HEAVY-LIFT BREAKBULK SHIP PRETEST RESULTS OF THE JOINT
LOGISTICS-OVER-THE... (U) ORI INC ROCKVILLE MD
H CASEY ET AL. 25 JUL 77 ORI-TR-1168 MDA903-75-C-0016
F/G 15/5
HEAVY-LIFT BREAKBULK SHIP PRETEST RESULTS OF
THE JOINT LOGISTICS-OVER-THE-SHORE (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, Defense Research and Engineering. The pretest was conducted from anchorages off Sewells Point, Norfolk, 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 deployment of the 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 pretest provided an opportunity to test the amount of saturation to the anchor while the ship was operating on an unstable foundation. The results are expected in a later report to be published during the LOTS main test.

After entering the beach, the crane was lowered to ramp lowered, and the pretest with the 100-ton crane was followed by containers.

The 100-ton capacity crane successfully loaded the 100-ton/crate container and the crane on the beach in an attempt to reach containers in lighter

The pretest was successfully and consis-
tently loaded, was employed to load con-
tainers both using the LCF, but wave motion and con-
tainers were not efficiently loaded. This operation took time-

The pretest was successful and to lighter containers at the beach, where a crane rapidly off-loaded

The pretest was a significant undertaking. The services' capabilities for using

The LOTS, a heavy and oversized equipment, are the first opportunity in over ec years

The opportunity provided the exp-

UNCLASSIFIED
The heavy-lift breakbulk ship pretest was to assess, in site such a ship for deploying equipment to a site where fixed port facilities were not available. The third of five planned preliminary tests and evaluation program conducted under (Test and Evaluation), Office of the Assistant Secretary of Defense, was part of an evaluation exercise in August, 1977. The heavy-lift ship was a container-orientated throughput vessel. This objective was to determine potential technical problems indicated that equipment could be deployed with minimal disassembly, and emphasized the continuing need for the heavy-lift breakbulk ship. The test savings are on the order of 6 to 10 hr in deployment of the ship's equipment, range with minimum disassembly. This is compared to the time required for the detailed disassembly required when only conventional breakdown is available.
The heaviest item loaded was a 140-ton-class LOF that weighed 150 long tons. A 130-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 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 such that the combined center of gravity of the LOF with the crane was for on deck. In safe and seaworthy. Consequently, after it was barked off the LOF, 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 container-stowage facility (TSF), an army 140-ton lifting capacity crane mounted on a barge, was used by military personnel to unload containers from a ship for the first time. A previous exercise, "SCS II, proved the concept feasible of a larger barge used civilian operators. This test 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 as a Naval laboratory and will be utilized during the 10/73 load test.

A Delong barge was also used to form a pier at the beach. The Delong, a 300-ton crane aboard, was beached, jackitated, ramps lowered, and operational in approximately 14 hr. The pier with the 140-ton crane was tested 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-stowage facility. Both the 300-ton crane-on-beach and the 140-ton crane on pier were hampered by an inability to reach containers in lighters off the pier. Amphibians—LPH-I9 and LPH-V9—were successfully and conveniently used during calm seas. A causeway ferry was employed to load containers on an existing amphibious using the LOF, but wave motion and container placement difficulties with the chassis made this operation too time-consuming. The causeway ferry was successfully used to lighter containers at the pier and move containers to the beach where a front-loader rapidly off-loaded the containers and placed them on Delong chassis.

In summary, the test verifies the services' capabilities for using a small breakwater barge and crane to deploy certain LOF heavy and out-sized equipment. Also, the 300-ton crane is feasible, because of its weight and size, in the LOF environment. The test also provided the first opportunity in over 4 years to conduct a container-throughput exercise. This opportunity provided the experience required by military personnel which will be amplified during the main
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1. 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 off Ft. 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.
Second, there are three 120-ton capacity 350-ft-long triple lifts in length which permit loading large heavy items in positions 1, 2, and 3. The 120-ton booms can also be paired to work together giving the ship a nominal 240-ton lifting capacity, permitting the hoisting of objects. A total of four LCAs can be stowed on the main deck. Figure 1 illustrates the capability 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>
<thead>
<tr>
<th>TABLE 1</th>
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<tbody>
<tr>
<td>GENERAL CHARACTERISTICS</td>
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<tr>
<td>U.S.S. TRANSCOLORADO AND S.G. TRANS-COLUMBIA</td>
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<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
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<tr>
<td>Length total</td>
<td>500 ft</td>
</tr>
<tr>
<td>Length between perpendicular</td>
<td>475 ft</td>
</tr>
<tr>
<td>Breadth molded</td>
<td>75 ft</td>
</tr>
<tr>
<td>Depth at main deck</td>
<td>71 ft</td>
</tr>
<tr>
<td>Max. inscribed waterline molded</td>
<td>65 ft</td>
</tr>
<tr>
<td>Displacement in salt water</td>
<td>80,075 tons</td>
</tr>
<tr>
<td>Deadweight</td>
<td>70,000 tons</td>
</tr>
<tr>
<td>Port horsepower</td>
<td>8,000</td>
</tr>
<tr>
<td>Continuous sea speed</td>
<td>15 knots</td>
</tr>
<tr>
<td>Light ship characteristics</td>
<td>11,248 tons</td>
</tr>
<tr>
<td>Tonnage</td>
<td>17,100 tons</td>
</tr>
<tr>
<td>Vertical center of gravity</td>
<td>87 ft 6 in above keel</td>
</tr>
<tr>
<td>Horizontal center of gravity</td>
<td>92 ft 3 in amidships</td>
</tr>
<tr>
<td>Centerline draft</td>
<td>28 ft</td>
</tr>
<tr>
<td>Summer Tonnage</td>
<td>11,248 tons</td>
</tr>
</tbody>
</table>

*The TRANSCOLUMBIA's master and chief mate reported that on one occasion the ship had loaded and discharged a 300-ton tugboat.*
In the early years of the project, some of the heaviest equipment used were the "heavy" man-powered lifts. These lifts were developed and tested at a U.S. Defense Department project. However, the equipment was never ready for field operations. The lifts were intended to be used in a "tactical" situation, where they could not be deployed for long periods of time.

There were several problems with the equipment. The first was the weight of the equipment. The lifts were too heavy to be lifted by hand for long periods of time. Another problem was the weight of the equipment. The lifts were too heavy to be lifted by hand for long periods of time.

The equipment was also difficult to assemble. The sections of the lifts were too heavy to be lifted by hand for long periods of time. Another problem was the weight of the equipment. The lifts were too heavy to be lifted by hand for long periods of time.

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To solve the problem of the lifting capacity, a smaller and lighter lift was designed. This lift was designed for an IAF, which has a capacity of approximately 5 tons. The lift can be deployed on most commercial ships.

In the initial tests, the lift was loaded into an IAF. The loading from a lighter lift was more difficult than the problem of the lifting capacity. The lift was deployed on a larger scale for longer periods of time.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Lift Mode</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>Lift Planned</td>
<td>Yes</td>
<td>57.6</td>
<td>12</td>
<td>13.5</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>Lift Planned</td>
<td>Yes</td>
<td>45.6</td>
<td>11.1</td>
<td>11.1</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Lift Planned</td>
<td>Yes</td>
<td>37.6</td>
<td>14.1</td>
<td>12.1</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Lift Planned</td>
<td>Yes</td>
<td>70.6</td>
<td>44.6</td>
<td>17.7</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Lift Planned</td>
<td>No</td>
<td>135.3</td>
<td>29</td>
<td>17</td>
<td>161.2</td>
<td>No ship available</td>
</tr>
<tr>
<td>Lift Planned</td>
<td>Yes</td>
<td>41</td>
<td>17.5</td>
<td>11.1</td>
<td>84</td>
<td>Top handler removed</td>
</tr>
<tr>
<td>Lift Planned</td>
<td>No</td>
<td>37.5</td>
<td>13.2</td>
<td>16.5</td>
<td>69.3</td>
<td>Lift was redundant*</td>
</tr>
<tr>
<td>Lift Planned</td>
<td>No</td>
<td>76.3</td>
<td>33</td>
<td>21.5</td>
<td>27.3</td>
<td>Not available for loading</td>
</tr>
<tr>
<td>Lift Planned</td>
<td>No</td>
<td>90</td>
<td>21.3</td>
<td>6.1</td>
<td>60.3</td>
<td>Lift was redundant*</td>
</tr>
<tr>
<td>Lift Planned</td>
<td>19</td>
<td>20</td>
<td>8</td>
<td>8</td>
<td>-</td>
<td>Weights varied by container</td>
</tr>
<tr>
<td>Lift Planned</td>
<td>1</td>
<td>40</td>
<td>8</td>
<td>8</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

* See HII Technical Report No. 1037.
Evaluating equipment aspects of the test the most important was the logistical feasibility of moving the LST's equipment with minimal obstruction. Once in the objective area, making the equipment available was another matter. Observations were concerned with matters such as the correct setting of slings with lift points, any pendulation problems, and the like. Times required for deployment of the equipment items were measured to support main test planning. Crane cycles and various throughput data samples were also obtained. The throughput rates reflect the factors that influence them were additional inputs to main test planning.

Some off-loading measurements were made of the sea state and wind effects on the test platform. An ancillary test to measure the stresses related to the areas of the LST was also conducted. These measurements, made by personnel from the Naval Civil Engineering Laboratory at Port Hueneme, California, will be the subject of a separate Navy report. The results may assist the Joint Surface Evaluation Program by establishing better safe working limit criteria for the LST crane working in this environment.

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

The operations began about 0700 on November 2, 1976, with the
HRM-1 lying off Sewells Point in Hampton Roads. Weather con-
tions were sufficient to permit the loading and discharge phases of the pretest were clear
with a light north wind and calm seas at both the Sewells Point anchorage
and the Blue Point, St. Story.

Preparations for loading required approximately 7 hr and included
the unloading of cargo, the loading of damage, cargo rigging sets, and
the vessel of the crane was accomplished using the ship's 120-ton booms
and, in several cases, the very large objects and, hence, move rather slowly.

During the first day, only containers and the LABC-14 were loaded before
beginning the operations. Most ships round-the-clock operations are
characterized with the heavy-lift ship. This is not advisable because of the
interference with the bow, 170 ft, and the need for the boom operator to con-
duct with the line passing through the sheaves at the bow tip. This is
rather unobstructed sight since artificial light at the 170 ft distance
is successful.

The first lift on the second day was the 1466-class EJ, which was
placed in the port aft side of hold No. 4 without difficulty. The 12.5 crane
loaded up to the main deck and stowed in the well deck in the LABC-14.
In hold No. 5

The crane 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 6.50
that was fitted with a pronounced forward and aft tilt.

Loading began about 0700 on November after the ship had moved
an anchorage off Blue Beach, St. Story. The order for off-loading was the
ABC-14, the 40 ft container, the 91.2 crane, the 1466-class
and the LABC-14. Only the 6.50 crane posed any difficulties and this was
FIGURE 5. ATTACHMENT POINTS TO ADJUST SPREADER BAR FOR CENTERS-
TEGRITY ON ENSO AND BILLIARD TABLES.
was the result, although there were minor delays in inserting the strap under the crane to set the lifting frame and also in re-handling the logs of the strap over the crane boom. As the crane was lifted from the heavy-lift barge.

The smaller crane, the 95L, was lifted first. There was a delay while the crane upper was rotated 180 degrees. The boom base was over the crane truck cab in the final configuration. After a test lift the crane was set down again in the crane, and the nylon logs inspected. The lift was then made without any further delays.

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 lift started, the load nased up. The front wheels were about 3 ft off the deck before the rear wheels began to lift clear. The crane boom, facing the main crane, slanted downward toward the front of the lift. It was being lifted from. If the lift had continued, the boom would have come in contact with the top edge of the ramp. Experience in the breakbulk ship repairs had shown that even bumping of the crane boom on the bulkhead impacting the top edge of the crane boom could 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-rig the lift so that it remained level. This would have involved shifting the lift point at the rear of the lift frame from one point to another in the series of holes available. However, such re-rigging 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 the edge of the hatch top before the crane wheels came into contact. This possibility caused a delay of about 15 minutes. The crane was repositioned in such a way that the boom base was located near a gap between the edge of the hatch and the deckhouse. This allowed the crane wheels to be just below the tip of the boom base. With that problem solved, the lift was continued.

The total time, including delays, was 2 hr and 15 minutes. There were three stops, one for the lift to stop in the vertical position for the crane to be checked, another for the crane to be checked, and a third for a break to complete the lifting of this lift and start the NEXT.

The crane had been raised to the deckhouse on December 1, 1979. The crane was then lowered to its normal position and the crane suspended in the mast part of the order.
The equipment installation was the reverse of that for hoisting. In general, successive equipment was installed at rate and, with the exception of the 450-
 horsepower main engine, installation was completed in a timely
 manner. The installation was completed on time due to the
 equipment ready for installation.
The LCM8 carrying the Army 9125 crane to shore had no difficulty
underway despite a pronounced list. The LCM8 grounded on an off-shore sand-
bar an hour before low tide. A LARC-V from the Naval Beach Group detachment
assisted it in breaking off. The LCM8 then waited for the tide to come in,
and some 3 hours later made a second attempt. Again the LCM8 was stuck on a
sandbar. This time cables were passed from bulldozers to the landing craft,
with a hard strain in the lines the LCM8 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 LCM8
had been pulled across the sandbar, the crane was ready for moving ashore.
In moving out of the LCM8 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 reeling 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 LCM8 carrying the 9125 crane.
After moving ashore out of the LCM8, 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 port
and deck stowage locations aboard the TRANSCOLUMBIA to various types of lighters,
including LCU, LCM8, LARC-XV, 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 LCM8 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.
Frontloader to off-load containers from a causeway
terrry onto milvan 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 con-
tainers were weighted with dummy cargo. Figure 2 shows the weight distribution
of the containers used.

![Graph showing weight distribution of filled containers.]

**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
of recognized drawbacks. First, there were no cell guides to assist in attach-
ment 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 TCCF had to
...with the 650-ton barge, crane, and crane foundations. Both of these tests were timed for cycle times. However, the time data gathered proved to be more valuable for main test planning.

During the tests, the container were first completely off-loaded from the ship and re-loaded. In some cases a container was back-loaded and then without delay. The containers from the spreader bar the container was released in the water. These latter iterations were disregarded since the data was of greater value than data validity. The TCOF working the TRANS-PAC collected and back-loaded 16 containers. When the ship charter period was complete, a 650-ton barge was used briefly instead. No timings were taken of these loading and unloading events. There were considerable periods while working the ship in which the crane was inactive or delayed. When the crane was active and was operating, a cycle required approximately 10 minutes. Transporting containers to the ship required approximately 7 minutes average time. Further details of these times is contained in Section III. Table 6 shows the characteristics of the crane.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>130 ft</th>
<th>60 ft</th>
<th>656.2 Tons</th>
<th>100 ft</th>
<th>Heavy duty</th>
<th>1,450 lb each</th>
<th>Double drum</th>
<th>1 inch</th>
<th>2 parts per hook</th>
<th>14.1</th>
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<tbody>
<tr>
<td><strong>Length (boom assembled)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Cranes</strong></td>
<td></td>
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<tr>
<td><strong>General operation</strong></td>
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<td></td>
<td></td>
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<tr>
<td><strong>Total time during test</strong></td>
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<td></td>
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</tbody>
</table>

Operations with the 650-ton crane at the water's edge commenced the afternoon of November 2. The first day's activities consisted of discharging the five tanks during a period of approximately 11 hr. Operations had commenced 45 minutes after low tide, so it was not possible to land LO's, crane or barges close enough for the crane to reach them. Therefore, to affect site crane use, amphibians were employed instead.
The next day, there was a morning high tide (CHS) at 10:30. So retrograde operations were possible. One LASH was beached, backloaded with four containers, and retracted to the beach. The average 14 minute per container was 10 minutes. 3:00 weather was being experienced at the beach so the next day was loaded with only two containers before it was retracted after 20 minutes. During the LASH crane, thrusters fouling and unloading operations, winds up to 20 knots were experienced which caused difficulties in loading operations.

The last day of beach operations for the 80-ton crane, approximately 6 hours after high tide, a LASH barge was grounded within the crane's reach and two containers were unloaded at an average rate of 25-30 minutes each. The crane was subsequently brought in at low tide and one container was still loaded.

The 330-ton crane was loaded at high tide and unloaded at low tide. It was two hours after high tide and approximately 6 hours after low tide. After the high tide, the crane was brought in at low tide and all its containers (27) were unloaded. The crane was unloaded at low tide and approximately 3 hours before high tide on the next day. Another 80-ton crane was loaded at high tide and unloaded at low tide. After the low tide, the crane was brought in at high tide and all its containers (27) were unloaded.

There was a morning high tide (CHS) at 10:30. So retrograde operations were possible. One LASH was beached, backloaded with four containers, and retracted to the beach. The average 14 minute per container was 10 minutes. 3:00 weather was being experienced at the beach so the next day was loaded with only two containers before it was retracted after 20 minutes. During the LASH crane, thrusters fouling and unloading operations, winds up to 20 knots were experienced which caused difficulties in loading operations.

Overall, the LASH handled approximately 2 containers during the peak tide. The first day of operations was rough, with extreme winds and tides. The crane was taken out of service due to unfavorable weather conditions. In the end, the operation was delayed significantly. During the low tide, the crane was used to unload some containers. During the high tide, the crane was used to load containers. The 80-ton crane was loaded with containers to the Belongia and these were unloaded onto the pier. The container was later reloaded via a LASH.
The last step, the vessel, was moved to the berth and with four containers. At one point, the 120' large was required to reach over the bulk. The welding was done at the stern of the vessel mounted and the hole repaired.

The second berth was used twice during the operation. The first operation was begun by loading three 40' trailers on the beach and at the second pier, bulldozers constructed a sand ramp to the causeway. As soon as the ramp was prepared, three 3-54 trucks with the trailer attached, proceeded onto the causeway. Each truck-trailer unit was then loaded in a separate causeway section. The most seaward section, the section between the two tender boats, was 'left vacant'. None of the vehicles were lost. The causeway retracted from the beach without difficulty, at the same time the ramps was loaded towards the ship.

To lift the first container was lifted from the deck of the vessel. After determining the correct position of the container on the platform trailer, the drivers moved the truck. The problems were:

- The relative motion of the vessel and the causeway.
- The twist angle (approximately 90 degrees) needed to properly align the container with the trailer (see Figure 4).
- The limited deck area for line holders.
- The target is small— even when there is no relative motion, 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 first attempt on a different trailer was successful, requiring only one attempt. The first lift attempted had been to a trailer spotted on the causeway, and forward of the 120' crane. The second lift loaded a trailer which was started at an angle to the axis of the boom. (Dotted lines, Figure 4.) The
There were a few more patients whom we had to check up on, but after that the work really started to wind down. All the volunteers were gathered together again and we began to pack up our equipment and begin the long journey back to the beach to prepare for the next shift.

The patients were very grateful for our efforts, and some of them even expressed their thanks in writing. It was a satisfying feeling to know that we had made a difference, however small it may have been in the grand scheme of things.

The sun was setting as we arrived back at the beach, and we could hear the sounds of the waves crashing against the shore. It was a peaceful and serene moment, a moment of reflection and gratitude.

It had been a long and arduous day, but it had also been a rewarding one. We had worked hard, and we had accomplished something. It was a feeling that we would carry with us for a long time to come.
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 12.)

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 Feasibility Times for Different Assembly Configurations

The disassembly of the 30-ton capacity crane to a tactical configuration for deployment takes less time than an administrative (detailed) disassembly with redeployment on a ship with a less capable boom. This, of course, is also true for crane reassembly 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 tests. 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 IS DIRECTLY BELOW SHIPS HOOK

POSITION OF CRANE WITH INCORRECT SUSPENSION POINT, CENTER OF GRAVITY IS DIRECTLY BELOW SHIPS HOOK

PHEE 11: SCHEMATICAL DRAWING OF CRANE

This resulted from incorrect selection of holes in top member of base rig.

(Not to scale.)
<table>
<thead>
<tr>
<th>Administrative, Disassembled LOR</th>
<th>Minimum Disassembly at Heavy-Lift Ship Pretest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disassembly and Loading Times</strong></td>
<td></td>
</tr>
<tr>
<td>Disassemble, transport, loading</td>
<td>Partial disassembly and mobile loading of boxes and OTR/Trucks</td>
</tr>
<tr>
<td>Transit time</td>
<td>Single heavy lift</td>
</tr>
<tr>
<td>Counterweights, boom, etc.</td>
<td>Counterweights, boom, etc.</td>
</tr>
<tr>
<td><strong>Disassembly Times (at objective area)</strong></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>On-landing assembled crane</td>
</tr>
<tr>
<td>Counterweights, boom, etc.</td>
<td>Assemble boom, counterweights</td>
</tr>
<tr>
<td>Movement to shore</td>
<td><strong>On-landing assembled crane</strong></td>
</tr>
<tr>
<td>Off-loading assembled crane</td>
<td><strong>On-landing assembled crane</strong></td>
</tr>
<tr>
<td><strong>Movement to Shore</strong></td>
<td><strong>Off-loading assembled crane</strong></td>
</tr>
<tr>
<td><strong>Assemble, times (based on best estimates)</strong></td>
<td></td>
</tr>
<tr>
<td>Assemble 9103 crane</td>
<td>1 hr</td>
</tr>
<tr>
<td>Install operator's module</td>
<td>1 hr</td>
</tr>
<tr>
<td>Assemble 650 crane</td>
<td>3 hr</td>
</tr>
<tr>
<td>Assemble boom and counterweights</td>
<td>1 hr</td>
</tr>
</tbody>
</table>

**Note:** Estimated time for complete disassembly is 5.2 hr.
Later in the operations, lifts are not realized to a contingency and
the lifted components, the deployment time, is different from those shown in
the table. It is noted that there would still be an advantage.
This advantage would be in the order of two days if the more fully assembled
configuration is possible for deployment. This advantage is gained by
the use of a heavy-lift ship that can land and discharge the crane (tactically
assembled) at the target location to transport the CEC crane (in its
folding configuration) to shore.

The decision of which configuration to use in moving the CEC crane
will be a matter of the shipping available. Assuming that in a future emergency,
the heavy-lift ship will have other cargo competing for sea transport, a comparison
between the two configurations could be of value in making a decision on shipping allo-
cations. When mobility is an issue, ships must be delayed until the appropriate
configuration is on hand. Thus, it has been established in the objective area.

It is noted that personnel considerations are the lesser risk in
the lifting of the crane, as the crane consists of three major sections which are
nearly as large as the deck of the ship. The personnel necessary to
assemble the crane is outside the scope of this study. The detailed personnel and
equipment considerations for the next study will be very much skill and experienced personnel.
However, in the risk of not being able to assemble these lifting components
that have been aboard the ship.

2.3.4. Lifting the Crane

Three of the cranes from the ship to the vicinity of the beach
were not handled effectively. The lifters, the lift and the lifters, presented no problem.
However, during the landing of the crane at high tide and
the crane at low tide presented problems. Thus, the sandbars were considerably dem-
onstrated to the operations at Green Beach, St. John, for
the transfer of amphibious cranes. Of course, an answer to sandbar and
amphibious crane landings. However, during the deployment phase and ship-
ment, the largest amphibious vehicles (batteries) is not
readily available, especially in the case of these vehicles, are in short
supply, and are themselves difficult to deploy. Thus, for deployment with
the LVTP, beach transit and sandbar problems appear to need further
study in the part of the potential problems they present to equipment deployment,
transportation, and equipment.

3. August 1, 1966

The need for the heavy-lift ship to deploy 145-class LCI's was reaffirmed
as a critical and proven procedure during the protest. However, the Navy's new 1456-
class, which has been scheduled for landing, was not because neither the ship
is in place, but the necessary lift. As part of the agreement the ship
3
is required to carry either lift or lift but no requirement has been levied for
the stands. As part of the agreement the ship
is required to carry either lift or lift but no requirement has been levied for
removing the type landing craft. Since this is the pro-
duction type, 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 'esr' in its lighterage mix during periods of the main test when landing craft are unable to beach.
A review of decision shows that the average error was 2.5%.
After a 2 hr. period of inactivity (November 1), work began on positioning the 120’ x 11’ x 1’ steel platform, mounted on rail-ties, was positioned in front of the barge on the beach as a foundation for the end of the ramp, when the ramp had been winched off the barge. Concurrently, a metal lip on the front edge of the barge wasburned off with an acetylene torch to facilitate positioning the ramp. Rail-ties were cut in the ramps for cable hooks, so that each ramp could be winched off with two bulldozers.

When the operation one bulldozer winched a little faster than the other, during the positioning of the first ramp. As a result, the cable hole in the front edge was obstructed and the line came loose. A new hook-up was made to the crane captain, and the ramp was winched off the barge without problems. The ramp was then pulled to a position with one end on the beach. The crane then levelled the large platform by approximately 1’.

The second ramp was again hoisted and the beach end foundation timbers were removed. The second ramp was winched off the barge. Alignment with the crane captain, was assisted by an additional bulldozer. The winching of the second ramp was repeated, the first ramp was evident during the alignment process on the ground.

At this point, the crane then lifted the barge end of the left ramp. At this point, the two ramps began pulling the beach end of the ramp until the ramp extended from the end of the barge. The crane then lowered the ramp onto the sand. The ramp was then secured. This operation took only minutes each for both ramps. An additional bulldozer was used to push the right ramp against the left when both ramps were in place, the right side at the barge end was elevated, 1’ higher than the left. This was the situation after initial stages of the end of the working day.

The next morning, November 2, two 15-ton cranes attempted to lift the second end of the left ramp in order to swing it to the height of the right end. The weight of the ramp was estimated at 12 tons. By lifting only one end, the total lift was only 6 tons. The two attempts to lift the ramp were unsuccessful, and the other cranes were secured. However, two bulldozers, working jointly, were able to lift the end of the ramp. Derricks was installed and proper alignment achieved.

The artificial platform were properly positioned and secured to the barge. The crane was constructed by two bulldozers. Immediately, thereafter, an Assault vehicle with a bridge (AVB) positioned its scissor and landing bridge over the extensions to the pier ramps. No problems were encountered with the AVB. Total time for the AVB operation was 4 minutes.

A final beach grader was completed at 1:00 and the pier was ready for operation. Total elapsed working time for the ramp installation was
After a night of repairs, the two loaded 250's, lacking and damaged, were removed from the pier. Two additional trailers were then loaded into these and after some difficulty were secured.

The second day, Number 2, the 1000's我们也 was removed, were substituted, together with Number 1, the 250's. This time the loads were rough with wave lengths estimates for the wind and seas.

The trail of the pier but because of the rough conditions, it was very hard. The 1000's would drop out whenever it might be necessary. Attempts to lift the trailer out of the water and secure it were unsuccessful.

After several attempts, the pier at 10th after some difficulty, with the wind and seas, and the brother's account, the trailer were called off.

Another set of two trailers were rapidly loaded into a 150's barge. For the first time ever, the 150's were with the barge before the barge moved at the pier. After the barge was loaded, two 150's arrived.

The barge with one trailer and the other was empty. The container was moved from the west three times. Average cycle time was 6 minutes.

During the lunch break, an 150's was repaired. The repair continued throughout the day.

The 150's was equipped with a new plate was welded over a hole inflicted in an

The repairs continued throughout the day.

The trailer was now equipped with a new plate.

The repairs continued.
APPENDIX C
Temporary Containership Discharge Facility (TCCF)

This pretest helped provide data on crane
abilities and limitations in the important area of Temporary Containership
Discharge Facility (TCCF) operations. This pretest was the first opportunity
to use the Army's new TCCF (300-ton lifting capacity) crane on a floating B
core barge for the discharge of containers from the holds of a ship. In
addition, it was the first time military operators were used to conduct TCCF-
like operations. Although there were some artificialities due to the
lack of container cell guides, the need to top the crane boom to clear the
relationship and kinematics, and the limited opportunity for establishing a rhythm
required, valuable data and insights were gained.

As for this report, it is uncertain what capacity load can be safely
inferred by a mobile crane mounted on a floating platform when the crane [and
platform] moves in response to waves or to the load. That is, when waves are
acting on the platform, different kinds of stresses occur in the crane from those
experienced on solid ground. Accordingly, the crane lift capability is reduced
to allow 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.
The result could also be beneficial in helping ship stability.

One must recall when the TOF is capable of reaching across the ship's center of gravity of containers. Thus, with only one TOF or FLC working, the ship can maintain a more even keel during the unloading process than if all the containers were first removed from one side and then the other.

Another factor to be considered is the freeboard of the ship. For a torefixer with a freeboard greater than the heavy-lift breakbulk ship, a longer boom would be required. This is illustrated in Figure 6.1.

With the range of weights and vessel characteristics now known, more detailed planning for the configuration and operation of the TOF crane or the strap and toefixers can be done.
FIGURE 7.3: 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 15,300 lb.
FIGURE 7.4. DECK PREPARATION: Equipment was laid on deck in preparation for the heaviest lift made in the test program, a 144-class Army LCM. 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 LCM could not be lifted because neither the ship nor the Navy had the necessary sling.
FIGURE 6. BOOM MARRIAGE. To lift the 140-ton LCU, a boom marriage of two 15-ton capacity booms was made. This gives the ship a maximum lift capability, although reportedly the ship has lifted and carried a 20-ton tug.
FIGURE iv. WELL WITH LADLE. 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 loading.
Fig. 36. EMPLOYMENT SC. HULL 12. No special preparation was
required, except for the paint coating. In this case the top coat was
towen to be unnecessary, but this proved to be unnecessary.
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.
FIGURE 5. SILENCE BEING LIFTED

To complete the lifting it is necessary to insert the hook through the hook and detach the chokers on the hook required for lifting. It took 5 minutes for the lifting cycle and 9 minutes during off-loading.
FIGURE D.32. SIDELOADER PLACED IN CLU. 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 procedure. It took 14 minutes to off-load the sideloader, including time to lower and cast off the lines.
FIGURE D.34. TCDF TOWED TO PRETEST SITE. Once the deployment cargo had been off-loaded, the TCDF was positioned alongside the ship so that containers could be off-loaded and throughput events could begin.
FIGURE D.35. FENDERS USED. Two special inflated fenders, one of which is shown above, were used to separate the TCDF 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 5-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 2.39. POSITIVELY, 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 D.4D. BOOM TORS. 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 0.42. LCC LIGHTLY LOADED. Normally an LCC 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 WITH ALIGNED. With a two-point spreader bar attachment and automatic taglines, 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.46. LCM8s USED. LCM8 landing craft received extensive use in the pretest and had better beaching capabilities than LCUs, although both were unable to beach close enough to shore cranes at low tide.
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 LCMs. 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. LCI FLOATERS. An LCI is shown above retracting from the dry dock pier after unloading.
FIGURE C.49. Un tide problems. 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 amphibians could be unloaded.
FIGURE 2.55. RAM PROBLEMS. Truck drivers experienced difficulty backing their trailers up the ramp so a rough terrain forklift, which has articulated steering, was tried. The above ALEB ramp connects unto the second ramp. The ALEB 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.
Once the ilvan chassis was on the
platform, the crane was lifted.
FIGURE 11. BERTH CRANE ASSEMBLY BEGINS. Once the 300-ton crane was landed and turned around, its assembly could be completed. It required 9 days before being operational, although no night operations were conducted and 3 days that time were spent reversing the crane due to the necessity of passing the crane through and fitting.
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 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.