaluate such a ship for deploying federal equipment to a site where fixed port facilities are not available. The pretest was the third of five planned preliminary tests and evaluation program conducted under authority of the Office of the Assistant Secretary of Defense (Test and Evaluation), Office of the Under Secretary of Defense (Research and Engineering). The pretest was conducted from November 1976, was part of an evaluation exercise in August 1977. The heavy-lift ship was selected for its abilities for deploying newly procured equipment in a ready-to-use configuration. It was anticipated that system could be established more efficiently and test costs were minimized. Operational requirements were improved because the detailed disassembly required for conventional breakbulk ships, containerships, and roll-on/roll-off ships was eliminated for the heavy-lift breakbulk ship.

The heavy-lift pretest indicated that equipment could be deployed with minimal disassembly, and emphasized the continuing need for the heavy-lift concept. Estimated time savings are on the order of 51 hr in deployment of equipment with minimum disassembly. This is compared to the time required for the detailed disassembly required when only conventional breakbulk ships are available.
The heaviest item loaded was a 180-ton-class LOCF that weighed 190 tons. A 140-ton-class LOF was scheduled for loading but lacked an appropriate sling. A recommendation was made that such a sling be included as part of the crane's equipment. Except for the 300-ton crane, all equipment was loaded/unloaded without difficulty. Handling of the 300-ton crane was complicated by the fact that it was rigged incorrectly. Also it had to be placed in the LOF, forwards so that the combined center of gravity of the LOF with the crane was for or over off. In safe and seaworthy. Consequently, after it was barked up the LOF, the crane had to be turned around on the beach, a move that reduced the crane's operational readiness for several hours.

During the container throughput phase a temporary container ship disposal facility (TCSF), an Army 140-ton lifting capacity crane mounted on a 140-ton barge, was used by military personnel to unload containers from a ship for the first time. A previous exercise, "Bull" proved the concept feasible by using a barge used civilian operators. This pretest provided an opportunity to instrument the crane for an evaluation on the amount of derating to the crane's lifting capacity is necessary when it is operating on an unstable platform. These findings are expected in a later report to be published by a naval laboratory and will be utilized during the LOF main test.

A former barge was also used to form a pier at the beach. The Delong, a 30-ton crane and a 140-ton crane aboard, was beached, jacked-up, ramps lowered, and operational in approximately 1 hr. The pier with the 140-ton crane was freewheel as an unloading facility for containers.

Also tested for the first time was the Army's 300-ton capacity crane which was placed at the high water line and used as a crane-on-beach container disposal facility. Both the 300-ton crane-on-beach and the 140-ton crane on the pier were harnessed by an inability to reach containers in lighters afloat. Amphibious-AH-1X and AH-1Y—were successfully and containerized using the LOF, but wave motion and container placement difficulties with the chassis made this operation too time-consuming. The Delong, a 30-ton crane was successfully used to lighter containers at the beach for an easier transport to the pier where a front loader rapidly off-loaded the containers and placed them on civilian trucks.

In summary, the pretest verified the Services' capabilities for using a floating breakwater to deploy certain LOF heavy and oversized equipment. At the same time, the LOF was considered feasible, because of its weight and size, in the hands of the LOF. The pretest also provided the first opportunity in over 4 years since a combined through exercise. This opportunity provided the experience required by military personnel which will be amplified during the main test.
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I. INTRODUCTION

The principal objective of the heavy-lift breakbulk ship pretest was to determine the capabilities of the Services to use a vessel of this type to:

- Deploy heavy and outsized, mission-essential, Logistics-Over-The-Shore (LOTS) equipment to an off-shore site,
- Off-load and transport the equipment to shore in landing craft deployable aboard the ship, and
- Prepare the equipment on the beach for LOTS throughput operations.

A secondary objective, conducting a container-oriented throughput operation, was added to the pretest by the Services for training purposes, and for identifying potential unforeseen technical problems during the main test. These objectives were accomplished in an exercise conducted November 1-9, 1976. The test began with the ship at anchorage in Hampton Roads, Virginia, where equipment was loaded and continued offshore at Fort Story, Virginia, where ship discharge and throughput operations took place.

The heavy-lift breakbulk ship pretest also offered a less obvious but important feature besides verifying the deployability of new equipment. There is rarely an opportunity for deployment of very large and heavy equipment, especially if handling by military personnel is required. The paucity of heavy-lift ships and the cost, difficulty, and infrequency of repositioning outsized, heavy equipment have diminished the familiarity and skill of military personnel in dealing with such equipment. Accordingly, it was found that some "rediscovery" of the special equipment and handling considerations was necessary for supporting this type of operation.
heavy items such as cranes, breakbulk, and locomotives. Second, there are three 120-ton capstan blocks mounted side by side on the main deck, which permit loading large heavy items on positions 2, 3, and 4. The 120-ton blocks can also be paired to work together giving the ship a nominal 240-ton lifting capacity, permitting the hoisting of a total of four LCLs can be stowed on the main deck. Figure 11 illustrates the capacity for use singly or paired. The general characteristics of the two heavy-lift breakbulk ships are contained in Table 1. Appendix A contains more detailed information on ship characteristics.

**TABLE 1**

<table>
<thead>
<tr>
<th>GENERAL CHARACTERISTICS</th>
<th>U.S.S. TRANSCOLORADO AND S.S. TRANSCOLUMBIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length (L)</strong></td>
<td>360 ft long</td>
</tr>
<tr>
<td><strong>Length between perpendiculare</strong></td>
<td>260 ft long</td>
</tr>
<tr>
<td><strong>Breadth molded</strong></td>
<td>60 ft wide</td>
</tr>
<tr>
<td><strong>Depth to main deck at side booms</strong></td>
<td>42 ft long</td>
</tr>
<tr>
<td><strong>Hull immersed at freeboard</strong></td>
<td>20 ft long</td>
</tr>
<tr>
<td><strong>Displacement in salt water</strong></td>
<td>21,000 long tons</td>
</tr>
<tr>
<td><strong>Draft</strong></td>
<td>11.475 tons</td>
</tr>
<tr>
<td><strong>Gross horsepower</strong></td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Hull speed</strong></td>
<td>12 knots</td>
</tr>
<tr>
<td><strong>Hull speed characteristics</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Displacement</strong></td>
<td>21,946 tons</td>
</tr>
<tr>
<td><strong>Centers of gravity and stability</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hull</strong></td>
<td>20 ft 30 ft above keel</td>
</tr>
<tr>
<td><strong>Structural center of gravity</strong></td>
<td>20 ft 40 ft above keel</td>
</tr>
<tr>
<td><strong>M.I. and trim</strong></td>
<td>14</td>
</tr>
<tr>
<td><strong>Current of draft</strong></td>
<td>0</td>
</tr>
</tbody>
</table>

*The TRANSCOLUMBIA's master and chief mate reported that on one occasion the ship had loaded and discharged a 200-ton tugboat.*
The objectives of the project were the heaviest lifts, the greatest spans, and the least amount of time. Among the tasks were:

1. The design of the crane was based on the assumption that it could not be sent to the site for prefabrication tests.
2. The crane was assembled on the site with a suction barge, and the sections of the boom were prefabricated to the actual lengths required.
3. The sections of the boom were assembled on the suction barge, and the counterweights and caterpillar floats were added.
4. The crane was tested to determine the loads and the ship's capacity required.
5. The crane was lifted and set in place using suction barge capacity of less than 100 tons and was required to be lifted with a crane of less than 100 tons.

The crane's lifting capacity is smaller and lighter than the crane's lifting capacity. However, it can be deployed on most commercial ships. The lifting capacity is approximately 100 tons, and the crane can be used to lift larger loads from a ship. The crane was tested on the ship's capacity of 100 tons. The crane was tested on the ship's capacity of 100 tons and was tested on the ship's capacity of 100 tons.
<table>
<thead>
<tr>
<th>Lifts Planned</th>
<th>Characteristics</th>
<th>Lift Made</th>
<th>Length (ft)</th>
<th>Width (ft)</th>
<th>Height (ft)</th>
<th>Weight (tons)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td>57.6</td>
<td>12</td>
<td>13.5</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>48.6</td>
<td>11.7</td>
<td>9.4</td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>67.6</td>
<td>28.6</td>
<td>15.1</td>
<td>88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>119</td>
<td>34</td>
<td>17.9</td>
<td>180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>135.3</td>
<td>29</td>
<td>17</td>
<td>151.9</td>
<td>No ships available</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>41</td>
<td>17.5</td>
<td>11.7</td>
<td>64</td>
<td>Top handler removed.</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>37.5</td>
<td>13.2</td>
<td>16.9</td>
<td>69.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>76.3</td>
<td>33</td>
<td>21.5</td>
<td>27.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>90</td>
<td>21.3</td>
<td>5.1</td>
<td>60.3</td>
<td>Lift was redundant*</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>20</td>
<td>8</td>
<td>8</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>40</td>
<td>8</td>
<td>8</td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The equipment deployment aspects of the test were most important with respect to the technical feasibility of moving the LIT's equipment with the equipment support ship, once in the objective area, making the equipment ready for deployment. Observations were concerned with matters of proper placement of slings with lift points, any pendulation problems, equipment movement, and the like. Times required for deployment of equipment items were measured to support main test planning. Crane cycles and timed deployment data samples were also obtained. The throughput rates from the test that influenced them were additional inputs to main test planning.

Other equipment measurements were made of the sea state and the load on the LIT platform. An ancillary test to measure the stresses in the equipment of the LIT was also conducted. These measurements, made by the Naval Civil Engineering Laboratory at Port Hueneme, California, will be the subject of a separate Navy report. The results may assist the Joint Test Evaluation Program by establishing better safe working limit criteria for crane working in this environment.

Finally, observations were made of the way various equipment functioned in the preparation of crane documentation and control procedures.
II. OPERATIONS

The operations began about 0700 on November 7, 1976, with the ship about 10 miles off Sewells Point in Hampton Roads. Weather conditions were good, and loading and discharge phases of the pretest were clear with moderate wind and calm seas at both the Sewells Point anchorage and at Blue Point, St. Story.

Preparations for loading required approximately 3 hr and included the handling of cargo, the loading of dunnage, cargo rigging sets, and the setting of the crane. The cargo was accomplished using the ship's 120-ton booms and a 20-ton derrick to handle very large objects, and, hence, move rather slowly. The handling of the LASH-1 containers and the LARC-Ls were loaded before the personnel or equipment. Most ships round-the-clock operations are limited to one with the heavy-lift ship; this is not advisable because of the stresses involved. The LASH-1s (100 ft) and the need for the boom operator to control, with the line passing through the sheaves at the boom tip. This is of particular importance at night since artificial light at the 200-ft distance is inadequate.

The first lift on the second day was the 1466-class EIR, which was loaded on the starboard side of Hold No. 4 without difficulty. The 412B crane was mounted on the side and stowed in the well and at the lower end. It held No. 4 crane, which was loaded on the port side and the sideloader on the starboard side. All lifts were made in a fairly routine fashion except for the 6,500-tbm crane which was fitted with a pronounced fore and aft tilt.

Off-loading began about 0730 on 4 November after the ship had moved to an anchorage off Blue Beach, St. Story. The order for off-loading was the 412B crane, sideloader, the 40-ft container, the 912B crane, the 1466-class EIR, and the LARC-Ls. Only the 6,500-tbm crane posed any difficulties and this was
The document appears to be a manual or instruction guide, possibly related to operations or maintenance. The text is dense and contains numerous abbreviations, technical terms, and instructions. Without being able to read the specific content, it seems to be a detailed guide covering various procedures or specifications. The language used indicates a professional or technical context, likely used by operators or technicians familiar with the specific subject matter.
FIGURE 3. TEMPORARY CONTAINERSHIP DISCHARGE FACILITY
The smaller crane, the 916, was lifted first. There was a delay while the crane upper was rotated 180 degrees. The boom base was over the crane track cat in the final configuration. After a test lift the crane was set down again in the, and the nylon long inspected. The lift was then made with no further delay.

The lift of the 6250 crane was the final heavy lift and was the only one that required an on-the-spot decision. The same lifting frame that was used for the smaller crane was used for the 110-ton 6250 crane lift. As the lifted started, the load moved up. The front wheels were about 3 ft off the deck before the rear wheels began to lift clear. The crane boom, facing the rear, slanted downward toward the rear of the lift. It was being lifted from.

If the lift had continued, the boom presumably would have come in contact with the top edge of the crane. Experience in the breakout ship project had shown that even temporary strong impacts on the tubular frame of the crane boom can cause dents that seriously affect the maximum lift capability of the crane. Thus the possibility of contact had to be minimized.

The way to avoid the problem would have been to re-ring the lift so that it remained level. This would have involved shifting the lift point at the apex of the lift frame from one point to another in the series of holes available. However, such re-ringing would have been time-consuming. A decision was made to continue the lift, but to first lower the lift ramp so as to provide increased clearance. This was done, and the lift proceeded with the crane at a pronounced slant. As the crane started downward toward the deck of the ship the lift would have caused the boom base to make contact with dents on the hatch top before the crane wheels made contact. This the possibility caused a delay of about 30 minutes. The crane was repositioned in such a way that the boom base was located over a gap between the crane and the deck house. This allowed the crane wheels to make lift to the tip of the boom base. With that problem solved, the lift was completed.

The total time required for the 6250 crane lift, including delays, was 3 hr and 12 minutes. "Time" here refers to the time-in-in the project: 2 hr and 36 minutes for the crane base lifting, 32 minutes for the crane upper lifting, and 14 minutes for the crane boom lifting. In addition, 8 minutes were spent preparing the site and making the load on the crane.

General

A.1: The lift of the 6250 crane was up on November 1, the week of the lifting, and by the week of December 8 the must part of the order

Operational Impact. The testing and evaluation of the conventional breakout ship project was part of the overall test and evaluation program.
The equipment handling was the reverse of that for lifting. In general, the equipment was left in place, with the exception of the lift. The equipment handling was made to the lift after the crane was off-load. The crane was used to get the lift to the floor when the equipment was left in place. The lift was then removed and the crane was used to lift the equipment to the floor. Since the equipment handling was made to the lift after the crane was off-load, the crane was left in place.
The LCM\(^*\) carrying the Army 3125 crane to shore had no difficulty
underway despite a pronounced list. The LCM\(^*\) grounded on an off-shore sand-
bar an hour before low tide. A LARC-Y from the Naval Beach Group detachment
assisted it in backing off. The LCM\(^*\) then waited for the tide to come in,
and some time later made a second attempt. Again the LCM\(^*\) was stuck on a
sandbar. This time cables were passed from bulldozers to the landing craft,
with a hard strain on the lines the LCM\(^*\) was pulled over the bar and into
the deeper water nearer the shore. From there it was successfully beached.

Bulldozers then graded a ramp for the crane to use in coming ashore.
Momat was unrolled onto the graded ramp and, some 30 minutes after the LCM\(^*\)
had been pulled across the sandbar, the crane was ready for moving ashore.
In moving out of the LCM\(^*\) onto the mat, the crane got hung up on the after
end of its carrier. By using an outrigger to jack itself up, the crane freed
itself and moved onto the beach with no further difficulty. No difficulty
was recorded in assembling the crane’s counterweights, attaching the boom sections,
and reeving the cables. These operations were accomplished during the night so
that the crane was ready for operations before the first landing craft arrived
the next day.

Sideloader

The LCU carrying the sideloader also had to be assisted by bulldozers
in landing. It came ashore on the same tide as the LCM\(^*\) carrying the 3125 crane.
After moving ashore out of the LCU, the sideloader overran the Momat matting
and got stuck in the sand. Bulldozers assisted and got it back on the Momat.
In another occasion it got stuck crossing a narrow gap between Momat strips.
This time it used its outriggers to elevate its tires so that beach matting
could be placed under them and then it was freed.

CONTAINER THROUGHPUT OPERATIONS

General

In the second phase of the pretest, which involved container throughput
operations, the TCCF was used exclusively to discharge containers from no:
and deck stowage locations aboard the TRANSCOLUMBIA to various types of lighters,
including LCU, LCM\(^*\), LARC-KY, LARC-LX, BC barge, and causeway ferry.

Four methods were used to unload containers from lighters:

- 140-ton crane on jacked-up B DeLong to off-load all
lighters and load containers on milvan chassis.
- 300-ton crane at the high waterline primarily to off-
load LCU and LCM\(^*\) craft. It was used to also off-
load amphibians and to transfer loaded containers onto
milvan chassis.
- 140-ton crane in the marshalling area to unload amphibians.

22
Frontloader to off-load containers from a causeway terry onto military chassis.

These subsystem elements were not used concurrently due to the small quantity of test cargo available (20 milvans and 1 40-ft van). Nevertheless, the test was the first opportunity in 4 years that a container throughput exercise had been attempted. Data and training on the new Army equipment were needed. It was also the first time in 4 years that a container marshalling area operation was conducted and, although the activities there were relatively slow and simple, the same data and training opportunities existed. Documentation and movements management also played a part in this phase with some limited use of the mobile CPC van.

To be representative of military cargo shipped in containers, the containers were weighted with dummy cargo. Figure 2 shows the weight distribution of the containers used.

![Graph showing container weight distribution](image)

**Figure 2. Distribution of Container Weights (20 and 40-ft)**

**Temporary Container Discharge Facility**

Use of the heavy-lift breakbulk ship as a containership had two recognized drawbacks. First, there were no cell guides to assist in attachment of the container spreader bar to containers in the hold. As a result, stevedores had to wrestle the spreader bar around over the tops of containers until it could be engaged with the corner fittings. Second, the TCF had to
During the test, the containers were first completely off-loaded from the ship and re-loaded. In some cases a container was back-loaded and then without data being collected. Containers from the spreader bar the container was loaded in the latter. These latter iterations were disregarded since they had more training value than data validity. The COG working the TRANS-5 had completed and back-loaded 16 containers. When the ship charter period was completed, a 1500 barge was used briefly instead. No timings were made of these loading and unloading events. There were considerable periods when working the ship in which the crane was inactive or delayed. When the crane was used and was operating, a cycle required approximately 10 minutes. The loading of containers to the ship required approximately 7 minutes each. The operational timing of these times is contained in Section III. Table 6 contains the characteristics of the COG.

<table>
<thead>
<tr>
<th><strong>TABLE 6</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUMMARY OF COG CHARACTERISTICS</strong></td>
</tr>
<tr>
<td><strong>60 ft</strong></td>
</tr>
<tr>
<td><strong>60 ft</strong></td>
</tr>
<tr>
<td><strong>656.2 Lons</strong></td>
</tr>
<tr>
<td><strong>100 ft</strong></td>
</tr>
<tr>
<td><strong>Heavy duty</strong></td>
</tr>
<tr>
<td><strong>1,450 lb each</strong></td>
</tr>
<tr>
<td><strong>Double drum</strong></td>
</tr>
<tr>
<td><strong>1 inch</strong></td>
</tr>
<tr>
<td><strong>4 parts per hook</strong></td>
</tr>
<tr>
<td><strong>14.3</strong></td>
</tr>
</tbody>
</table>

Operations with the COG crane at the water's edge commenced the afteroon of 28 November. The first day's activities consisted of discharging 654 containers during a period of approximately 3.5 hr. Operations had commenced but 55 minutes after low tide, so it was not possible to land LOUs. However, it was later close enough for the crane to reach them. Therefore, to allow proper operation, amphibians were employed instead.
The next day, there was a morning high tide (KHWS) so retrograde operations were possible. The LASH was berthed, backloaded with four containers, and retaken to the pier. The average time per container was 10 minutes. The weather was being experienced at the beach on the next day, was light with calm twos for two containers before it was retracted after 20 minutes. The LASH had to make multiple loading and unloading attempts in the calms and high seas. A total of 3 knots were experienced which caused difficulties in handling operations.

The last day of beach operations for the 144-ft crane, approximately 8 minutes before high tide, a LASH barge was grounded within the crane's reach. The containers were unloaded at an average rate of 4-5 minutes each. The barge was subsequently brought in at low tide and one container was...

The beach unloading system was designed for the barge to land in the water, and the crane with the shore base was used to handle the containers and position them at the beach using the crane. A container's behavior during transportation was normally followed by a barge on the return trip.

The barge was brought in approximately 1 hr before high tide and offshore. 4 minutes later all its containers (piling) was has been lowered.

On the next day and the third day, December, after some additional effort, the ramps to the Belong were lowered from the beach to the pier. However, at the end of that day some additional alignment was required to the Belong. No was spent aligning the ramps. Then, because of the 4-ft high Belong ramps, an asphalt vehicle was used to unloading in all the working. By the end of the day, after a period of 2 days, the Belong was ready for unloading. The amount of asphalt provides a detailed description of the installation and handling operations.

On December 1st, the Belong handled approximately 2 containers during the 144-ft crane. The first day of operations was made possible. The next day, an additional landing craft and crane truck were added. The crane was the result. The Belong unloading was found to be manual and limited. Consequently, the opportunity for operations was lost. During the low tide joint equipment, some problems were encountered, handling and off-loading trucks. Two LASH were brought with containers to the Belong and these were attached onto the pier. The container was later retracted via a LASH.

On the next day, December, more active. In the morning during the 144-ft crane, 2 containers were loaded with three retrograde containers. Over three LASH were brought for unloading a total of 4 containers. The crane's 4 containers were handled landing craft to reduce that operations could continue until high tide. Two LASH were unloaded and two others were loaded.
The first step in unloading the large vessel was to prepare a high side to the beach end of the second pier. Bulldozers constructed a sand ramp, length of 100 ft, over the beach. The ramp was level with the beach mounted and the slope increased.

The ramp, lengthwise, was used twice during the operation. The first operation began when the containers were placed on rail truck chassis and loaded on the second pier. The second unit was loaded on the causeway. The second unit was loaded at the beach end of the second pier. The causeway used in both cases was the same. The rail truck chassis.

The trailer was loaded by three rail trucks at the beach end of the second pier. As soon as the ramp was prepared, three rail trucks were loaded on the causeway. Each rail truck and trailer unit was a separate causeway section. The second unit, rear of the second pier, was used. None of the trailers were used. The causeway was used to the beach without difficulty, at low tide, and proceeded towards the ship.

After the first rail truck was lifted from the deck of the vessel. After unloading, the operation continued by positioning the container on the platform trailer, the deck and the ship. The problems were:

- The relative motion of the TIC and the causeway.
- The twist angle (approximately 8 degrees) needed to properly align the container with the trailer (see Figure 4).
- The limited deck area for line holders.
- The trailer is small—e.g., even when there is no relative motion, as on dry land, it is not easy to position a container; directly onto the container fittings of this type of trailer without repeated tries.

The second attempt on a different trailer was successful, requiring three attempts. The first lift attempted had been to a trailer spotted on the causeway and forward of the TIC crane. The second lift loaded a trailer which was driven forward along the axis of the boom. (Dotted lines, Figure 4.)
The beach was not flat, but sloped slightly. The approach to the beach was via a narrow path that led to the causeway and then down to the water. The path was bordered by small rocks and sand, and it was clear that the area was well-suited for a beach. The rocks were smooth and the sand was soft, making it a comfortable place to walk.

In the distance, the ocean was visible, and the waves were rolling in. The sky was clear, and the sun was shining brightly. It was a perfect day for a day at the beach. The water was calm, and the waves were gentle. It was a beautiful day, and the beach was just waiting to be enjoyed.
This position proved to be in error—the pins should have been at the other end. As the lift began the error became all too evident. The center of gravity of the crane assembly began to swing to a position under the suspension point, with the crane at a severe tilt. (See sketch, Figure 17.)

The tilt, however, was accommodated in the loading phase, although it did create some delay while the ship was underway or prior to the initiation of this unloading; the lifting frame should have been modified. The decision not to correct the location of the pins resulted in additional delays during off-loading operations.

**Comparison of Crane Readiness Times for Different Assembly Configurations**

The disassembly of the 91-ton capacity crane to a tactical configuration for deployment takes less time than an administrative (detailed) disassembly wait for employment on a ship with a less capable boom. This, of course, is also true for (crane reassembling once the crane has been shipped to the objective area) Table 7 illustrates the differences in deployment times for the two disassembly operations. The table is based upon judgments regarding which delays are typical of real operations, which operations can be done concurrently, and the like.

In the test the 6250 crane was made ready from its minimum disassembly configuration in a shorter period than required when fully disassembled as in previous protests. The turnaround of the crane on the beach makes a precise comparison of the times for the two get-ready operations difficult. Even after subtracting administrative delays, it is not possible to make an exact comparison.

The comparison shown in Table 7, then, should be interpreted as showing a general order of magnitude of difference in the times that could be expected between the two assembly operations, if two otherwise similar operations are compared. The table indicates what times were included and excluded in the comparison.

Looked at in total, the savings in time by moving the crane in its minimum disassembly configuration is about 7 days. This difference depends on the assumptions made. These assumptions concern such matters as:

- Whether the loading bottleneck will be the heavy crane (in effect, Table 7 does assume this);
- The order of unloading from the ship (the components for the 9125 and 6250 cranes are assumed to have priority for unloading); and
- Whether the assembly of the 9125 crane could be done concurrently with the discharge of the 6250 crane components from the ship (as assumed in Table 7).
POSITION OF CRANE WITH CORRECT SUSPENSION POINT, CENTER OF GRAVITY DIRECTLY BELOW SHIP'S HOOK.

POSITION OF CRANE WITH INCORRECT SUSPENSION POINT, CENTER OF GRAVITY DIRECTLY BELOW SHIP'S HOOK.

FIGURE 1: SCHEMATIC VIEW OF CRANE.

This resulted from incorrect selection of holes in top center of kink rig. (Not to scale.)
### Table 1

**Administrative, Disassembly, and Loading Times**

<table>
<thead>
<tr>
<th>Time Category</th>
<th>Administrative</th>
<th>Disassembly and Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembled</td>
<td>2.0 hr</td>
<td>7.4 hr</td>
</tr>
<tr>
<td>Partially assembled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td>11.0 hr</td>
</tr>
</tbody>
</table>

**Minimum Disassembly** at the Heavy-Lift Ship

**Disassembly and Loading Times**

| Disassembly | Partial disassembly and mobile loading of boxes and cranks | 11.0 hr |
| Loading area | Single heavy lift | 7.4 hr |
| Counterweights, hoists, etc. | 7.4 hr |
| 12.0 hr | 11.0 hr |

**Mobilizing Times (at objective area)**

| Mobilizing | Off-loading assembled crane | 7.4 hr |
| band | Transfer time | 7.4 hr |
| Local transfer | 7.4 hr |
| 1.0 hr | 1.0 hr |

**Assembling Times (based on best estimates)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Time (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assemble 915 crane</td>
<td>1.0 hr</td>
</tr>
<tr>
<td>Install operator's module</td>
<td>1.0 hr</td>
</tr>
<tr>
<td>Assemble booms and counterweights</td>
<td>4.0 hr</td>
</tr>
<tr>
<td>11.0 hr</td>
<td>11.0 hr</td>
</tr>
</tbody>
</table>

*Degree of Disassembly*
many other operations listed are not realized in a contingency and thus are not necessary. The deployment time is different from those shown in the table. It is assumed that there would still be a definite advantage. This advantage would be in the order of two days if the more fully assembled crane configuration is possible for deployment. This advantage is gained by the use of a heavy lift ship that can load and discharge the crane (tactically assembled) at the site lighter needs to transport the 500 ton crane (in its

In the event in which configuration to use in moving the C-130 crane will be a matter of the shipping available. Assuming that in a future emergency such a ship will have the same operating for sea transport, a comparison for the difference in time could be a value in taking a decision on which option is necessary. It seems that the more assembled or boat that carries an off-loading

ships must be delayed until an appropriate

configuration for use, both, has been established in the objective area.

In this area, the vehicle considerations are the lesser risk. In the area of the beach, full, assembled crane versus the risk of coordinated elements in a single element, is necessary. Should the crane be assembled on a ship that carries an off-loading configuration or not, the detailed transfers and equipment must be delayed until the mission are minimally skilled and experienced personnel can land the risk of not being able to assemble these lifting components that have been developed in transit.

What it looks like from ship:

Removal of the cranes from the ship to the vicinity of the beach at an effective operating depthers, the LCI and LCT, presented no problem. Though there was the beach presented real difficulties at low tide and was very deep at high tide. Thus, the sandbars were considerably depreaculated. The operations at Green Beach, Montauk, for the current amphibious landings were, of course, an answer to sandbar and other current solutions. However, during the deployment phase and ship recovery phase, the largest amphibious vehicle (the LCAC) is not capable of transporting heavy, in any case, these vehicles are in short supply and are themselves difficult to deploy. Thus, for deployment with the current, beach protocol and sandbar problems appear to need further study, if the last of the potential problems they present to equipment deployment, effectively, into equipment.

In any event, the heavy-lift ship to deploy 1410-class LCI's was reaffirmed as a title and proven procedure during the present. However, the Navy's new 1646-class LCAs which have been scheduled for loading was not because neither the ship is the LCAs, but the necessary slings. As part of the charter agreement the ship is required to carry either LCI's slings but no requirement has been levied for carrying a sling needed for this type landing craft. Since this is the predominant LCAs in the Navy and the older Army LCI's will be phased out in favor of a craft similar to the Navy's, this shortcoming should be rectified.
The causeway ferry provides a beaching capability where landing craft are not able to function. Its use should be considered by the AR in its lighterage mix during periods of the main test when landing craft are unable to beach.
After a 24-hour standby period (November 1), work began on positioning the first steel plate platform, mounted on rail-ties, was positioned in front of the barge on the beach to act as a foundation for the beach end of the ramp. When the ramp had been winched off the barge. Concurrently, a metal lip at the rear edge of the barge was removed with an acetylene torch to facilitate offloading the ramp. Ropes were cut in the ramps for cable hooks so that each ramp could be winched off with two bulldozers.

During the operation one bulldozer winched a little faster than the other, causing some sagging of the first ramp. As a result, the cable hole in the barge failed and the line came loose. A new hook-up was made to the second ramp and the ramp was winched off without further incident. The crane was raised to a position with one end on the beach and the other end resting on the large platform by approximately 15 ft.

The barge was next snubbed and the beach end foundation timbers were replaced. The second ramp was winched off the barge. Alignment with the timbers was assisted by an additional bulldozer. The winching of the second ramp took only 15 minutes each for both ramps. An additional bulldozer was used to push the right end against the left when both ramps were in place, the right side of the barge was approximately 5 ft higher than the left. This was the situation after both ends of the end of the working day.

The next morning, November 2, the third crane attempted to lift the top end of the left ramp in order to bring it up to the height of the right end. The weight of the ramp was estimated at 1 1/2 tons. By lifting only one end, the ramp fell and only about 1 1/2 tons. The attempts to lift the ramp were unsuccessful, but the other ramps were secured. However, the bulldozers, working together, were able to lift the end of the ramp. Timbers were installed and proper alignment achieved.

The left ramp was properly positioned and secured. The right end remained high and was illuminated by two bulldozers. Immediately thereafter, an Assault Vehicle with the bridge (ABE) positioned its scissors-lifting bridge over the top ramp to the other ramps. No problems were encountered with the ABE. Total time for the lift operation was 4 minutes.

The final beach section was completed at 1600 and the pier was ready for operations. Total elapsed working time for the ramp emplacement was
At the end of the lunch break, the LRM was being replaced. The ripples were on the pier
and it involved the backfilling area. These ripples were ultimately
covered with backfill. The work on the backfill was completed. A test after being
completed.

The test results of the backfill, the LRM, shaving and diss
were determined. The additional ripples were then loaded into these

operations were completed.

The LRM was then loaded onto the barge. The new container was loaded on the pier before the barge moved at
the end of the LRM. After the barge was loaded, two LMVs arrived.

The LRM was then loaded and the other was empty. The container was
then loaded onto the barge three times. Average cycle time was 5 minutes.

At 15:30, a LRM was loaded during the lunch break. At 15:45, a LRM barge
was loaded with minor repairs. The repairs continued throughout the
afternoon. The LRM was loaded onto a hole inflicted on the
weeks. The container was loaded on one whole side of the pier and restricted
operations for the time being.

After the test results of the LRM, the LMVs were loaded with con-

operations were completed.
APPENDIX C

TEMPORARY CONTAINERSHIP DISCHARGE FACILITY (TCDF)

The pre-lift breakbulk ship pretest helped provide data on crane capabilities and limitations in the important area of Temporary Containership Discharge Facility (TCDF) operations. This pretest was the first opportunity to use the Army's new TCDF (300-ton lifting capacity) crane on a floating Barge to discharge the discharge of containers from the holds of a ship. In addition, it was the first time military operators were used to conduct TCDF operations. Although there were some artificialities due to the "test" container cell guides, the need to top the crane boom to clear the decks, waves and kinks, and the limited opportunity for establishing a rhythm and maintaining valuable data and insights were gained.

In this report, it is uncertain what capacity load can be safely lifted by a mobile crane mounted on a floating platform when the crane and platform move in response to waves or to the load. That is, when waves are occurring, different kinds of stresses occur in the crane from those experienced on solid ground. Accordingly, the crane lift capability is reduced to account for such extra or different stresses; in other words, the crane must be operated for operations in a seaway. It is possible that the point may be reached where the crane on the barge cannot safely hoist the heaviest loads. In that case, in attempting a lift there is the possibility of a catastrophic failure to some component of the crane.

C-1
...
Figure 9-4. 40-ft container. One 40-ft container was included in the load to provide data and experience in handling a 40-ft container which weighed 30,000 lbs.
FIGURE 1.2. DECK PREPARATION: Lumber was laid on deck in preparation for the heaviest lift made in the test program, a 144-class Army LCU. Each of the two heavy-lift ships (the only heavy-lift ships currently in the U.S. flag fleet) can carry four of these large landing craft. A 144-class LCU could not be lifted because neither the ship nor the Navy had the necessary sling.

[Image description: A ship is shown with heavy-lift equipment on deck, preparing for a large-scale operation.]
FIGURE 6. BOOM MARRIAGE. To lift the 140-ton LCU, a boom marriage of two 100-ton capacity booms was made. This gives the ship a greater lift capability, although reportedly the ship has lifted and carried a 100-ton tug.
FIGURE 1 - LCP WITH LCU. The LCU lift, although infrequently accomplished, was made with relative ease. Military personnel acted as stevedores but the ship's crew operated all machinery and directed the technical aspects of the lift.
FIGURE 1.10. "MAL. LOSC EXPERIENCES". During the LCU lift the ship did experience nearly a 90-degree list; however, the ship was designed to take a maximum of a 10-degree list during loading. A counter-balasting system is used for heavy lifts.
In 1975, the U.S. vessel "KIRK-ROSE" was involved in a serious incident that resulted in the loss of life and severe environmental damage. The vessel was carrying hazardous materials, which leaked into the environment, causing significant ecological harm. The incident highlighted the need for improved safety measures and regulations in the maritime industry.
FIGURE 4: LOADING TOWERS ON DECK 5 DECK 4 DECK 3. Three overhead clearance problems were experienced by the 100' tower during the 6.5' high 150' load across the deck and into the hull.
FIGURE D.29. SIDELOADER EASY LIFT. Compared to the other equipment embarked the sideloader went aboard relatively easily. It weighs 64 long tons and is 41 ft long, 12.5 ft wide, and 11.7 ft high.
The sideloader could have been stowed in a hold but to reduce loading time so that other events could be accomplished, it was deck-stowed. Its loading time was only 27 minutes, including rigging time.
The hook used for lifting it is
necessary to attach and detach the chokers
on the hook required a topping cycle and 9 minutes
during off-loading.
No difficulties were experienced off-loading the sideloader into an LCU. The sea state was relatively calm and the wind was light.
The sideloader lift was the fastest pre-rate. It took 34 minutes to off-load the sideloader, including time to moor and cast off the line.
FIGURE D.35. FENDERS USED TO SEPARATE THE TOF FROM THE SHIP.
FIGURE D.37. TCDF OPENS HATCH. To gain experience and crane data on hatch square opening, the TCDF was used to remove the 1-ton sections of the hatch cover.
FIGURE D.38. BLOCK DENTS CRANE BOOM. On the first full day of container unloading the sea state caused the crane’s block to pendulate during a break in the unloading. The heavy block struck the boom’s tubing with sufficient force to seriously dent it.
FIGURE 3.39. POSITIONING SPREADER BAR. Without cell guides it was necessary to position the spreader bar manually in the hold. If the boom was not at a 90-degree angle to the container axis, delays and difficulties in attaching the spreader bar were experienced.
FIGURE 1.37. BOOM TOPS 5. Once the container was attached the crane had to top up as well as raise the hook in order to clear the ship's beams and kingposts. This added delays to cycle times that would not be typical of operations on the clear deck of a container ship.
FIGURE D.41. LCU USED FIRE HOSE. To cushion the impact of containers being lowered, a problem when there is a sea state, fire hose was used on the deck of this LCU.
FIGURE D.42. LCU LIGHTLY LOADED. Normally an LCU would be loaded with four containers but because of the limited number of containers available, capacity loading was not practiced.
FIGURE D.43. MOBILE LOADING TIME-CONSUMING. One method of minimizing handling at the beach is to place trailers on a causeway ferry and load the trailers shipside. However, because of the motion of the seas and the need for close alignment during loading, it required approximately an hour to load just two of three trailers and it became apparent that the method was too time consuming.
FIGURE D.44. SPREADER BAR VIT ALIGNED. With a two-point spreader bar attachment and automatic tautlines, the spreader bar and container were nearly always perpendicular to the boom, while the trailer chassis was not. This necessitated man-handling the container until it was in a position that would permit lowering the trailer corner fittings.
FIGURE D.45. ALIGNMENT DIFFICULT. Aligning the container with the trailer required four--person crew to force the container into position so it would engage the corner fittings. Because the procedure was so time-consuming one trailer returned to the beach without being loaded.
FIGURE D.47. DELONG PIER POSITIONED. To improve shoreside unloading capabilities a 140-ton crane was positioned on a DeLong barge and towed to the objective area. The DeLong was beached using two LCMSs. Later the DeLong was jacked-up out of the water on its pilings and ramps were added so that trucks could drive from the beach onto the pier.
FIGURE D.48. LCU RETRACTS. An LCU is shown above retracting from the DeLong pier after unloading at high tide.
FIGURE 3.6: TURNABLE PROBLEM. Because of the gentle beach gradient and the fact that a single beach does not extend far enough seaward, landing craft were stranded at low tide. At low tide only amphibious vehicles could be unloaded.
FIGURE 7.50. RAMP PROBLEMS. Truck drivers experienced difficulty backing their trailers up the ramp so a rough terrain forklift, which has articulated steering, was tried. The above ALB ramp connects unto the second ramp. The ALB ramp was subsequently replaced by a sand ramp.
FIGURE D.51. CRANE DELAYED. Until the trailer was positioned under the crane, operations were choked. With experience drivers were able to more rapidly back their trailers up the ramp.
Fig. 1. CHASSIS IN POSITION. Once the Milvan chassis was on the
existing foundation, it was raised.
Fig. 41 (53).  Fig. 37 (53).  Another chassis in a part surface in loaded by the front loader.  
From the time the container was released in the caisson to the time it was loaded onto the chassis 
required approximately 3 minutes.
FIGURE D.59. 140-TON CRANE ASSISTS. To recover time lost in turning the 300-ton crane, a 140-ton crane assisted in reassembly. Normally, the 300-ton crane can make itself operational without assistance.
FIGURE D.60. HIGH TIDE OPERATIONS. At high tide landing craft were able to beach within reaching distance of the beach crane and were unloaded without difficulty.
FIGURE 8.63.  CHANNEL SEDIMENTS.  In an effort to keep the beach crane operational a channel was dredged seaward of the crane by bulldozers.
FIGURE D.65. ROUGH WEATHER EXPERIENCED. Another problem was encountered when the surf and winds increased. The sand ramp upon which the crane had been placed began to erode and had to be repaired at high tide by dozers.
FIGURE 3.1. SOME CONTAINERS STILL AFOE. Core container unloading was possible before the heavy weather required cessation of operations.
FIGURE D.71. FRONTLOADER.Clears Container. Once a vehicle was unloaded a frontloader, shovel or side loader was used to clear the discharge point.