UNCLASSIFIED

AD NUMBER

ADB237370

NEW LIMITATION CHANGE

TO
Approved for public release, distribution unlimited

FROM
Distribution: DTIC users only.

AUTHORITY

Army Aberdeen Test Center ltr dtd 15 Jun 98

THIS PAGE IS UNCLASSIFIED
AD NUMBER

ATI: 4Ø ø75

NEW LIMITATION CHANGE

TO

UNCLASSIFIED

"DTIC USERS ONLY"

FROM

RESTRICTED

19980730 052

AUTHORITY

E.O. 10501, Nov 05, 1953

THIS PAGE IS UNCLASSIFIED
This document is the best quality available. The copy furnished to DTIC contained pages that may have the following quality problems:

- Pages smaller or larger than normal.
- Pages with background color or light colored printing.
- Pages with small type or poor printing; and or
- Pages with continuous tone material or color photographs.

Due to various output media available these conditions may or may not cause poor legibility in the microfiche or hardcopy output you receive.

☐ If this block is checked, the copy furnished to DTIC contained pages with color printing, that when reproduced in Black and White, may change detail of the original copy.
Reproduced from low contrast copy. Original documents may be obtained on loan from CADO.
FIRST REPORT ON DETERMINATION OF POSSIBLE

MOVEMENT OF CORPS AND DIVISION ARTILLERY UTILIZING

C-47, B-27, AND B-24 AIR PLANES,

AND FIRST REPORT ON ORDNANCE PROGRAM NO. 6077 — /

ORDNANCE PROGRAM NO. 6077

UNCLASSIFIED

ABERDEEN PROVING GROUND
ABERDEEN, MARYLAND
FIRST REPORT ON THE DETERMINATION OF POSSIBLE
MOVEMENT OF CORPS AND DIVISION ARTILLERY UTILIZING
C-47, B-17, AND B-24 AIRPLANES

FIRST REPORT ON ORDNANCE PROGRAM NUMBER 6077
ORDNANCE PROGRAM NUMBER 6077

Date of Test: 8 to 12 February 1944

INDEX

I. INTRODUCTION .................................................. 2
II. OBJECT OF TEST .................................................. 2
III. AUTHORITY FOR TEST .......................................... 2
IV. ASSUMPTIONS ..................................................... 3
V. CONCLUSIONS ...................................................... 3

APPENDIX

I. SUMMARY .......................................................... 5
II. BEST LOADING ARRANGEMENTS ................................... 8
III. NUMBER AND TYPE OF AIRPLANES REQUIRED .................. 123
IV. WEIGHTS AND DIMENSIONS OF AMMUNITION .................... 131
V. AMMUNITION FOR 6500 LB. LOAD ............................... 132
I. INTRODUCTION

Numerous investigations have been conducted in recent months to develop procedures for the installation of miscellaneous weapons and automotive equipment in transport aircraft. It has now become desirable to investigate methods for the installation of division and corps artillery, together with necessary tools, accessories, sighting and fire control equipment, communication equipment, ammunition, and expedient prime movers in C-47, B-17, and B-24 aircraft.

II. OBJECT OF TEST:

To determine -

A. Major items of Corps and Division Artillery which can be loaded on C-47, B-17, and B-24 airplanes.

B. Best loading arrangements therefor.

C. Number of airplanes by type to move for a distance of 150 miles (airplane return to be made without refueling).

1. Corps artillery which can be air transported.

2. Division artillery which can be air transported.

3. 100 round units of ammunition therefor.

4. Practicable prime movers for Corps and Division Artillery and ammunition.

III. AUTHORITY FOR TEST:

A. Memorandum to Chief of Army Ground Forces, Chief of Army Air Forces, and Chief of Army Service Forces, from Chief of Staff, dated 8 February 1944.

B. Verbal instructions from Major General G. M. Barnes, Ordnance Department to Major General C. T. Harris, Jr., Aberdeen Proving Ground, Maryland.

C. Written memorandum from Brigadier General H. A. Craig, Army Air Forces, to Brigadier General H. E. Gross, Army Air Forces.

D. Verbal instructions Major General G. M. Barnes to Colonel H. A. Quinn, Ordnance Department.
IV. ASSUMPTIONS:

A. Only equipment readily available to field units may be used.

B. Disassembly must be the minimum practicable in order to insure rapid reassembly.

C. Airplanes will not drop equipment - unloading will be by hand with aid only of equipment transported.

D. Crew of airplane to consist of pilot, co-pilot, radio operator, navigator, crew chief and at least one other person who assisted in loading the airplane.

E. Where practicable, the complete weapon and its ammunition will be loaded in the same airplane.

F. Reassembly will be accomplished chiefly by the gun crews.

V. CONCLUSIONS:

A. The following loadings are considered impracticable.

1. Gun, 155 MM, M1 and Howitzer, 8", M1. The weight and length of the tubes of these weapons exceed the capacity of any of these airplanes.

2. Prime movers, larger and/or heavier than the truck, 2-1/2 ton, 6 by 6 cannot be satisfactorily disassembled into small enough units for installation in these planes and subsequent reassembly under emergency conditions.

B. Loadings which were found to be practicable were shown in Appendix One (Summary).

C. The best loading arrangement of these items are shown in the individual test reports in Appendix Two.

D. The number of airplanes by type required to move normally assigned Corps Artillery units and organizational division artillery together with sufficient prime movers for each is shown in Appendix Three.

Mervin E. Gross
Brig. Gen. U.S.A.
Chief, Requirements Div.
Headquarters, AAF

H. A. Quinn
Col. Ord. Dept.
Chief

Charles A. Carlson
Capt. Ord. Dept.
Proof Officer

John W. Cave
Chief, Arms & Ammunition Div.

C. H. Johnson
Maj. Ord. Dept.
Proof Officer
The following personnel were present at Aberdeen Proving Ground during the test:

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Office</th>
</tr>
</thead>
<tbody>
<tr>
<td>Col. F. B. Porter</td>
<td>F. A. Board</td>
<td>Fort Bragg, N. C.</td>
</tr>
<tr>
<td>Lt. Col. R. H. Berry</td>
<td>AAF 1st Bomber Command</td>
<td>Charleston Air Base, S. C.</td>
</tr>
<tr>
<td>Lt. Col. E. A. Peterman</td>
<td>AAF Materiel Command</td>
<td>Wright Field, Ohio</td>
</tr>
<tr>
<td>Major R. T. Crane</td>
<td>AAF C.C.R.</td>
<td>Washington, D. C.</td>
</tr>
<tr>
<td>Major V. K. Gregory</td>
<td>AAF Materiel Command</td>
<td>Wright Field, Ohio</td>
</tr>
<tr>
<td>Major F. J. Shaffer</td>
<td>AAF Materiel Command</td>
<td>Wright Field, Ohio</td>
</tr>
<tr>
<td>Capt. R. J. Jerome</td>
<td>AAF</td>
<td>Westover Field, Mass.</td>
</tr>
<tr>
<td>1st Lt. G. W. Holmes</td>
<td>Airborne Engineers</td>
<td>Richmond, Va.</td>
</tr>
<tr>
<td>Mr. J. L. Beardsley</td>
<td>Ord. Dept.</td>
<td>Washington, D. C.</td>
</tr>
<tr>
<td>Mr. A. B. Colla</td>
<td>Signal Corps</td>
<td>Philadelphia, Pa.</td>
</tr>
<tr>
<td>Mr. J. S. Baglaitis</td>
<td>AAF</td>
<td>Washington, D. C.</td>
</tr>
<tr>
<td>Mr. W. H. Lucht</td>
<td>Ord. Dept.</td>
<td>Washington, D. C.</td>
</tr>
<tr>
<td>Mr. W. B. Miller</td>
<td>AAF Materiel Command</td>
<td>Wright Field, Ohio</td>
</tr>
<tr>
<td>Mr. Z. A. Noraiishi</td>
<td>AAF Materiel Command</td>
<td>Wright Field, Ohio</td>
</tr>
<tr>
<td>Mr. A. Ruben</td>
<td>Signal Corps</td>
<td>Philadelphia, Pa.</td>
</tr>
</tbody>
</table>
## Appendix I

### Practicable Loadings

#### Summary

<table>
<thead>
<tr>
<th>Items</th>
<th>C-47</th>
<th></th>
<th>B-17</th>
<th></th>
<th>B-24</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In addition to crew</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>units per airplane</td>
<td>ammunition per airplane</td>
<td>cargo weight</td>
<td>units per airplane</td>
<td>ammunition per airplane</td>
<td>cargo weight</td>
</tr>
<tr>
<td>Corps Artillery 155 mm Howitzer, M2</td>
<td>1/2</td>
<td>7543</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1/2</td>
<td>7400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: This Howitzer can be carried in two C-47's with weights as shown. However, by using two C-47's with one B-17 or one B-24 (three airplanes), two Howitzers may be carried in three airplanes. Details of loadings shown in tests Nos. 16 a, b, c, d.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5” Gun, M1</td>
<td>1/2</td>
<td>7797</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1/2</td>
<td>7400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: This gun can be carried in two C-47's with weights as shown. However, by using two C-47's with one B-17 or one B-24 (three airplanes), two guns may be carried in three airplanes. Details of loading shown in tests Nos. 16 a, b, c, d.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>155 mm Howitzer, M1 Ammunition</td>
<td>50</td>
<td>6166</td>
<td>56</td>
<td>7612</td>
<td>72</td>
<td>9072</td>
</tr>
<tr>
<td>4.5” Gun, M1, Ammunition</td>
<td>80</td>
<td>6235</td>
<td>90</td>
<td>6510</td>
<td>176</td>
<td>12088</td>
</tr>
<tr>
<td>Note: Weights include allowances for rigging.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### RESTRICTED
<table>
<thead>
<tr>
<th>Items</th>
<th>C-47 In addition to crew</th>
<th>B-17 In addition to crew</th>
<th>B-24 In addition to crew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo Truck 2-1/2 Ton 6 x 6 Short wheel base with winch.</td>
<td>1/2 5210 Impractical</td>
<td>Impractical</td>
<td>Impractical</td>
</tr>
<tr>
<td>Cargo Truck 3/4 Ton 4 x 4 with winch</td>
<td>1 5500 Impractical</td>
<td>Impractical</td>
<td>Impractical</td>
</tr>
<tr>
<td>Trailer Cargo 1 Ton 2 Wheel wood or steel body</td>
<td>#1 1500 Impractical</td>
<td>Impractical</td>
<td>2 3000 Disassembled in rear bomb bays. Note: Two 1/4 ton trailers may be carried in same load in front bomb bays.</td>
</tr>
<tr>
<td># One 1 ton and one 1/2 ton can be placed in C-47.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trailer Cargo 1/4 Ton 2 Wheel</td>
<td>#1 550 2 1100 Disassembled in front bomb bays. Note: Two 1 ton trailers may be carried in same load in rear bomb bays.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tractor, Clark Engineers, 20 HP</td>
<td>1 4135 Impractical</td>
<td>Impractical</td>
<td>Impractical</td>
</tr>
<tr>
<td>Clark Fork Lift Truck (minus fenders)</td>
<td>1 6100 Impractical</td>
<td>Impractical</td>
<td>Impractical</td>
</tr>
</tbody>
</table>
### APPENDIX I (Cont'd)

<table>
<thead>
<tr>
<th>Items</th>
<th>C-47 In addition to crew</th>
<th>B-17 In addition to crew</th>
<th>B-24 In addition to crew</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>units per airplane</td>
<td>ammunition per airplane</td>
<td>cargo weight per airplane</td>
</tr>
<tr>
<td>Division Artillery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 mm Howitzer, 12</td>
<td>1</td>
<td>18</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 mm Ammunition</td>
<td>105</td>
<td>6010</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army Special Troops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Chemical Mortar</td>
<td>2</td>
<td>160</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 mm Howitzer, 13</td>
<td>2</td>
<td>30</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 mm Ammunition</td>
<td>105</td>
<td>6010</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd Antitank Crew, 11</td>
<td>1</td>
<td>12</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd Ammunition</td>
<td>114</td>
<td>5763</td>
<td>114</td>
</tr>
</tbody>
</table>

**Note:** Weights include allowances for rigging.
RESTRICTED

The following tabulation shows the method employed for assignment of test numbers.

<table>
<thead>
<tr>
<th>MATERIEL</th>
<th>AMMUNITION</th>
<th>PRIME MOVER</th>
<th>PLANES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C-47</td>
<td>B-17</td>
<td>B-24</td>
</tr>
<tr>
<td>Mortar, 4.2&quot;</td>
<td>1 (1)</td>
<td>2 (1)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Howitzer, 105 mm, M3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Howitzer, 105 mm, M2</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Gun, 3&quot; M1</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Gun, 4.5&quot; M1</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Howitzer, 155 mm, M1</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Gun, 155 mm, M1</td>
<td>19 (2)</td>
<td>20 (2)</td>
<td>21 (2)</td>
</tr>
<tr>
<td>Howitzer, 8 M1</td>
<td>22 (3)</td>
<td>23 (3)</td>
<td>24 (3)</td>
</tr>
</tbody>
</table>

(1) Details of tests nos. 1, 2, and 3 are not shown separately in this report. These tests were combined with tests nos. 25, 26, 27 since it was found practicable to load both material, in complete units, and ammunition in all three types of airplanes.

(2) Tests nos. 19, 20, and 21 were not conducted since the weight and length of tube, which is the heaviest component of the complete assembly, exceeded the weight carrying capacity of any position on any aircraft. The tube, which weighs 9695 pounds, can be hung on 4000 pound external bomb racks for the B-17 and B-24, but their strength is inadequate. Hence, though these planes can carry 15,000 pounds, the tube cannot be carried.

The weight of the tube exceeds the permissible payload of a C-47. Further, the floor of a C-47 will not stand a concentrated load of this magnitude.

Therefore, no attempt was made to carry any other part of this weapon in any of the three aircraft.

(3) The same remarks apply to tests nos. 22, 23, and 24 as for the 155 gun except that the tube weighs 10,240 pounds.

(4) No installations of this ammunition were attempted since it was determined that the installation of the material was impracticable for these airplanes, as indicated in (2) and (3) above.

RESTRICTED
Installation of the 105 mm Howitzer, M3, on Carriage, M3A1, in C-47 Airplane

A. Two complete howitzers (no disassembly) were installed in this airplane together with a total of 30 rounds in 10 boxes (3-round bundles, ammunition and 2 boxes of battery accessories, 2 boxes of sights and 1 box of standard tools. Ramps were installed and the first howitzer was run into the plane after the seats had been folded back so that the muzzle of the tube was just inside the doorway leading into the radio compartment. The traveling lock was unlocked and the howitzer was elevated slightly. Six 3 round crates of complete rounds were then placed against the forward wall. The second howitzer was then man-handled into the main compartment of the ship in a similar manner until the spades of the first howitzer could be placed on top of the axles of the second howitzer. This union of spades and axles was made secure by lashing. Battery accessories, tools, and sights in their containers were then stored on the floor underneath the second howitzer and four cases of ammunition were lashed to the floor opposite the closed trails of the second howitzer. Diagram No. 4 shows the floor plan for this loading arrangement. Reference is made to appended APG photographs Nos. 99793 and 99696 to 99699, inclusive. These photographs show respectively the complete 105 mm Howitzer, M3, loading operations in progress, progressive installation in plane, and final installation in plane.

B. In order to remove this equipment from the plane, the ammunition, tool boxes, sights, and battery accessories must be removed first and the howitzers removed in inverse order of loading. In moving the howitzers up or down the ramp, effective use can be made of the truck, 1/4-ton, 4 x 4, with two men as guides. Without the truck, installation may be accomplished by the efforts of eight men using a safety rope.

C. Material Used for Installation

1. Two pieces of planking, 2" x 10" x 16', four blocks, 2" x 10" x 12" thirty-two ten-penny nails.

2. Plane rigging. Sixteen lengths of one-half inch plane rigging for lashing material to the floor, each length fourteen feet. Two side ramps for loading material on ship.

3. No additional rigging was used.

D. Weights

<table>
<thead>
<tr>
<th>Description</th>
<th>Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten boxes of 105 mm Howitzer complete rounds</td>
<td>1770</td>
</tr>
<tr>
<td>Two boxes of battery accessories</td>
<td>240</td>
</tr>
<tr>
<td>Ten boxes of sights</td>
<td>150</td>
</tr>
<tr>
<td>One box of tools</td>
<td>125</td>
</tr>
<tr>
<td>Two 105 mm Howitzers, 23</td>
<td>5400</td>
</tr>
<tr>
<td>Total Weight</td>
<td>7635</td>
</tr>
</tbody>
</table>
NOTE: In addition to the assumed crew and cargo load 0 soldiers may be carried.

E. Disassembly time: None
   Loading time: 1-1/4 hours
   Unloading time: 1/2 hour
   Reassembly time: None
Compart. D - Hub of 1st howitzer directly on section 216 - 3'11" from compartment partition.

Compart. E - Hub of 2nd howitzer centered between sections 312 and 32 - 12'1" from compartment partition.

Compart. D - (4 boxes ammunition against partition, under muzzle of 1st howitzer.
(6 boxes ammunition against axle, under trails of 1st howitzer.

Compart. E - Accessory boxes under muzzle.
Compart. F - Tools and Sight boxes.

C.G. = 18.5 inch units
Gross Cargo Wt. = 7635 lbs.

C-47
R4D-1, a=5

EXTERNAL STORACE
PACKS - FORWARD Center Rear
FWD - NO SCALE REQUIRED
A. The carriage was rolled underneath the exterior bomb rack manually and placed in the firing position. Both wheel and tire assemblies were removed from the axle on each side. By removing the wheel brake drum assembly nut, the entire wheel and brake drum assembly can be removed as a unit. The next step was to place the remainder of the howitzer and carriage assembly on two small bomb trucks and to elevate the howitzer to 10 degrees. By means of the bomb trucks, the unit was hoisted up to the exterior bomb rack. The next step was to fasten a 3/8" cable to one side of the axle, pass it over the top of the exterior bomb rack, and cut it to the desired length so that a turnbuckle could be installed to draw the entire assembly tightly to the bomb rack. In order to prevent any lever motion of the load in flight, another cable was attached to one side of the axle and was passed around the front top of the bomb rack to the other side of the axle and a turnbuckle was installed so that the cable could be drawn tight to anchor the axle. Another cable was wrapped twice around the trails two feet from the spade and was passed over the top of the bomb rack (approximately six inches from the end) and drawn securely by means of a turnbuckle. The next step was to install a piece of plywood 1/2" thick in the form of a trapezoid 30 inches high, 30 inches wide at the bottom and 12 inches wide at the top. This board rested between the axle and the muzzle of the tube. The purpose was to reduce wind resistance and prevent wind pockets from tearing off the canvas cover. The entire unit, after being suspended from the wing, was covered with the canvas. The canvas was tied securely at the muzzle, passed over the assembly and the ground, and the side portions were tied to the bomb racks at the top. To store the ammunition and wheels in the bomb bays, a floor was built under both bomb bays. Ten pieces of timber 2" x 8" x 36" and twelve pieces 2" x 6" x 7' were cut for use as flooring. The cross members were placed on 2" x 8" x 9" blocks resting on the middle girder and on the outer girder. When the cross members are laid, use the 2" x 6" x 7' timbers as flooring, driving one nail through each overlap. Load seven boxes of ammunition in each side, and lash them securely in place with 1/2" rope and by using wedges. After the ammunition was loaded, the wheels were raised to the top of the bomb bay with the bomb bay winch. Two wheels were placed on each side of the bomb bay and were lashed with 1/2" rope to a 2" x 8" plank that had been fastened into the bomb bay by 3/8" cable. Progressive loading is illustrated by A.P.G. Photograph Nos. 99757, 99758, 99759, 99770, and 99813; final loading is shown by Diagram 5.

B. To remove the material, the procedure was reversed.

C. Materials Used:

- 60 feet 3/8" cable
- 6 - 10" turnbuckles
- 20 cable clevis clamps
- 1 piece tarpaulin - 16' x 10'
- 20 feet 1/2" rope
- 1 - 1/2" plywood strip 30" x 30"
- 2 boards 2" x 8" x 24"
- 50 ft. 2" x 3" wood
- 90 ft. 2" x 6"
- 10 ft. 2" x 4'
- 50 - 15 penny nails
D. Weights:

Weight of 13 Howitzer Carriage (less wheels)........... 2420 lbs.
Weight of Lumber ........................................... 272 lbs.
Weight of 14 Ammunition Boxes ....................... 2408 lbs.
Weight of two 105 mm L2 ................................ 5400 lbs.

Total Weight including lumber ............... 6100 lbs.

E. Time to Load: 5 hours

F. Time to Unload: 2 hours

G. Number of soldiers which can be carried in addition to crew - 13
Bomb Racks

Bomb Bays

Build wooden floor for carrying ammunition and wheels

Bomb racks

Suspend
105 M3 How. and
M3A1 Carriage complete less 2 wheels.

M3 How. and Carriage complete 2420 lbs. less wheels.

1 wheel 150 lbs.
4 wheels 600 lbs.

C. G. = 25.5 Index Units
Cargo Wt. = 8100 including
300# lumber

B-17G

14 boxes ammunition - 172# per box

TEST NO. 5
A. This howitzer was installed, disassembled, in the 3-24 airplane. The details of this installation are recorded in the Air Arm Command report of tests conducted at Camp Mackall.
Test No. 7

INSTALLATION OF 105 MM HOWITZER, HEAL, WITH CARRIAGE, M2A2
IN C47 AIRPLANE

A. One complete howitzer (disassembled into five major units; howitzer cradle with recoil mechanism, equilibrator, carriage, and the trails) was installed in this airplane, together with a total of 12 complete rounds of ammunition (in six bundles crated for overseas shipment) and one accessory chest. A 3/4 ton truck with an "A" frame was required for disassembly and lifting the component units into the plane. The equilibrator was removed prior to the disassembly of the tube, which was followed by the removal of the cradle and recoil mechanism. It was necessary to lift most of the weight off the carriage with the boom in order to remove the trails. The carriage (composed of wheels, axle and bottom carriage) was lifted into the plane and worked forward into Compartment D by alternately rolling one side of the carriage crosswise to the longitudinal axis of the plane and sliding it forward. The tube was lifted into the plane manually and carried to the left side of Compartment E and placed on 2" by 10" planking. The recoil and cradle were lifted into the plane and carried to the right side of Compartment E and placed on 2" by 10" planking. The trails were laid between the cradle and tube in the center of the plane, and the equilibrator was placed under the carriage. Two boxes of ammunition were placed on top of the trails and four boxes, with the accessory chest, were placed on the floor in Compartment F. All units of the howitzer and the boxes of ammunition were secured with lashing to prevent any movement. Diagram No. 7 shows the floor plan of this loading arrangement. Reference is made to appended A.F.C. Photographs 99700, 99701, 99702-A, which illustrate details of the loading operations and the final installation in the plane.

B. In order to remove this equipment the loading operation was reversed.

C. Material Used for Installation.

1. Six pieces of planking 2" x 6" x 9'.
2. Five pieces of planking 3" x 6" x 10'.
3. Two pieces of 2" x h" x 9' planking.
4. Plane rigging. Lashing and tools.
5. Additional rigging. Single and double block plus 100' of 3/4" rope to lift carriage. 3/4 ton h x h with an "A" frame was required for all lifting operations. 1/2" rope 75' long for lashing parts into plane.
RESTRICTED

Test No. 7 (Con'td)

D. Weights.

<table>
<thead>
<tr>
<th>Item</th>
<th>Lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor, complete</td>
<td>1061</td>
</tr>
<tr>
<td>Cradle</td>
<td>333</td>
</tr>
<tr>
<td>Carriage</td>
<td>2433</td>
</tr>
<tr>
<td>Right trail</td>
<td>280</td>
</tr>
<tr>
<td>Left trail</td>
<td>255</td>
</tr>
<tr>
<td>Recoil Mechanism</td>
<td>163</td>
</tr>
<tr>
<td>Six Bundles of Ammunition</td>
<td>1032</td>
</tr>
<tr>
<td>Battery Accessory Chest</td>
<td>215</td>
</tr>
<tr>
<td>Lumber</td>
<td>154</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6229</strong></td>
</tr>
</tbody>
</table>

E. Time to disassemble - 2 hours
Time to load - 2 hours
Time to unload - 1-1/2 hours
Time to reassemble - 3 hours

F. Number of soldiers which can be carried in addition to crew - 6

RESTRICTED

-17-
Compartment "D" Carriage - 1500 lbs. - Equilibrator
Compartment "E" Recoil Mech., Tube, Trails
Compartment "F" Ammunition & Accessory Chest

Center of Gravity falls at Index of 50.1
Total Cargo Weight = 6229

C-47 R4D-1, a-5
A. The howitzer, recoil mechanism, and cradle (which were attached to the external bomb rack) were removed as a complete unit from the carriage. This unit was placed upright on two blocks, 8" x 8" x 11/4", one under either end of the cradle. The trails, which had been removed from the carriage, were centered lengthwise on top of the tube, with the spade end of the trails toward the muzzle of the howitzer, supported at the muzzle by a piece of 6" x 6" x 11/6" timber and at the other end by a thin piece of wood placed on top of the breech ring to protect the quadrant seats. The trails were locked together by the trail locks, and wedged apart by two 2" x 6" x 12" blocks. This group was bound together by means of two 3/8" cables, each placed 3 feet from either end of the bundle and drawn tight by means of turn buckles. The entire bundle was then inverted, using a four (4) ton wrecker.

Two special pieces of steel plate, fabricated as shown by sketch, were centrally secured to the top of the bundle by 3/8" cable placed around it and tightened by turn buckles so that the slotted holes of the plate were engaged by the bomb lifting hooks. The bomb hooks were then lowered to engage the slotted holes of the plate, and the entire bundle was then raised into the rack by means of the bomb rack winches. Two 3/8" cables were then placed over the top of the bomb rack, one at either end, and around the bundle, and tightened by turn buckles.

The two bomb winch cables of the main bomb bay were lowered and hooked around either end of the axle, and the axle assembly and carriage were raised slightly. The wheels were then removed, and the carriage hoisted as high as possible into the bomb bay. A piece of 2" x 6" x 24" timber, 30" long, was placed underneath the axle across the bomb bay, resting on the outer girder, and on a 10" block placed on the inner girder. The axle assembly was then lowered onto this block and lashed by means of 3/8" cable connecting one pair of bomb hooks and the opposite end of the assembly. In order to prevent sideward motion, a 2" x 8" x 36" timber was placed between the assembly and the outer side of the bomb bay, and a 6" x 8" x 12" block between the assembly and the inner side of the bomb bay. One of the wheel assemblies was lifted manually and placed flat against the bottom of the axle assembly, and secured to it by means of a 3/8" cable passed over the axle assembly through the hub and around a 6" x 6" x 12" block on the opposite side of the hub and tightened securely with a turn buckle. The other wheel was then secured in a similar manner on top of the axle assembly. The shield, broken down to its separate components, was placed in the radio room behind the bomb bay and secured by short lengths of 1/2" rope in a position least inconvenient to the crew members. The material and the loading operations are illustrated in Fig. 7. Photographs 97573 and 97566 to 9752 inclusive, 9766, 9758, 9778 and 9920. The distribution of the load is shown in Diagram 8.

B. Disassembly is accomplished in the opposite manner to assembly.

C. Materials used:
TEST NO. B (Cont'd)

50 ft. - 3/8" cable
16 - 10" turn buckles
50 - cable clamps
12 ft. - 2 x 4 Timber
8 ft. - 2 x 8 Timber
25 - 2 x 8's 1/4 ft. long
70 - 16-penny nails
50 ft. - 1/2" rope
1 Double Sheave 6" block
1 - 1-Ton Cargo Carrier with Winch
200 ft. - 3/4" rope

D. Weights

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Howitzer, recoil mechanism, top carriage and trails</td>
<td>2400</td>
</tr>
<tr>
<td>Wheels (2)</td>
<td>50</td>
</tr>
<tr>
<td>Axle Assembly and bottom carriage</td>
<td>1832</td>
</tr>
<tr>
<td>Armor shields</td>
<td>350</td>
</tr>
<tr>
<td>Total (2 units)</td>
<td>9800</td>
</tr>
</tbody>
</table>

E. Time of Disassembly - 3 hours
Time of Loading - 5 hours
Time of Unloading - 1-1/2 hours
Time of Reassembly - 4 hours

F. In addition to assumed crew (6) and above load, 12 fully equipped men may be carried.

The 105-mm Howitzer M2A1 on Carriage M2A2 (disassembled) has been installed in the B17 Airplane successfully and reported by the Airborne Command.
<table>
<thead>
<tr>
<th>Item</th>
<th>Howitzer Weight</th>
<th>Complete Unit Weight</th>
<th>lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>1061#</td>
<td>4900</td>
<td>163#</td>
</tr>
<tr>
<td>Width</td>
<td>3-1/2&quot;</td>
<td>82&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>Height</td>
<td>15&quot;</td>
<td>60&quot;</td>
<td>19&quot;</td>
</tr>
<tr>
<td>Length</td>
<td>101-1/2&quot;</td>
<td>238&quot;</td>
<td>62&quot;</td>
</tr>
<tr>
<td>1 wheel complete w/tire &amp; tube</td>
<td></td>
<td></td>
<td>276#</td>
</tr>
<tr>
<td>Left Trail Assembly</td>
<td></td>
<td></td>
<td>255#</td>
</tr>
<tr>
<td>Right Trail Assembly</td>
<td></td>
<td></td>
<td>280#</td>
</tr>
<tr>
<td>No Shield Weights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top Carriage &amp; Elevating &amp; Traversing Mechanism</td>
<td></td>
<td></td>
<td>172#</td>
</tr>
<tr>
<td>Bottom Carriage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center of Gravity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Rear of wheel hub</td>
<td></td>
<td>5-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>(b) Above wheel hub</td>
<td></td>
<td>12-3/4&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>In traveling position</td>
<td></td>
</tr>
</tbody>
</table>
Test No. 9. Installation of Howitzer 105 mm, M2, in B-24 Airplane

Details of this installation may be found in the report of the Airborne Command of tests conducted at Camp Mackall, North Carolina. No loading diagrams or photographs of this installation are available for this report.
Installation of 3" Gun, HS on Carriage, XI, in the C-47 Airplane.

A. One complete weapon (disassembled into six major units; Gun, Equilibrator, Cradle, two (2) Trails and Carriage) was installed in the airplane together with two (2) boxes of ammunition containing four (4) rounds each, and the accessory chest. A 3/4-ton truck with an "A" frame was used to disassemble the weapon and to lift the various units into the plane. A counterbalance load was required on the rear of the 3/4-ton truck when the Carriage was picked up. Six (6) men were required to handle the equipment. The carriage was moved to the forward portion of the compartment by rolling from side to side and moving it forward. The wheels were lashed to the floor to prevent any longitudinal or lateral movement. The cradle was placed on 2" x 10" planking and lashed to the right side of the floor. The gun, which was lifted into the cabin, muzzle first, was pulled into position with a block and tackle just to the left of the center of the cabin. The forward end of this block and tackle was tied to the wheel of the carriage in this operation. The left trail was placed to the right of the center of the cabin with the spade to the rear and the right trail placed on the extreme left of the cabin. The trails were manually handled within the plane and placed on 2" x 10" planks. The equilibrator brackets were placed on the right side of the cabin in compartment "O" and securely lashed. Two (2) boxes of ammunition were placed end to end in the extreme right side of the cabin with the rear end under section 3124. The accessory chest was lashed in place in the center of compartment "P". Diagram No. 10 shows the floor plan for this loading arrangement. Reference is made to appended A.P.C. Photographs Nos. 55266 and 37702. These photographs show the complete 3" Gun Carriage, XI, loading operations in progress, progressive installation, and final installation in the plane.

B. In order to remove this equipment, the loading operation is reversed.

C. Material Used for Installation.

1. Two (2) pieces of planking - 2" x 10" x 8' and four (4) blocks -
   3" x 12" x 12".

2. Plane rigging, lashings, and tools.

3. Additional rigging - 3/4 ton 4x4 Truck with winch and "A" frame

   - One (1) Single block
   - One (1) Double block
   - 1" Ropes.

D. Weights.

   Tube .........................................................1640 lbs.
   Right Trail ..................................................260 lbs.
   Left Trail ...................................................265 lbs.

RESTRICTED
-25-
RESTRICTED

TEST NO. 10 (cont'd)

D. Weights (cont'd)

Carriage, less trails ......................... 2433 lbs.
Equilibrator .................................. 72 lbs.
Recoil Mechanism and Cradle .................. 796 lbs.
2 Boxes Ammunition .......................... 316 lbs.
Accessory chest ................................ 215 lbs.
Lumber ........................................ 143 lbs.

Total Weight 6150 lbs.

E. Time required to disassemble - 2 hours
   Time required to load - 2 hours
   Time required to unload - 1 1/2 hours
   Time required to reassemble - 3 hours

F. Number of soldiers which can be carried in addition to crew - 1.
Carriage with shield facing up and bottom of carriage facing right side of plane.
Rear face of breech ring on tube between sections 351\(\frac{1}{2}\) and 372\(\frac{1}{2}\).
Rear face of spades centered between sections 390\(\frac{1}{2}\) and 411\(\frac{1}{2}\).
Accessory chest in center of plane w/front under section 411\(\frac{1}{2}\).
Cradle on right side muzzle end first, rear end between sections 372\(\frac{1}{2}\) and 390\(\frac{1}{2}\).

**C-47**

**R4D-1, a-5**

Center of Gravity - 29.5 index units
Cargo Weight - 6150
A. Details of Loading.

1. The tube was rolled into position under the open left-hand bomb bay by means of two bomb dollies, one at the breech, the other at the muzzle. One bomb hoist cable was fastened to the muzzle approximately 4 feet from the muzzle. The hoist was cranked up, and at the same time the bomb dolly supporting the breech was slowly pushed toward the bomb bay. The muzzle was guided through the radio compartment door as the breech came into the bomb bay. When the breech was under the bomb bay, the second bomb hoist was fastened around the tube near the breech ring, and the breech was raised into the bomb bay until the breech was approximately 2' below the radio compartment door sill. Approximately 5' of the tube projected into the radio compartment. This will not interfere with the radio operator in the performance of his duties. The tube was secured with 2 pieces of 3/8" wire rope approximately 5' long. Each cable was wrapped once around the tube approximately 2-1/2" forward of the breech. The ends of the cables were fastened to the shackles of the outboard and inboard bomb racks. The hoist cables were left in place for quick unloading, but could be disconnected if desired. A 3/8" cotton rope was used to lash the tube to prevent fore and aft movement and vertical movement. The muzzle end of the tube was also lashed to prevent movement on the door sill. A.P.G. Photograph 99773 illustrates the loading operation.

B. Unloading is accomplished by the reverse of the procedure.

C. Material Used.

2 pieces 3/8" wire rope, 5 ft. long
275' of 3/8" cotton rope
4 cable clamps, 3/8"

D. Weights.

Gun tube, breech ring, and breechblock ................. 1610 lbs.

E. Data for tube alone.

Loading time - 1 hour
Unloading time - 30 minutes

F. Number of soldiers carried in addition to crew -

NOTE: The other parts of the gun have been loaded in an airplane at Camp Mackall and are not shown in this report for other details of this loading see the Mackall report on the same subject.
TEST NO. 12

INSTALLATION OF 3" GUN, M5 ON CARRIAGE, M1

INTO B-24 AIRPLANE

A. Details of Loading.

1. Before attempting to load the gun tube into the airplane, the airplane was tipped backwards until its tail skid rested in a hole approximately 12" deep, which had been dug before tipping. Tipping was accomplished by having 5 men walk inside the airplane to the tail. The nose wheel was blocked up as far as possible (approximately 10") to prevent the nose coming down from the weight of the gun tube, refer to A.P.G. Photograph No. 99774. To maneuver the tube into the plane, one bomb hoist was fastened to the muzzle while the breech was supported by a hydraulic bomb carriage. Refer to A.P.G. Photograph No. 99771. As the hoist was cranked up, the bomb carriage was slowly moved toward the bomb bay until the breech was in position beneath the bomb bay with the muzzle projecting into the left rear bomb bay. The front bomb bay hoist was fastened near the breech and the rear bomb bay hoist was fastened near the muzzle. The tube was hoisted into place and secured to the bomb shackle with 3/8" wire rope and cable clamps. The bomb hoists were left connected to the tube, but could be disconnected if desired. The tube was secured to prevent fore and aft and sideward movement by additional lashing with 1" Manila rope.

2. It was considered impractical to load the carriage, M1 intact into this airplane (A.P.G. Photograph No. 99704). Loading of the carriage in a disassembled condition was successfully accomplished at Camp Mackall, North Carolina, by the Airborne Command. In connection with the loading of Howitzer, 105mm, M2 in B-24 airplane.

B. Unloading was accomplished by the reverse procedure.

C. Material used.

- 2 pieces 3/8" wire rope approximately 48" long.
- 4, 3/8" cable clamps.
- Approximately 50' of 1" Manila rope.

D. Weights.

Gun tube, breech ring, and breech block .......... 1640 lbs.

E. Disassembly time - None.

Loading Time - 1 hour.

Unloading Time - 30 minutes.

Reassembly Time - None.
TEST NO. 13, 14, AND 15

INSTALLATION OF 4.5" GUN CARRIAGE, M3A1
MATERIEL ON C-47, B-17, AND B-24 AIRPLANES

These tests were not conducted because the carriage for the 4.5" Gun, M1, is identical with the carriage for the 155-mm Howitzer, M1. The difference between the two units lies in the weight and length of the tube. 4.5" Gun weighs 4,075 lbs. while the 155-mm Howitzer weighs 3,825 lbs. Tests of the 155-mm Howitzer Materal are reported in Test Nos. 16, 17, and 18.
## TEST NO. 16 GENERAL

### 155mm Howitzer, M1, and 4.5 Inch Gun, M1, Loading

#### A. Installation of the 155mm Howitzer, M1, with Carriage, M1, in two C-47 Airplanes, was accomplished with the following loads in each airplane.

<table>
<thead>
<tr>
<th>C-47 (Test 16A)</th>
<th>C-47 (Test 16B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>155mm Howitzer</td>
<td>1 Top and Bottom Carriage</td>
</tr>
<tr>
<td>2 Trails</td>
<td>1 Recoil Mechanism</td>
</tr>
<tr>
<td>2 Wheels</td>
<td>2 Equilibrators</td>
</tr>
<tr>
<td></td>
<td>2 Spades</td>
</tr>
<tr>
<td>Tools and Accessories</td>
<td>1 Float</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### B. Two 155mm Howitzers and Carriages can be loaded successfully in two C-47 Airplanes and one B-24 Airplane.

<table>
<thead>
<tr>
<th>C-47 (Test 16C)</th>
<th>B-24 (Test 16D)</th>
<th>C-47 (Test 16E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Top and Bottom Carriage</td>
<td>2 155mm Howitzer Tubes (mounted on the external bomb racks)</td>
<td>1 Top and Bottom Carriage</td>
</tr>
<tr>
<td>2 Trails</td>
<td>2 Trails</td>
<td></td>
</tr>
<tr>
<td>2 Equilibrators</td>
<td>2 Spades</td>
<td></td>
</tr>
<tr>
<td>1 Wheel</td>
<td>1 Float</td>
<td></td>
</tr>
<tr>
<td>2 Spades</td>
<td>1 Wheel</td>
<td></td>
</tr>
<tr>
<td>1 Float</td>
<td>2 Equilibrators</td>
<td></td>
</tr>
<tr>
<td>Tools and Accessories</td>
<td>2 Equilibrators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tools and Accessories</td>
<td></td>
</tr>
</tbody>
</table>

#### C. Two 155mm Howitzers and Carriages can be loaded successfully in two C-47 Airplanes and one B-17 Airplane.

<table>
<thead>
<tr>
<th>C-47 (Test 16C)</th>
<th>B-17 (Test 16E)</th>
<th>C-47 (Test 16C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Top and Bottom Carriage</td>
<td>2 155mm Howitzer Tubes (mounted on the external bomb racks)</td>
<td>1 Top and Bottom Carriage</td>
</tr>
<tr>
<td>2 Trails</td>
<td>2 Trails</td>
<td></td>
</tr>
<tr>
<td>2 Equilibrators</td>
<td>2 Equilibrators</td>
<td></td>
</tr>
<tr>
<td>1 Wheel</td>
<td>1 Wheel</td>
<td></td>
</tr>
<tr>
<td>2 Spades</td>
<td>2 Spades</td>
<td></td>
</tr>
<tr>
<td>1 Float</td>
<td>1 Float</td>
<td></td>
</tr>
<tr>
<td>Tools and Accessories</td>
<td>1 Recoil Mechanism and 1 Wheel in the right bomb bay</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### D. The 4.5 inch Gun can be loaded successfully in place of the 155mm Howitzer in the C-47, B-17 and B-24 Airplanes. The carriages and recoil mechanisms for both cannon are identical.

#### E. The details of the above loadings are recorded in Test Nos. 16A, 16B, 16C, 16D, and 16E.
TEST NO. 16A

INSTALLATION OF THE 155 mm HOWITZER, M1, WITH TRAILS AND WHEELS
IN C-47 AIRPLANES.

A. One complete 155 mm Howitzer, M1, consisting of the tube, breach ring, and breach block assembly were installed in a C-47 airplane along with the 155 mm howitzer carrying trails and wheels. Flooring was first laid in the plane using 3" x 10" planks 16' long. After the tube was placed in the doorway of the plane by a ten-ton wrecker, it was pried into the center of the plane. A sixteen foot plank, 3" x 10", was eased 30" down on each side enough to allow the 30" length to go into the breech end of the cannon. In the other end of the plank, a hole was drilled to allow a rod to be inserted, making a lunette to be utilized in lifting the board with a wrecker, which in turn lifted the breech end of the tube. This allowed the tube to be pushed to the front of the plane by swiveling the boom of the wrecker and guiding the front end of the tube with bars. The tube was blocked in all four directions as shown in A.P.C. Photograph No. 99741. The trails were next loaded as follows with the same procedure used for each. The trail was placed into "D" compartment by means of the wrecker with one chain around the C. of G. of the tube and the heavy end of the trail toward the front end of the airplane. There was sufficient space for the trails to be laid on their sides between the tube and the sides of the airplane. The trail was pulled into position by means of a block and tackle anchored to eye bolts of "C" and "E" compartments and guided with crowbars. The trail was blocked into position as shown in A.P.C. Photograph No. 99741. The wheels were loaded into "G" compartment by means of the wrecker. The wheels were lifted to a vertical position by four men, and rolled into compartment "E" and "F" respectively, where they were lowered to a horizontal position and lashed down. The wheels were first placed in "D" compartment as shown in A.P.C. Photograph No. 99741, but this distribution of weight placed the C. of G. beyond acceptable limits. Therefore, the wheels were shifted to "E" and "F" compartments, as illustrated in Loading Diagram 16.

B. To remove the material from the plane, a wooden ramp 4 ft. high, 10 ft. wide and 13 ft. long, extending approximately 5 ft. horizontally from the loading door, then sloping to the ground, was assembled and placed at the doors. The wheels were then rolled down the ramp and onto a bomb dolly, where they were laid flat. Four men were required to do the job. The trail on the right hand side was shifted out of the plane by means of crowbars and ropes. Ropes were fastened to the forward end of the trails to act as guides and also to pull. Planking was placed under the trails to prevent damage to the floor of the plane. The trail was pried and pulled down the ramp onto a 2" x 12" plank extending from the ramp to the bomb dolly. The tube, which was in the center of the plane, was next removed. A rope was fastened around the breach ring and tied to a block and tackle which was anchored to a 6x6 truck. Four men were required to pull on the block and tackle, while two men guided the tube. A rope was attached to the muzzle and as a safety precaution. The truck was then parked parallel to the plane to get a straight pull to bring the tube out of the plane. Planking was also kept under the tube to protect the floor. The tube was first pulled out of the plane a distance of approximately 3 feet. The truck was then moved to face the door of the plane. The tube was guided down the ramp with crowbars so that it would not slide off the ramp. A rubber rope was used on the tube as a safety precaution. A 2" x 12" plank was placed between the ramp and the bomb dolly and the tube slid upon the bomb dolly. The left trail, which was all that was left in the plane, was brought out in the same manner as the right trail.
C. Material Used:
1. 90 - 16 penny nails.
2. 50 ft. 1/2" Manila rope (for lashing).
3. 3 - 8" x 8" timber, 13' long.
4. 1 double sheave (6" block).
5. 1 single sheave (6" block).
7. 3 - 5 ft. crobbers.
8. 9 Planks 3" x 10" x 16' long.
9. 16 Blocks - 2" x 6" x 12".
10. 30 Blocks - 2" x 4" x 6".
11. 2 Planks - 2" x 4" x 6".
12. 2 Blocks - 6" x 6" x 1'.
13. Tools used:
   a. 1 Claw Hammer.
   b. 1 Crosscut Saw.
   c. 1 Large Dolly.
D. Weights:
   Tube .......................................................... 3825 lbs.
   2 Wheels (complete with tire and tube) at
      650 lbs. each ............................................. 1300 lbs.
   Left Trail Assembly - 950 lbs.) ................................ 950 lbs.
   Right Trail Assembly - 950 lbs.) ................................ 950 lbs.
   Total ......... 7025 lbs.
E. Time (estimated)
   To disassemble: 5 hours
   To load: 3 hours
   To unload: 2 hours
   To reassemble: 7 hours
F. The number of soldiers that may be carried in addition to the crew members: 0
G. A.P.Q. Photograph Nos. 55816, 99859, 99739, 99741 thru 43 inclusive.
Cargo Weight = 7025 lbs.

Wheels should be moved from "D" Compartment to "E" and "F" Compartments for C. of G. to be in limits. After this change C. of G. will be 20.4 index units.
INSTALLATION OF THE 155-MM HOWITZER CARRIAGE, ML-(LESS TRAILS AND WHEELS) IN C-47 AIRPLANE

A. The 155-mm Howitzer, Carriage, ML, less the trails and wheels, was installed in the C-47 Airplane together with all tools and accessories. The various units were hoisted aboard using a 4-Ton wrecker and were placed as shown in floor plan 16 B. The top and bottom carriage unit, the most bulky, was placed first. It was skidded forward aided by rollers and a block and fall fastened to the central large floor eyebolt near the door to the radio room. All units were thoroughly lashed to the floor and to the ship side rails using 1" rope. This lashing is shown in A.P.O. Photographs Nos. 99775 Right and 99776.

B. Removal.
The units were removed in reverse order. A.P.O. Photo 99801 Left shows the removal of the recoil mechanism. The heavy items were hoisted out of the rear door using a 4 x 4 "A" frame hoist mounted on the front of a 3/4 Ton 4 x 4 (Dodge) weapons carrier.

C. Material used for installation.
Sufficient 2 x 8 timbers to cover the entire cargo space timbered lengthwise and in addition twenty (20) 2 x 8 timbers placed crosswise. About 1,000 lbs. of timber were used.

D. Weights.

<table>
<thead>
<tr>
<th>Item</th>
<th>Wt. (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top and Bottom Carriage</td>
<td>1850</td>
</tr>
<tr>
<td>2 Equibrators, 250# each</td>
<td>500</td>
</tr>
<tr>
<td>2 Spades</td>
<td>368</td>
</tr>
<tr>
<td>Recoil Mechanism</td>
<td>1582</td>
</tr>
<tr>
<td>Tools and Accessories</td>
<td>576</td>
</tr>
<tr>
<td>NET LOAD</td>
<td>5876</td>
</tr>
<tr>
<td>Timber</td>
<td>1000</td>
</tr>
<tr>
<td>GROSS LOAD</td>
<td>5876</td>
</tr>
</tbody>
</table>

E. Time to Disassemble.............. 5 hours
F. Time to Load........................ 3 hours
G. Time to unload..................... 2 hours
H. Time to reassemble............... 7 hours
I. Number of soldiers as passengers - None.
Two spades - 368 lb
Top & Bottom - 1850 lb Cariage
Two Equillibrators - 500 lb
Loading tray - 50 lb
Two Tarpaullins - 150 lb
Recoil Mechanism - 1532 lb

Weight
Planking - 1000 lb

C, o. = 39 Index Units
Cargo Wt. = 4830 lbs.

C = 47
155 mm Howitzer

TEST NO. 168
**RESTRICTED**

**TEST NO. 163**

**INSTALLATION OF THE 155 MM HOITIZER CARRIAGE, ML (LESS RECOIL MECHANISM AND ACCESSORIES) IN C-47 AIRPLANE**

A. The 155 mm Howitzer Carriage, ML, less the recoil mechanism and one wheel, was installed in the C-47 Airplane together with all tools and accessories and in addition a heavy pipe tripod to be used in assembly operations. The various units were hoisted aboard using a 1-ton winch and were placed as shown in floor plan 16C. The top and bottom carriage unit, the most bulky, was placed first. It was skidded forward aided by rollers and a block and fall fastened to the central large floor eyebolt near the door to the radio room. It is necessary to block under the hubs of the carriage to distribute the concentrated load sufficiently over the floor. The trails were similarly skidded aided by the block and fall. All of these units were thoroughly lashed to the floor and to the ship side rails using 1" rope. This lashing is shown in A.P.G. Photographs Nos. 97792 and 97791 (right side) showing this lashing. The remaining units were hoisted aboard and placed as shown in the floor diagram and securely lashed. The weight of the trail units was distributed by placing 2 x 8 timbers underneath them, and blocking to carry the weight. The tool chests were spaced above and lashed to the equilibrators at the forward left corner of the cargo space. The large pipe lifting tripod was lashed, two members on the right resting on and lashed to the trail and the spades, and the third member on the left side resting on and lashed to the tool chests and the trail. The smaller items were placed as shown in the floor plan 16C and A.P.G. Photograph No. 97791 (right side) and securely lashed.

B. Removal

The units were removed in reverse order. The heavy items, wheel, trails, and the combined top and bottom carriages were hoisted out of the rear door using a 1 x 1 "A" frame hoist mounted on the front of a 3/4 ton 1 x 1 (Dodge) weapons carrier.

C. Material used for installation

Sufficient 2 x 8 timbers to cover the entire cargo space timbered lengthwise and in addition twenty (20) 2 x 8 timbers placed crosswise. About 1,000 lbs. of timber was used.

D. Weights

<table>
<thead>
<tr>
<th>Item</th>
<th>lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top and bottom carriage</td>
<td>1650</td>
</tr>
<tr>
<td>2 Equilibrators, 250 lbs. each</td>
<td>500</td>
</tr>
<tr>
<td>2 Spades</td>
<td>368</td>
</tr>
<tr>
<td>Right and left trails</td>
<td>1900</td>
</tr>
<tr>
<td>1 Wheel</td>
<td>650</td>
</tr>
<tr>
<td>2 Shields</td>
<td>165</td>
</tr>
<tr>
<td>Tools and Accessories</td>
<td>578</td>
</tr>
<tr>
<td>1 Lifting Tripod</td>
<td>600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net Load</th>
<th>6500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber</td>
<td>1000</td>
</tr>
<tr>
<td>Gross Load</td>
<td>7500</td>
</tr>
</tbody>
</table>

**RESTRICTED**
Test No. 16c (Cont'd)

E. Time to disassemble - 5 hours
F. Time to load - 5 hours
G. Time to unload - 2 hours
H. Time to reassemble - 7 hours
I. No. of soldiers (passengers) - None
TEST NO. 16C

INSTALLATION OF THE 155-MM HOWITZER CARRIAGE, M1 (Less Recoil Mechanism and one wheel) in C-47 Airplane

Cargo Weight . . . . . . 6800 lbs.
Planking . . . . . . . . . . 1000 lbs.
Gross Wt. 7500 lbs.
C.G. Location - 48.8 Index Units

NOTE - This floor plan supersedes A.P.G. Photographs (With regard to location of tool chests and three pipe tripod.)
TEST NO. 16 D

Part I

INSTALLATION OF RECOIL MECHANISM, M6, AND WHEEL OF CAR-RIAGE FOR 155MM EIGHTER CARRIAGE IN B-24 AIRPLANE

A. The recoil mechanism and wheel were installed in the right rear and right front bomb bays, respectively, of airplane, B-24. The recoil mechanism, placed on a small dolly, was wheeled under the plane and lifted into the bomb bay by means of the bomb hoisting winch. The elevating arc was toward the front of the plane. A 3/8" cable lashed the top cylinder (and complete unit) to the bomb rack frame in the center of the plane. Two wood planks wedged the ends tightly in the bay. Cables of 1/4" lashed the forward and rear ends of the recoil mechanism to the left center bomb rack frame. The wheel, placed flat on ground under the plane with hub to ground, was lifted by means of the bomb hoisting winch. Sufficient height could not be obtained so a small bomb dolly with blocks was used to raise the wheel seven inches higher and permitted closing of the bomb bay door. A 3/8" cable was fastened to the front top bomb shackle hook, passed through the center of the wheel, and anchored to the opposite top bomb shackle hook. The winch was released and the bottom lashed to the bottom of the bomb rack with a wire. See loading diagram 18. A.P.G. Photograph No. 99794 illustrates the installation.

B. Disassembly was accomplished in reverse order.

C. Material used:

1. Wood plank ........................................... 7' x 10" x 3"
2. Wood plank ........................................... 22" x 10" x 2"
3. Wood plank ........................................... 35" x 10" x 2"
4. 18 feet 1/4" cable.
5. 18 cable clamps.
6. 4 - 6" turnbuckles.
7. 15 feet 3/8" cable.
A. One complete assembled 155 IM Howitzer, M1, consisting of the tube, the breech ring, and the breechblock assembly, was installed on the external 4,000 lb. bomb rack of the B-24 Airplane. The howitzer was installed with the breech end forward with the breech turned clockwise 90° from the normal position when looking at the breech. The center of gravity of the howitzer was located midway between the supporting lugs on the bomb rack. The howitzer was raised to the bomb rack by means of a six wheel bomb dolly, M22. The howitzer was supported on the dolly by blocking, which raised it approximately three feet above the bed of the bomb dolly, as shown in A.P.G. Photograph No. 99857. It was placed on the dolly by means of an automobile wrecker. The howitzer was held in place in the bomb rack by means of two steel bands, 1/8" x 2" as per Sketch No. 1, appended. Each band was located directly in line with the bomb support hook and was fastened to the hook by a 5/8" bolt which passed through the open space between the lugs located at each end of the band. It was found necessary to cut down the top edge of each lug so that there was only 7/16" between it and the tops of the bolt holes. 2" parachute tape was wrapped twice around the howitzer tube and inserted under each band. A 3/8" cable, approximately 9 ft. long, including a clevis approximately 1 ft. long in the extended position, was placed around the breech and the lugs on the front band, which was attached to the bomb rack. Sideways was prevented by using the standard transverse braces on the bomb rack. Reference is made to A.P.G. Photograph No. 99858, which shows the final installation on the bomb rack.

B. In order to remove this equipment, the loading operation was reversed.

C. Material used for installation:

1. Two special 1/8" x 2" Steel bands, shown on the attached sketch.
2. Two 5/8" steel cap screws 3" long with 4 nuts and 4 flat washers.
3. One 3/8" steel cable which was approximately 9 ft. long overall.
4. One six wheel bomb dolly, M22
5. Wrenches:
   1 Box wrench, 15/16"
   1 Open and wrench 7/8" x 15/16"
   1 Open and wrench 13/16" x 3/4"
   1 Socket wrench 3/8"
6. 1 Pr. Fliers
7. 1 8" Screwdriver
8. Blocking as shown in A.P.G. Photograph, which is referred to in Paragraph A.
9. Two connected straps are necessary as shown in Sketch No. 2 appended.
## PART III

**Weights:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Recoil Mechanism</td>
<td>1580</td>
</tr>
<tr>
<td>2. Wheel</td>
<td>650</td>
</tr>
<tr>
<td>3. Tube</td>
<td>3825</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6055</td>
</tr>
<tr>
<td>4. Timber, bands, and cable</td>
<td>120</td>
</tr>
<tr>
<td><strong>One unit</strong></td>
<td>6175</td>
</tr>
<tr>
<td><strong>Two units, Gross Load</strong></td>
<td>12350</td>
</tr>
</tbody>
</table>

*Time to load* - 4 hours

*Time to unload* - 1-1/2 hours.

Number of soldiers which may be carried in addition to crew - 6.
Wheel Wt. - 650 lbs.

Recoil Mechanism, M6
1580 lbs. total

Wood Plank 3" X 10" X 7' - 100 lbs. for each side of bay

155 Howitzer Recoil Mechanism and Wheel in B-24 and Tubes

C. G. = 60.0 Index Units

Cargo Wt. = 12,350 lbs.

B-24D,E,G,H,J
PB4Y-1

Note: Two tubes can be carried in the external bomb racks in addition to the load shown in the diagram.

One 155-mm Tube = 3825 lbs.
Bands & Cables
for one tube = 20 lbs.

TEST NO. 16 D
155mm Howitzer M1 Installation in External Bomb Rack on B24 Plane (Sketch 1)
TEST NO. 168

INSTALLATION OF 155 MM HOWITZER, M2, RECOIL MECHANISM AND WHEEL AND TIRE ASSEMBLY IN B-17 AIRPLANE

PART I

A. DETAILS OF LOADING.

Both recoil mechanism and wheel were loaded inside the right bomb bay. Refer to A.P.O. Photograph No. 99806. Identical loading is required for the left bomb bay. The wheel was raised as high as possible into the right bay using one bomb hoist and a 3/8" wire rope sling 22" long. The tire was secured to the outboard bomb shackle carrier by hooking the sling to the bomb shackle. The recoil mechanism was lifted to approximately 12" above the keel of plane with both bomb hoists. The recoil mechanism was put into the bomb bay with the elevation arc up and toward the nose of the plane. Extreme care must be used to insure that the ends of the recoil mechanism do not damage wiring, hydraulic lines and bomb-bay door closing mechanism. Three 1/4" x 4" x 4" timbers were placed beneath the Recoil Mechanism, spanning the bomb bay and resting on the outer truss of the ship's frame at one end and on blocks cut to fit the center truss (keel) at the other end. Refer to A.P.O. Photograph No. 99805. 2" x 4" blocking was nailed to the 1/2" x 4" timbers to prevent side motion. Care must be taken that no weight is supported by the howitzer tube cradle when installed in the plane or at any time during handling. 2" x 6" x 12" blocking was installed between the elevation arc and the center bomb shackle carrier. 2" x 6" and 1/2" x 4" blocking was placed at each end of the recoil mechanism to prevent fore and aft movement. Refer to Photograph No. 99805. Care must be taken to insure that this blocking bears on the main structural members of the plane. Three 3/8" wire rope slings with turnbuckles were placed around the counter-recoil cylinder and the keel of the plane and the turnbuckles were tightened to secure the load.

B. The unloading operation is reversed. After removing the wire rope slings and end blocking, the recoil mechanism was lifted with both bomb hoists, and the cross bracing beneath the recoil mechanism was removed. The recoil mechanism was lowered with both bomb hoists, taking care to clear the airplane accessories at each end of the bomb bay, and then removed from beneath the plane. Using one bomb hoist cable, the tire was raised and released from the bomb shackle, lowered to the ground, and rolled from under the plane.

C. Material used.

Wire rope:

1 piece - 3/8" diameter, 22" long (to secure wheel)
1 piece - 3/8" diameter, 3/4" long, with turnbuckle to secure recoil mechanism
1 piece - 3/8" diameter, 53" long, with turnbuckle to secure recoil mechanism
1 piece - 1/8" diameter, 69" long with turnbuckle to secure recoil mechanism

Lumber used to secure recoil mechanism:

- 1 piece 10" long (rear end block)
- 2" x 6"
  - 1 piece 6-3/4" long (front end block)
  - 1 piece 12" long (side block)
- 2" x 11/2"
  - 3 pieces 1/8" long (under recoil mechanism)
  - 1 piece 10" long (rear end block)

Three blocks, shown in attached sketch, were required to provide supports for the 2" x 4" timbers under the recoil mechanism. No additional rigging was required.

**INSTALLATION OF 155 MM HOWITZER, ML, ON EXTERNAL BOMB RACK OF B-17 AIRPLANE**

**PART II**

A. One complete assembled 155-mm Howitzer, ML, consisting of the tube, breech ring, and breech block assembly, was installed on the external 4000 lb. bomb rack in a B-17 Airplane. The howitzer was installed with the breech end forward and with the breech in an upright position. The howitzer was raised by means of a six wheel bomb dolly, M22. It was lashed in place by means of three 3/8" steel cables each approximately thirteen feet long including a clevis which was approximately one foot long in the extended position. One loop of a cable was placed around the breech and front bomb beam support and the second loop was placed around the tube and bomb rack beam. The other two cables were placed at approximately the same location as the two hooks on the bomb racks. Each cable was wrapped completely around the tube once with two additional wraps around the tube and bomb rack beam. Light metal sheeting was placed over the sharp upper corners of the beam to protect the cables. Two 2" by 4" blocks were placed between the beam and tube. Each block was cut to the shape of the tube on one side with the flat side against the beam. Two blocks were placed underneath the breech cable one resting on the beam and the other resting between the cable and the beam's front support. Reference is made to A.P.G. Photograph No. 99786 which show the howitzer installed on the bomb rack. The center of
gravity of the howitzer was approximately 1/2" to the rear of the mid point between the two bomb support hooks.

B. In order to remove this equipment, the loading operation was reversed.

C. Material used for installation:
   1. Three 3/8" cables each approximately thirteen feet long.
   2. Two 2" by 4" wooden blocks approximately 18" long with one side cut the same arc as the diameter of the tube.
   3. One 2" x 4" block approximately 6" long and one 1" x 4" block approximately 18" long.
   4. Three pieces of sheet iron 8" wide and one foot long.
   5. Additional blocking was placed on the bomb dolly to support the howitzer.

PART III

Weights: Lbs.

<table>
<thead>
<tr>
<th>Description</th>
<th>Lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel and Tire</td>
<td>650</td>
</tr>
<tr>
<td>Recoil Mechanism</td>
<td>1580</td>
</tr>
<tr>
<td><strong>Total interior load</strong></td>
<td><strong>2230</strong></td>
</tr>
<tr>
<td>Tube</td>
<td>3825</td>
</tr>
<tr>
<td><strong>Total weight per side of plane</strong></td>
<td><strong>6055</strong></td>
</tr>
<tr>
<td><strong>Total Gross Weight</strong></td>
<td><strong>12150</strong></td>
</tr>
</tbody>
</table>

Time to load = 4 hours

Time to unload = 1 1/2 hours

Number of soldiers which may be carried in addition to crew = ten.
BLOCKS FOR INSTALLATION OF 155 MM HOWITZER RECOIL MECHANISM IN B-17 AIRPLANE

ALL BLOCKS 2" THICKNESS
RESTRICTED

TEST NO. 25

INSTALLATION OF 4.2" MORTAR AND AMMUNITION IN C-47 AIRPLANES

A. Two complete 4.2" Mortars (disassembled into crated components, namely: barrel, standard, and base plate) were installed in the plane together with two sights, M2, and 144 complete rounds in 72 boxes. The complete loading was accomplished manually. Two rows (two boxes high) of ammunition boxes were placed in Compartment E on each side of the plane with the long axis of the boxes parallel with the longitudinal axis of the plane. Additional boxes were placed in the center with the long axis transverse to the longitudinal axis of the plane. The rear of the ammunition 2" x 10" planks were placed on the floor to support the base plates, which were securely lashed to the planking. The standards were fastened on top of the base plates and the barrels were placed parallel to the longitudinal axis of the plane and directly behind the base plates. Diagram No. 25 shows the floor plan for this loading arrangement. Reference is made to appended A.P.G. Photograph No. 93754A. This photograph shows the 4.2" mortars and ammunition installed in the plane.

B. In order to remove this equipment from the plane each unit is carried out manually in reverse order of loading.

C. Material used for installation.

1. Four pieces of planking 2" x 10" x 6'.
3. Additional rigging. 3/4" rope 200' long to lash ammunition and mortars.

D. Weights:

<table>
<thead>
<tr>
<th>Item</th>
<th>Lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Barrels</td>
<td>200</td>
</tr>
<tr>
<td>2 Base plates</td>
<td>300</td>
</tr>
<tr>
<td>2 Standards</td>
<td>100</td>
</tr>
<tr>
<td>2 Sights, M2 and accessories</td>
<td>40</td>
</tr>
<tr>
<td>72 Boxes of ammunition</td>
<td>4824</td>
</tr>
<tr>
<td>Lumber</td>
<td>130</td>
</tr>
<tr>
<td><strong>Total Weight</strong></td>
<td>5800</td>
</tr>
</tbody>
</table>

E. Time to disassemble - 10 minutes.
F. Time to load - 1 hour.
G. Time to unload - 30 minutes.
H. Time to reassemble - 10 minutes.
J. Number of soldiers which may be carried in addition to crew - 3.

RESTRICTED
Stacking of Ammunition

Center row piled crossways two boxes high
Two rows on each side of center row piled
lengthways with plane, two boxes high.

<table>
<thead>
<tr>
<th>C-47</th>
<th>Complete load - 5600 #</th>
</tr>
</thead>
<tbody>
<tr>
<td>R4D-1, a-5</td>
<td>C. of G. - 16.5 index units</td>
</tr>
</tbody>
</table>

TEST NO. 25
TEST NO. 26

INSTALLATION OF 4.2 INCH MORTARS AND AMMUNITION IN B-17 G AIRPLANE

A. A floor was laid in bomb bay. This floor was constructed by first laying 5 timbers 2" x 8" x 3'0" perpendicular to the longitudinal axis of the plane, with the outer ends of the timber resting on the outer bottom girder. The inner ends rested on blocks, 2" x 8" x .9", placed on the center girder. After the five cross-timbers were in position, six 2 x 6 inch timbers, 7 feet long, were laid equidistantly apart on the five cross-timbers. The floor was then nailed together with 16 penny nails. Two complete 4.2 inch Mortars (disassembled into barrel, base plate and standard) together with Sights, M4, accessories and 100 rounds of ammunition in two round boxes were manually loaded into the bomb bay in the following manner.

1. The fifty boxes of ammunition were loaded and blocked.
2. The component parts of the mortars, sights and accessories were then stacked on top of the ammunition in the most convenient manner.
3. The load was then securely lashed together with ropes. See loading diagram 26. A.P.O. Photograph No. 99779 illustrates the complete installation.

The loading was accomplished in one bomb bay only for the purpose of this test. A similar procedure would be carried out to load the other bomb bay.

B. Removal of this load was carried out manually after first unlashing the ropes and removing the blocking.

C. Material used for installation.
1. Forty-four feet of 2 x 8 inch timbers.
2. Eighty feet of 2 x 6 inch timbers.
3. Fifty 16 penny nails.

D. Weights.

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of mortar (two)</td>
<td>610</td>
</tr>
<tr>
<td>Weight of ammunition (50 boxes)</td>
<td>3380</td>
</tr>
<tr>
<td>Weight of floor</td>
<td>200</td>
</tr>
<tr>
<td>Weight of accessories</td>
<td>20</td>
</tr>
</tbody>
</table>

Total weight in one bomb bay ....... 4210
Total weight of load ............... 8420

RESTRICTED
E. Operational time.

1. Disassemble mortar - 10 minutes.
2. Loading - 2 hours.
3. Unloading - 1 hour.
4. Reassemble mortar - 10 minutes.

F. Number of soldiers which may be carried in addition to crew - 26.
Wooden floor installed in bottom of bombbay

Stack chemical mortar 4.2" and ammunition on floor (secure firmly)

Capacity - 100 boxes at 67.5 lb. ea.

Weight of mortar (two) - - - - - 610
Weight of ammunition (50 boxes) - 3380
Weight of floor -- -- -- -- -- -- 200
Weight of accessories -- -- -- -- 20
Total weight in one bomb bay - 4210

Total weight of load -- -- - 8420

C.G. = 12.5 index units

TEST NO. 26
INSTALLATION OF 4.2 INCH CHEMICAL MORTARS IN B-24 AIRPLANES

A. Eight complete mortars, disassembled, and crated in component parts - namely, tube, standard, and base plate, were installed in this airplane together with a total of 208 rounds of ammunition (in 104 boxes) and eight sights in case, 12. Two lengths of 2" by 10" plank were laid on the catwalk to which was nailed an inclined floor of 2" by 10" planks. The joists of this flooring ran transversely with the longitudinal axis of the plane and were beveled on the outer end which rested on the spars which accommodate the cables. Lengths of 2" by 10" timbers were placed vertically, approximately one foot on centers, on each side of the catwalk to permit free passage of personnel. These timbers were nailed to the joists of the flooring and were supported by the transoms at the top. One plank was omitted in each section of the bomb bay to permit the entry of the material and ammunition. The base plates were loaded first directly on the platform and the barrels were placed on top of them. The standards were placed on top of the barrels, with the accessories alongside. The ammunition in the boxes was then stowed on the top of disassembled parts of the mortars with a total of 26 boxes in each section. All material and ammunition were lashed to the uprights, bomb racks, and floor boards progressively during the loading operations (due to the limited amount of space in which there was to work) to make the load secure during transit. Diagram No. 3 shows the floor plan of this loading arrangement. Reference is made to appended A.P.Q. Photographs Nos. 91934*- and 99745. These photographs show the mortar in firing position and the load complete in one section of the bomb bay, respectively. The platform structure and uprights are shown in A.P.Q. Photograph No. 99744.

B. In removing this equipment from the plane, the loading operation was reversed.

C. Material used for installation

1. Plane rigging - Two lengths of 1/2" rope fifty feet long.

2. Additional rigging - 1/2" rope three hundred feet long and 1/4" rope six hundred feet long for lashing material and ammunition.

D. Weights

104 - boxes of 4.2" mortar complete rounds .......................... 6654 lbs.
3 - 4.2" mortar barrels total of .................................. 800 lbs.
3 - base plates, 52 .................................................. 1200 lbs.
3 - standards, VI ...................................................... 426 lbs.
8 - sights in case, 12 .................................................. 16 lbs.
Lumber - Estimated weight ............................................ 700 lbs.

Total weight 10,034 lbs.

* See Ld # 25
E. In addition to plane load and crew (see assumptions) a maximum of 15 men can be carried.

F. Time required for:

- Disassembly: 10 min.
- Loading: 1.5 hrs.
- Unloading: 0.5 hrs.
- Reassembly: 10 min.
A. One hundred and five complete rounds, crated for overseas shipment were manually loaded into the plane in 35 crates. Three crates were nested on each side of center aisle with the long axis parallel to the longitudinal axis of the plane, with the forward ends of the crates butting against the wall of Compartment J. Another row was placed just to the rear of the first row and to the rear of the second row, the crates were placed transversely in the cabin. The arrangement of the crates in Compartment S was similar to that used in Compartment J. Three crates were placed transversely in the cabin in Compartment T, on each side of a center aisle with one crate placed transversely in the center aisle. All crates were lashed to the seat and center aisle crossbars. Diagram No. 28 shows the floor plan for this loading arrangement. Reference is made to A.I.S.C. Photograph No. 97793 which shows the final installation in the plane.

B. In order to remove this ammunition from the plane, the loading operation is reversed.

C. Material used for installation

1. Two pieces of planking 2" x 4" x 4 feet long and one piece 2" x 6" x 1 foot long.

2. Plane rigging; normal lashings issued with the plane.

3. No additional rigging was used.

D. Weights

Thirty-five crates of 105 mm howitzer complete rounds 6100 lbs.

Total weight 6100 lbs.

E. Time for loading - 1.5 hours

Time for unloading - .75 hours

F. No additional men who can be carried - 2.
A. Assembly in Plane.

To give support to cross beams as a platform, 2" x 6" boards were cut to fit between the girders below the bomb bay catwalk, and 2" x 6" boards, the length of the bay, were bolted to these on each side. Five 2" x 12" boards were nailed to these boards and rested at the other end upon girders at the side of the bay. Across the 2" x 12", 2" x 6" boards were placed to make a platform. 2" x 4" boards the length of the bay were wedged against girders at the ends and the bomb racks at the side and were nailed to 2" x 6" uprights which had been nailed to the platform. The uprights were also held in place by boards nailed crosswise between two of them, thus forming the frame of a box. Fourteen boxes with three complete rounds each were placed lengthwise in two stacks. The rear stack was two tiers of four boxes each; the front stack, two tiers of three boxes each. The boxes were lashed with 1/2" rope running from the side bomb rack to the ends of the catwalk. See loading diagram No. 29. A.P.G. Photograph Nos. 99755, 99756, 99783, 99784 illustrate this installation.

B. Removal from Plane.

The ropes having been removed, the boxes were removed over the supporting frame by two men on the ammunition and three men on the ground.

C. Material used for Installation:

1. 5 boards 2" x 12" x 48".
2. 2 boards 2" x 6" x 99".
3. 4 boards 2" x 6" x 36".
4. 4 boards 2" x 6" x 90".
5. Additional boards 2" x 4" - 8' total.
6. Additional boards 2" x 6" - 10' total.
7. 8 dozen nails.
8. 10 each: nuts and bolts, 7" long.
9. 25 feet rope (1/2" min.).

D. Weights

1. 28 Boxes Ammunition, 105 mm, H.E., M1 (3 rds.) ........ 4316 lbs.
2. Weight of lumber ........................................... 500 lbs.

Total .................................................. 4816 lbs.

E. Number of soldiers carried in addition to crew: and above load - 15

F. Time to load - 1-3/4 hrs. (including mfgr. of platform)

G. Time to unload - 30 minutes.
B-17G

Loading 105 mm Ammunition in B-17 G Bomber

Center of Gravity - 18.3 Index Units
Cargo Weight - 5316 lbs.

TEST NO. 29
INSTALLATION OF AMMUNITION FOR 105 MM Howitzer, M3 in B-24 AIRCRAFT

A. A total of 24 bundles, which consisted of 3 complete rounds, crated for overseas shipment, were placed in the front section, Compartment D, and the same number of bundles were placed in the rear section, Compartment E. The platform arrangement was identical to that used for loading the 4.2" chemical mortar. One floor board and one upright support were removed on either side directly to the rear of the bomb racks in the front section to permit the loading of the ammunition. It was not necessary to remove any of the planking for loading the rear section as the ammunition could be loaded into the compartment between the floor boards. It was necessary to load the forward portion of each section first to facilitate handling. The crated ammunition was securely lashed to the floor and the uprights to prevent any movement during transit. Diagram No. 30 shows floor plan for this loading arrangement. Reference is made to appended A.P.3. Photographs - Nos. 99763, 99764. These photographs show the crated ammunition and the final installation in the plane.

2. In order to remove the ammunition from the plane, the loading operation was reversed.

C. Material Used for Installation.
   1. Plane rigging. Two lengths of 1/2" rope 50' long.
   2. Additional rigging. 1/4" rope 500' long.

D. Weights, Lbs.
   45 boxes of 105 mm Howitzer complete rounds ...................... 3256
   3 boxes of fuses .......................................... 240
   Lumber estimated ........................................... 1304
   Total Weight ................................................ 10,000

E. Disassembly time - none
   Time to load - 4 hours
   Time to unload - 1 hour
   Reassembly time - none

Note:
In addition to assumed crew and cargo load, 20 soldiers may be carried.

* - See test No. 29
7 boxes per pile @ 172 lb.

Use same loading platform as for 4.2 Mortar & Ammunition.

Weights
Comp. "D" - 5000 with Platform
Comp. "E" - 5000 with Platform
Total Cargo - 10000
C. of G. - 67.0 Index Units

B-24D, E, G, H, & J
PB4Y-1

TEST NO. 30
These tests pertain to the loading of ammunition for Howitzer, 105 mm, M2, in the C-47, B-17, and B-24 airplanes respectively. Inasmuch as the difference in this ammunition and that for the Howitzer, 105 mm, M3, is so little as to be negligible, the same type of loading is used. The tests for the loading of the ammunition for the Howitzer, 105 mm, M3, is covered in Tests No. 28, 29 and 30; and, therefore, is not repeated.
A. 144 complete rounds in 36 boxes were installed in the plane with the long axis of the boxes parallel to the longitudinal axis of the plane. Complete loading of the ammunition was a manual operation. Three rows, two boxes deep, were placed on each side of a 9" center aisle with the forward edge of the boxes behind the second side eye hook. Two additional rows were placed directly behind the first row. 2" x 4" timbers were placed between the outside edges of the boxes and the fuselage and wedges were used to prevent any lateral movements. The center eye hooks should remain accessible. Diagram No. 34 shows the floor plan for this loading arrangement. Reference is made to A.F.G. Photograph No. 99767 which shows the completed installation.

B. In order to remove this ammunition from the plane the rear boxes were unloaded first.

C. Material used for installation.
1. Plane rigging. None.
2. Additional rigging. 1/2" rope, 100' long.

D. Weights.

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 boxes of 3&quot; complete rounds</td>
<td>5538</td>
</tr>
<tr>
<td>Lumber</td>
<td>75</td>
</tr>
<tr>
<td>Total</td>
<td>5613</td>
</tr>
</tbody>
</table>

E. Disassembly time = none.
Time to load = 1 1/2 hours.
Time to unload = 1/2 hour.
Reassembly time = none.

F. Number of soldiers which may be carried in addition to assumed crew and cargo load is 2.
A. With the bomb bay doors open, a floor was built in the bomb bays on each side of the airplane. Five timbers 2" x 8" x 36" were cut and placed from the outer girder to the middle of the ship. Four short 2" x 8" timbers about 9" long were placed on the middle girder to support the cross members of the flooring. Timbers 2" x 6" x 7' long were laid over the top of longitudinal cross members in order to obtain floor strength. Ammunition was manually loaded into the bomb bay, and the boxes were placed longitudinally in the ship. The boxes were pushed together and wedges were pushed between the sides and edges of the ship and the boxes. By means of lashing, the ammunition was secured in place. When a floor was installed on both sides, it was necessary to load and unload one side through the rear door.

B. Removal is the reverse of the loading procedure.

C. Materials used:

- 30' of 2" x 8"
- 30' of 2" x 6"
- 20' of 2" x 4"
- 20 - 16 penny nails
- Hammer and saw.

D. Weights:

- 36 boxes ammunition - 158 lb./box = 5688
- Lumber = 600

Total = 6288

E. Time to load - 2 hours.

F. Time to unload - 1 hour.

G. Soldiers which can be carried in addition to regular crew - 34.
Temporary wooden floor built into bomb bay.

Boxes of 3\textsuperscript{rd} Ammunition stacked longitudinally with the length of the ship.
18 boxes could be stacked per side in bomb bay.

- 1 box of four weighs - 158 lb.
- Complete Load = 5688 lb.
- Lumber = 600 lb.
- Total = 6288 lb.

C. G. = 26.9 index units
Cargo Wt. = 6288

B-17G

TEST NO. 35

RESTRICTED
INSTALLATION OF 3" A.T. GUN AMMUNITION IN THE 9-24 AIRPLANE.

A. One hundred twenty-eight (128) complete rounds of 3" A.T. Gun ammunition were installed in this airplane, four (4) rounds of ammunition per box. All ammunition was to be installed in the bomb bays. Six crosspieces of 2" x 10" lumber were placed in each section and spaced equidistant along the floor of the bomb bay. A 2" x 10" was laid along the walkway so that the crosspieces could be spiked to it to prevent displacement. As the walkway is lower than the structural rest for the opposite end of the crosspiece, the flooring sloped toward the center of the ship at an angle of approximately 30 degrees. Two vertical uprights and the bomb racks prevent the load from sliding to the center. It was then possible to load these sections of bomb bay before placing the final six crosspieces for the fourth section. Eight crates can easily be placed in the first 3 bay sections. In order to get the same loading in the fourth section, five crates should be placed while one of the cross members is still out. Three crates can be placed on end in the center of the walkway and the final 2" x 10" fitted in position. The remaining three crates are then manhandled into their respective positions. Great care should be taken at all times to prevent damage to control cables, brackets, and fittings. When the final position of the load is obtained, it should be lashed securely in place, with 1/4" rope, reference loading diagram No. 35, A.F.I. Photograph No. 99750 (right view). This photograph is included in Part 37.

B. Material used:

1. Twenty-four pieces of flooring 2" x 10" x 319"
2. Eight vertical uprights 2" x 10" x 413/4"
3. Approximately 200' of 1/4" rope

D. Weights:

1. 32 cases ammunition 5056 lbs.
2. Weight of lumber 600 lbs.

E. Time to load: 2 hours

F. Time to unload: 1 hour

G. Number of soldiers which may be carried in addition to crew and above load 15.
Weights:
32 cases ammunition = 5056 lbs.
Weight of lumber = 600 lbs.

3" A.T. Ammunition

B-24D,E,G,H & J
PB4Y-1

C. G. = 62.0 Index Units
Cargo Weight = 5056 lbs.

This is typical of four sections.
A. Eighty (80) projectiles, 100 fuzes, and 81 propelling charges, W7, packed for overseas shipment, were loaded into a C-47 transport in normal operations. The seats on either side were protected by the use of a 3/4" x 1" x 14' strip and the flooring by the use of 2" x 10" x 72" planks. The projectiles were placed on the floor planking with their longitudinal axes parallel to that of the plane, six on either side of the center aisle. Individual shell were separated by wood strips out to size and held in place by the weight of the shell except for the aisle strips which were nailed securely). 2" x 10" planks were placed with the 10" dimension against the base plates of the shell in order to prevent any rearward movement. 2" x 9" planks were laid over the top of the shell and lashed down to the center aisle eyebolt to prevent any upward movement of the shell. This process was repeated for three sections in compartment "D", comprising 36 shell. Six (6) propellant-powder crates (18 charges) were lashed, using seat and center aisle eyebolts on either side of the center aisle, with their longitudinal axes parallel to that of the plane. The same set up was repeated for Compartment "E", making a total of 72 shell and 72 propellant charges. The remaining eight shell were secured in a similar manner, four on a side of the aisle. The remaining 3 propellant crates were lashed to the rear of the shell. The four boxes of fuzes were lashed securely, using seat and center aisle eyebolts. Diagram No. 37 shows the floor plan for the loading arrangement. A.P.C. Photograph No. 97790 (left view) shows this installation in Compartment "D" in the plane.

B. The operation is reversed in order to remove the ammunition from the plane.

C. Materials used for installation:

<table>
<thead>
<tr>
<th>No. Pieces</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>2&quot; x 4&quot; x 72&quot;</td>
</tr>
<tr>
<td>10</td>
<td>2&quot; x 6&quot; x 72&quot;</td>
</tr>
<tr>
<td>10</td>
<td>2&quot; x 10&quot; x 72&quot;</td>
</tr>
<tr>
<td>44</td>
<td>4&quot; x 3/4&quot; x 22&quot;</td>
</tr>
<tr>
<td>4</td>
<td>1&quot; x 3/4&quot; x 14&quot;</td>
</tr>
</tbody>
</table>

Plane rigging is normal issue with plane. No additional rigging was used.

D. Weights:

<table>
<thead>
<tr>
<th>Ammunition</th>
<th>6158 lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber</td>
<td>250 lbs.</td>
</tr>
<tr>
<td><strong>TOTAL WEIGHT</strong></td>
<td><strong>6408 lbs.</strong></td>
</tr>
</tbody>
</table>

E. Time to load - 2 hours.

F. Time to unload - 1 - 1/4 hours.
Weights

Ammunition = 6047 lbs.

Primers and fuses = 111 lbs.

Lumber = 250 lbs.

C. G. = 39 Index Units

Cargo Wt. = 6408 lbs.

C = 47

Stowage of 4.5" Ammunition in C-47

RESTRICTED

TEST NO. 37
A. Assembly in place. (Platform identical to that used with 105 mm Ammunition). To give support to crossbeams as a platform, 2" x 6" boards were cut to fit between the girders below the catwalk, and 2" x 6" boards the length of the bay were bolted to these on both sides. Five 2" x 12" boards were nailed to these boards and rested at the other end upon girders at the side of the bay. Across the 2" x 12", 2" x 6" boards were placed to make a platform, 2" x 6" boards, slightly shorter than the length of the bay, were placed one upon the other on the inside faces of the bomb racks, forming the sides of a box, about 3 ft. high. 2" x 6" boards, cut to length, were nailed to the side boards in a similar position to form the sides of the box. 45 projectiles and 15 boxes of 3 powder charges were placed in one of the two bomb bays. 23 shells placed lengthwise, nose to tail, 6 wide, rear to front (last 4 placed crosswise) formed the first layer. The second layer was composed of 22 projectiles placed in the same manner. The top layers were composed of powder containers (3 charges in each), placed lengthwise in 5 rows of 3 each; 2, 1, and 2 in the third, fourth and fifth rows, respectively. The ammunition was then lashed to the box, platform, and girders with rope tied to the side bomb rack and the ends of the catwalk. See loading diagram No. 38. A.P.U. Photograph Nos. 997550 and 99855 illustrate this installation.

B. Removal from Plane. When the ammunition was unleashed, 2 men on the ammunition and 2 men on the ground were able to unload the ammunition.

C. Material used for Installation:

14 boards 2" x 6" x 90"  
14 boards 2" x 6" x 30"  
5 boards 2" x 12" x 48"  
2 boards 2" x 6" x 99"  
4 boards 2" x 6" x 36"  
4 boards 2" x 6" x 90"  
Odd boards 2" x 6" - 8 total  
Odd boards 2" x 6" - 10 total  
6 doz. nails  
25 ft. rope (1/2" min.)  
18 ea. bolts and nuts - 7" long.

D. Weights:

(Shell, H.E. ................................................................. 55 lbs.)  
(Box, Powder Charge .................................................. 52 lbs.)

90 Shells ................................................................. 4950 lbs.  
30 boxes, Powder Charge .............................................. 1500 lbs.  

Weight of Ammunition .............................................. 6450 lbs.  
- Weight of Lumber ................................................. 600 lbs.  

TOTAL WEIGHT ......................................................... 7110 lbs.

E. Number of soldiers carried in addition to crew: 31

F. Loading Time: 2 hours.

G. Unloading Time: 1 hour.
RESTRICTED

INSTALLATION OF 4.5 AMMUNITION

Box (2" x 3") with last layer of shells (3 rows of 4 + 1) (1 row of 4 + 1)

Beam

5 beams (2" x 12"

Fender Charges
3 rows, 5 boxes to a row

Top View Platform

Girder on side of nose bay

2" x 12" supports

Cross Section Ammunition

2" x 4" or 2" x 6" planks to distribute weight

B-17G

5 boxes fender

Shells

Girder beneath catwalk

Bolted planks

C.G. - 24.9 Index Units
Cargo Wt. - 7110

Test No. 36
A. One hundred seventy-six 4.5" gun projectiles, 50 cases of propellant, (3 lbs./case) and the necessary fuses were installed in this airplane. Four 2" x 4"'s, approximately 55" long, were lashed horizontally to the outer side of each bomb rack about 1" apart. Starting with the bottom 2" x 4", 11 projectiles were suspended across its entire length. 1/4". rope was used to fasten each projectile individually in place. As each row of 11 was completed, a rope was lashed around the entire row to prevent any swinging motion. Four 2" x 10"'s were slung from a structural member at the outer edge of the bomb bay to a 2" x 10" placed on the walkway. In the rear bomb bay, three of the 2" x 10" crosspieces were placed to the rear of the bomb rack and one crosspiece was placed forward. In the forward bay, the three crosspieces were placed ahead of each bomb rack in each bay section. After all the projectiles had been hung in place, a plank 2" x 10" x 72" was spiked longitudinally between the projectiles and the sides of the fuselage. In loading the three sections of the bomb bay, 19 cases (3 lbs./case) can easily be placed in each section. To facilitate loading the final section, one crosspiece should not be placed until several cases are in position. The crosspiece should then be placed and the remaining cases passed in from the center of the walkway. Two vertical uprights in each section prevent the load from shifting. Care should be taken to prevent damage to cables or fittings, reference loading diagram No. 32. A.F.C. Photographic No. 27365 illustrates this installation.

B. Removal of the load can be affected by reversing the loading procedure.

C. Material

1. Sixteen crosspieces, 2" x 10" x 56"
2. Four planks, 2" x 10" x 72"
3. Sixteen 2" x 4"'s, 55" in length:
4. Eight vertical uprights, 2" x 10" x 56"
5. 300' - 1/4" rope.

D. Weights

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>176 - 4.5&quot; projectile</td>
<td>2762 lbs.</td>
</tr>
<tr>
<td>60 - cases propellant</td>
<td>1320 lbs.</td>
</tr>
<tr>
<td>weight of liner</td>
<td>476 lbs.</td>
</tr>
<tr>
<td>Total weight</td>
<td>12,358 lbs.</td>
</tr>
</tbody>
</table>

E. Time to load - 4 hours

F. Time to unload - 2 hours

G. Number of soldiers which can be carried in addition to crew - 6.
1 - 2" x 10" Forward of Bomb Rack

- 1 - 2" x 10" Between Fuselage Side and Projectiles

- 3 - 2" x 10" Spaced to Rear of bomb Rack

Bomb Rack

11 - 4.5 Shells Lashed to Each 2" x 4" Member

4 - 2" x 4" x 5' 14-g. Spaced on 12" Centers

B-24D, E, G, H, & J
PB4Y-1

4.5" AMMUNITION

G.C. - 70 Index Units
Cargo Wt. - 12,888 lbs.
Wt. of Lumber - 470 lbs.

TYPICAL ELEVATION

RESTRICTED
INSTALLATION OF AMMUNITION FOR 155 MM HOWITZER, VI,
IN C-47 AIRPLANE

A. Fifty Projectiles, 27 - M4 Charges in nine bundles and 24 - M3 Charges in four bundles, crated for overseas shipment, fifty fuzes in two boxes, and one box of fifty primers were installed in the airplane. Two pieces of 1" x 10" x 18' of board were placed on edge parallel to the longitudinal axis of the plane along the seats with the forward end buttting against the D compartment wall. Two pieces of 2" x 6" x 73" planking were placed transversely on the floor one piece being located six inches from D compartment wall and an 18 inch space between planks. One piece of 2" x 6" x 73" planking was placed transversely with the flat side against the D compartment wall. Twenty shell separated by 1" x 1/4" x 2'2" boards were placed in two rows with the longitudinal axis parallel to the longitudinal axis of the plane. A free space was left in the center for the floor hook eye and a 2" x 6" x 6'1" plank was placed at the rear end of shell, forming a box frame and nailed together. Four pieces of 2" x 1/4" x 6'1" long were placed transversely across top of shell and lashed to center eyes in the floor of the plane. One bundle of propelling charge M3 was placed at each end of the planking and lashed securely to the sides and center with the centers of the planks being lashed to the aisle eye hook. Three cases of propellant, M4, were placed on each side of the cabin directly behind shell framework and lashed to center and side eye hooks. One plank 2" x 10" x 6'1" was placed on edge across cabin, with the flat side against the rear ends of the bundles of powder and lashed to forward, center and side eye hooks to prevent the bundles from slipping to the rear. The second section of framework was started 2'6" behind the bundles of powder utilizing the same type cribbing and frame as in the forward compartment. The M3 powder bundles were used to secure the ends of the top planks as in the first section. The third section was started 21 inches to the rear of the second section, utilizing the same type cribbing except that only a single row of shell were placed, and one box of fuzes, at each end of the planking, took the place of the M3 powder bundles as used in the other two sections. Three bundles of M4 propellant and one box of primers were placed 11" to the rear of third section of shell and in the center of the cabin and lashed securely to floor eye hooks.

B. Removal:

In order to remove ammunition from plane, the reverse procedure is applied.
C. Material used for installation

1. Plane rigging - Evans tie down equipment and lashings.

2. Additional rigging: 10 pounds of 8 penny nails, 2 pcs. 1" x 10" x 18", 8 pcs. 2" x 6" x 73", 5 pcs. 2" x 10" x 73", 10 pcs. 2" x 4" x 73", 50 pcs. 1" x 4" x 26" wedges from scrap wood.

D. Total Weights:

<table>
<thead>
<tr>
<th>Description</th>
<th>Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Projectiles</td>
<td>4800</td>
</tr>
<tr>
<td>9 Boxes M4 Powder Charges</td>
<td>711</td>
</tr>
<tr>
<td>4 boxes M3</td>
<td>300</td>
</tr>
<tr>
<td>2 boxes PDM51AL Fuzes</td>
<td>154</td>
</tr>
<tr>
<td>1 Box Primers</td>
<td>1.</td>
</tr>
<tr>
<td>Lumber</td>
<td>200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6166.</strong></td>
</tr>
</tbody>
</table>

E. Time to load - 2 hrs.

F. Time to unload - 1-1/2 hrs.

G. Soldiers which may be carried in addition to regular crew - 2
1 Case, 1/2, Powder on side holding down 4 - 2" X 4" top of shells. 8" had to side rings and center ring.

3 Cases of 1/2 powder on each side lashed to center floor and side rings. 1 box of fuses tied down on top with two 2" X 4" lashed to sides and center ring.

2" X 6" Planking

1" X 10" Planking along both sides.

3 boxes of 1/2 powder and 1 box of primers and lashed in center 11" behind third section.

10 shells in single row

2 Sections - 10 shells in each row - 2 rows = total 40 shells

"d" = 262.4 lbs.
"g" = 2150 lbs.
"p" = 1392 lbs.

1/2 Powder = 35-1/2" long.
1/4 Powder = 27-1/2" long

C. G. = 37 Index Units
Cargo Wt. = 6166 lbs.

Evans' Tie Down equipment used.

TEST NO. 40
A. Fifty-six shells, six bundles of propelling charge, 32, eight bundles of propelling charge, 32, two boxes of fifty fuses, two boxes of primers, and two accessory boxes were installed in the bomb bay of this plane. A box was constructed for one section of the bomb bay and assembled between the longitudinal strut and the fuselage, as shown in sketch which is appended. The complete loading was a manual operation of lifting all components through the open section of the bomb bay and placing in the box. When a similar box was installed in the other section of the bomb bay, it was necessary to load all components through the rear doorway and carry forward for placement in the box. The construction of the box for one section of the bomb bay is indicated in the sketch appended. The shell were placed transversely in the boxes in two layers with two 2" x 4" timbers 710" long placed between the layers. The bundles of charges were placed on top of the shell with one box of fuses and primers on top of the bundles. A.P.7. Photograph Nos. 99789 and 99808 which are appended, show the shell partially loaded into the boxes, and bundles installed respectively. Diagram No. 41 shows the floor plan for this loading.

B. Removal from plane. To remove the ammunition from the plane the loading operation is reversed.

C. Material used.

5 pieces 2" x 6" x 710" planking
5 pieces 2" x 8" x 210" planking
4 pieces 2" x 6" x 716" planking

4 pieces 2" x 6" x 213-1/2" planking
4 pieces 2" x 4" x 216" planking

Plane rigging - None
Additional rigging - None

D. Weights.

155 mm Howitzer Shell .................................................. 3376 lbs.
13 Propelling charges .................................................. 450 lbs.
124 Propelling charges .................................................. 632 lbs.
Fuses ................................................................. 154 lbs.
2 Accessory boxes ...................................................... 400 lbs.
Lumber ................................................................. 600 lbs.
Total ................................................................. 7512 lbs.
E. Time required to load - 4 hours
   Time required to unload - 2-1/2 hours
F. Number of men who can be transported in addition to the cargo - 20
TEST NO. 41

Box all 2\" x 2\" lumber

2.2\" x 4\" outside beam of bomb bay

2.2\" x 9\" bottom beam in center of bomb bay

C2 lumber fitted into center girder of bomb bay

Bomb hanger supports

7.1\"

27.5\"
Each Side
28 Shell, placed transversely = 688 lbs.
3 Bundles of M3 Charge = 225 lbs.
4 Bundles of M4 Charge = 316 lbs.
1 Box Fuses = 77 lbs.
1 Accessory Box = 200 lbs.
Total = 3506 lbs.

B-17G

C. G. = 14 Index Units
Cargo Wt. = 7612

TEST NO. 41

RESTRICTED
A. The same platform was used as for the 4.2" mortar. The ammunition was passed by hand through a hole formed by removing a plank of the platform at the bomb rack. The boxes of charges were piled on the platform before the projectiles were installed. Using parachute harness D rings, one 2" x 4" x 4' timber was lashed to each of the three top bomb shackles. Six (6) projectiles were suspended by the lifting ring in a cluster from each 2" x 4". The projectiles were lashed with 1/4" rope to each other and to the bomb rack. The boxes were also lashed with 1/4" rope to the uprights, floor boards, and to the bomb racks. The container of fuzes and boosters was also lashed in position. Loading is as shown by Diagram No. 42. Photograph Nos. 99761, 99757, 99755, 99779A, and 99767A show details of the completed installation.

CAUTION: The bottom row of projectiles must not be hung so low as to interfere with the opening and closing of the bomb bay doors.

B. The ammunition is removed in a manner opposite to installation.

C. Materials used for installation:
   1. Platform material as for 4.2" mortar.
   2. Six (6) 2" x 4" x 4' Timbers
   3. 500 ft. - 1/4" rope.

D. Weights:
   Shell ........................................... 95.1 lbs.
   Charge, Propelling, 24, per unit (6 charges per unit) ................ 75 lbs.
   Charge, Prop., 24, per unit (3 charges per unit) .................. 75 lbs.
   Fuses, P.D., 251A1 assembled w/21A1 Booster, per unit (25 per unit) ........... 77 lbs.
   Projectile, weight per bomb rack ...................... 1726 lbs.
   Propelling Weight per section, 24 .................. 225 lbs.
   Propelling Weight per section, 24 .................. 234 lbs.
   Weight of Fuzes .................................. 77 lbs.
   Weight of Flanking ................................ 500 lbs.

   TOTAL LOAD .................................... 7555 lbs.

REFERENCES

-87-
E. Time to load - 2 hours
Time to unload - 45 minutes.

F. Number of soldiers which may be carried in addition to crew and
above load - 15
Six projectiles suspended from 2 X 14 board in cluster formation (used 386 lbs. per section).
Six projectiles suspended from 2\" x 4\" board in cluster formation (used three 2\" x 4\""). Total of 18 rds. per section.

Weights:
- Projectile weight
  - Per Bomb Rack = 1726 lbs.
  - Propellant Weight, kg = 225 lbs.
  - Per section, kg = 234 lbs.
- Weight of fuses = 77 lbs.
- Planking = 500 lbs.

B-24D, E, G, H, & J
PB4Y-1

C. G. = 70 Index Units
Cargo Weight = 9556 lbs.

155 Ammunition for How., Ml.

TEST NO. 42

RESTRICTED
A. 1. Description: The weight and physical dimensions of this vehicle are such that loading and transporting it in the C-47 Cargo plane requires the chassis and body to be divided into two separate loads. This is accomplished by using the frame splicing kit developed by Office, Chief of Ordnance Detroit, and the Truck and Coach Division of General Motors Corporation. This kit is installed and the vehicle modified as shown in ARC Photographs 99194, 99195, 99196, 99197, 99203, 99207, 99210, 99212, 99215, 99219, 99220. The modified vehicle completely assembled is shown in ARC Photograph 99339 and the front and rear chassis sections ready for loading in Photograph 99342 and 99344 respectively. Note the one-wheel dolly supporting the rear end of the forward chassis section. Loading is facilitated by using a special wooden ramp as shown in Photograph 99355. This ramp is entirely demountable, and is a duplicate of the ramp used in the Pacific theater where the airborne modification of this vehicle was pioneered.

2. Disassembly: The disassembly procedure requires approximately one hour's time with a crew of 5 men.

3. Loading: The forward section of the chassis with a one-wheel dolly installed at the rear is driven up the ramp and into the cargo compartment of the plane under its own power. The rear chassis section is rolled into place manually. Both sections may be pulled into place by means of a snatch block and line, using a 1/4-ton truck as motive power. The remaining portion of each load can be manually loaded by a crew of four men. Diagram No. 49 (both load No. 1 and load No. 2) and Photographs 99352 and 99353 show the loading arrangement of each load. Estimated loading time with crew of six men: First load - 45 minutes, second load - 30 minutes.

B. 1. Unloading: Unloading is accomplished by first manually removing the body sections, pulleys, running boards and other miscellaneous equipment in each load. The chassis sections are then easily rolled back out of the plane and down the ramp. Estimated unloading time with crew of six men: First load - 30 minutes, second load - 20 minutes.

2. Re-assembly: Re-assembly is just the reverse of the disassembly procedure and requires approximately 2 hours' time with a crew of 5 men.

C. Material used for installation:

1. a. Two pieces of planking 2" x 6" x 6' under wheels.
   b. Two pieces of planking 2" x 6" x 6' for blocking.
   c. Three pieces of lumber 1" x 6" x 36" under dolly.
   d. Two blocks 6" x 5" x 8" for blocking.
3. Optional, or as necessary, a second load was added using approximately 50 lb. of
lumber and weights about 900 lbs. See Photograph 77365.

2. Plane rigging. The Evans airborne tie-down equipment furnished with the plane proved entirely adequate and satisfactory.

3. No additional rigging was used.

4. Weights

**First load - total**

- Chassis front section: 4600 lbs.
- Body front section: 470 lbs.
- Fenders, running boards, bows,
  - paulin, sills, etc.: 290 lbs.

**Second load - total**

- Chassis rear section: 3120 lbs.
- Body rear section: 515 lbs.
- Six wheels and tires: 765 lbs.
- Fuel tank and spare wheel carrier: 375 lbs.
- Body racks, windshield, muffler,
  - frame slings, etc.: 396 lbs.

**Total Weight:** 10,879 lbs.

5. For more detailed information, attention is invited to Second
   Report on C.R. No. 5722, titled "Trucks, Cargo, airborne (81 417)" and
   Motion Picture Film 393, airborne 2-1/2 ton 6 x 6 cargo truck, both
   of which will be available at the Ordnance Research Center, Aberdeen Proving
   Ground, Maryland.

   **Note:**
   - Dismantling: 1 hr. (5 men)
   - Loading: 45 min. 1st load; 30 min. 2nd load (5 men)
   - Unloading: 30 min. 1st load; 30 min. 2nd load (5 men)
   - Reassembly: 2 hrs. (5 men)

   **Note:** in addition to assumed crew and cargo load 9 soldiers may be carried, (4 in the 1st load and 5 in the 2nd load).

   REFERENCES

   51
2-1/2 TON CARGO TRUCK W/WINCH

1st Ford

---

Front Section of Chassis (C.G. at Rear Spring Shackle at Station 270)

Fenders, Running Boards, Body Sills, Bows, Paulin, Chains, Tools, & Windshield inside and around body, refer to photo 00352

---

C-47
R4D-1, e-5

Cargo Wt. = 5360 lbs.
C. of G. = 25.5 Index Units

Test No. 49
Tests Nos. 50 and 51

INSTALLATION BY HOOK, 2-1/2 TON, 6 x 6 IN 3-17 AND 3-24

A. This installation was found to be entirely impractical since a complicated disassembly procedure is required for loading into the bomb bays of these ships.
LOADING TRUCK, 3/4-TON, 4 X 4, WEAPONS CARRIER WITH WINCH IN C-67A TRANSPORT PLANE

A. 1. Description: Loading and transporting this vehicle in the C-47 transport plane requires that the chassis be stripped of wheels, body, fenders, running boards, rear axle assembly, driver's seat and right tail light as shown in photograph 993523. The same one-wheel dolly photographed 99762 used with the forward chassis section of the 2-1/2 ton truck is used on the chassis section of this vehicle. The same wooden ramp used in loading the 2-1/2 ton truck is also used. The only modifications required to the truck itself are on the cab floor sill as shown in photograph 99762 and the hydraulic brake lines at the rear axle as shown in photograph 99792.

2. Disassembly: Disassembly of the truck preparatory to loading into the plane requires approximately 3 man hours of labor.

3. Loading: The chassis section with the one-wheel dolly at the rear is driven up the ramp and into the cargo compartment of the plane under its own power. The rear axle assembly is rolled up the ramp by hand and the remaining parts of the truck are manually loaded. Diagram No. 52 and photograph 99764 show the loading arrangement inside the plane. Note that the dimensions of the body section are such that it cannot be set up on the edge or laid flat on the floor of the plane, but must be supported above seat height by two 2" by 4" by 92" wooden timbers placed crosswise of the cargo compartment with ends resting on the seat ledges. Estimated loading time with crew of six men is 30 minutes. Reference also A.P.6. Photographs 99761 and 99797.

B. 1. Unloading: Unloading is accomplished by first manually removing the spare wheel, rear axle assembly, and body parts. The chassis section is then easily backed out of the plane and down the ramp under its own power. Estimated unloading time with crew of six men is 20 minutes.

2. Reassembly: Reassembly is just the reverse of the disassembly procedure requires approximately 6 man hours of labor.

C. Material used for installation:

1. a. Two pieces of planking 2" by 6" by 6" under wheels.
   b. Two blocks 8" by 3" by 21".
   c. Three pieces of lumber 1" by 6" by 36" under dolly.
   d. Two pieces of planking 2" by 4" by 92" under body.
   e. Special wooden ramp using approximately 600 board feet of lumber and weighing about 900 lbs. See photograph 99355. (See Test No. 49).

2. Plane rigging: The tie-down equipment (Evans Skyloader Kit) furnished with the plane proved entirely adequate and satisfactory.

3. No additional rigging was used.
### Test No. 52 (Cont'd)

#### D. Weights

1. Chassis section .......................... 2515 lbs.
2. Chains, tools, and fuel ................... 650 lbs.
3. Body, fenders, boss, canvas, etc. .......... 650 lbs.
4. Rear axle assembly ........................ 450 lbs.
5. Spare wheel ............................... 150 lbs.
6. Total weight ............................... 5515 lbs.

**Time of disassembly** - 45 min. (4 men)
**Time of loading** - 30 min. (6 men)
**Time of unloading** - 20 min. (6 men)
**Time of reassembly** - 1-1/2 hrs. (4 men)

**NOTE:** In addition to assumed crew and cargo load 3 soldiers may be carried.
A. The need for an airborne means of unloading heavy parts and facilitating the assembly of partially disassembled equipment after it is unloaded from planes during airborne transportation prompted the construction of a simple "A" frame and mounting it on the 3/4 ton 4 x 4 truck. Since the 3/4 ton truck has been found to be transportable in a C-47 transport plane, this "A" frame answers that requirement.

B. Various photographs throughout this report show it in operation and testify to its usefulness. In lifting parts weighing about 4000 lbs. and over, the cargo body of the truck must be heavily loaded with ballast and an additional snatch block employed at the point of attachment to multiply the winch effort is desirable.

C. A.P.C. Photographs 99759A and 99760 show this "A" frame mounted on the truck while A.P.C. Sketch No. DS-5050A gives details of construction. The "A" frame complete with snatch block and stay cable weighed about 130 lbs. The "A" frame itself can if necessary be manufactured of salvage materials in any field or base shop and with minor modification is adaptable to the 2-1/2 ton 6 x 6 SWB cargo truck (Airborne) with winch.
"A" FRAME
Winch Powered
3/4 Ton 4x4 Cargo Truck
INSTALLATION OF TRUCK, 3/4-TON, 4 x 4 IN B-17 AND B-24

A. This installation was found to be entirely impractical since a complicated disassembly procedure is required for loading into the bomb bays of these ships.
TEST NO. 55: INSTALLATION OF TRUCK 1/4 TON 4 X 4 IN C-47 AIRPLANE

Details of this installation are shown in the report of the airborne Command of tests conducted at Camp Mackall, North Carolina. Numerous other installations of the 1/4 ton truck have been made in this plane and it has been found that no particular problems are involved since it is necessary to merely drive the truck up the ramp into the ship under its own power.
A tandem hitch for the 1/4 ton lhd truck has been developed and put to limited use by the Field Artillery to move artillery weighing in excess of 2500 lbs.

A.P.C. Photograph 99772 shows the hitch in its folded position when not in use and its position when coupled to a companion 1/4 ton lhd military vehicle.

As shown in the photograph the design of the hitch is such that it could be easily duplicated with the facilities available in any third or higher echelon shop.

Two 1/4 ton trucks coupled in this manner provide a prime mover that could be airborne and put into service with the least possible delay after the plane has landed.
Tests Nos. 56 and 57

INSTALLATION OF TRICK, 1/4-70', A x A, IN B-17 AND B-24

This trick was installed, disassembled in the B-17 and B-24 airplanes. The details of this installation are recorded in the Airborne Command report of tests conducted at Camp Mackall.
INSTALLATION OF C-47 AIRCRAFT TRACTORS WITH TOWERS AND WHEEL 20-50 TB IN C-47 AIRCRAFT

A. This information was extracted from a tentative airborne aviation Engineer Manual. This unit was designed to carry for the C-47 Airplane and, therefore, no difficulty was experienced during the installation operation. The standard C-47 loading ramps were used and 1" x 6" planking was placed on the tread ways within the cabin to protect the plane flooring. It was found necessary to back the tractor into the plane. When the center of gravity of the tractor was between the D and E compartments, the dozer blade was lowered and the ignition disconnected. The transmission gears remained engaged and the forward reverse clutch was also engaged. The steering brake controls were locked and the tractor lashed in place to available eyebolts in the floor. Check blocks may be placed in front of and to the rear of each track tread to increase the security against any movement. Diagram No. 52 shows the floor plan of this loading arrangement. No photographs were available as this test was not conducted.

B. To remove the tractor from the plane, the loading operation is reversed, but care must be exercised in approaching the inclined portion of the loading ramp to prevent the tractor from crossing the balance point too rapidly as it is likely to slide and jump off the ramp.

C. Material Used for Installation.

1. Two pieces of 1" x 6" planking 12' long.
2. Plane rigging. None required.
3. Additional rigging. Two lashings of 5/8" rope 10' long.

D. Weight.

Tractor .................................................. 4135 lbs.

In addition to assumed A/P crew and above load, 7 soldiers may be carried.

Time for loading = 25 min.
Time for removal = 25 min.
Overall Length of Tractor = 96\textdegree
Weight of Tractor = 4135 lbs.

C. G. = 17 Index units
Cargo Wt. = 4135 lbs.

TEST NO. 58
Tests Nos. 59 and 60

INSTALLATION OF TRACTOR, CRAWLER, 26 H. P. IN 3-17 AND 3-24

A. This installation was found to be entirely impractical since a complicated disassembly procedure is required for loading into the bomb bays of these ships.
A. Description.

Loading and transporting this trailer in the B-17 Bomber requires that it be completely disassembled. The body of the trailer is placed edge-wise in one side of the bomb bay with the bottom toward the center catwalk and lifted into place by means of the bomb hoists. The upper side of the trailer body was lashed with the cable to the uppermost bomb shackles and the lower side supported on wooden cross-members placed across the catwalk to longitudinal members of the fuselage. The disassembled parts were all placed within the body of the trailer and braced in place with 2" x 4" planking from the bomb racks. The entire unit was then lashed to the bomb racks with rope. A second trailer can be loaded similarly in the opposite bomb bay. Estimated loading time with a crew of four men is 30 minutes per trailer. Loading diagram No. 82 shows the arrangement of the trailers in the bomb bay. Reference A-73, Photographic No. 99561.

B. Unloading.

Unloading was accomplished manually by a 4-man crew in 15 minutes per trailer.

C. Materials Used for Installation.

1. Lumber.
   a. Four pieces of planking, 2" x 4" x 30"
   b. 30 ft. of 2" x 4" planking cut to length for bracing
   c. 7 ft. of 5/16" wire cable
   d. Four 5/16" cable clamps
   e. 100 ft. of 3/8" rope

D. Weights.

Two (2) 1/4-Ton Cargo Trailers ..................................1,100 lbs.

E. Estimated Time (Four (4) Man Crew) Per Trailer.

1. Disassembling .................. 30 min.
2. Loading .......................... 30 min.
3. Unloading ........................ 15 min.
4. Reassembling .................... 30 min.

Note: In addition to assumed crew, 2,500 lbs. can be added in bomb bay and 12 soldiers may be carried.

RESTRICTED
Test No. 61 and 64

Loading 1/4-ton and 1-ton Cargo Trailers Into C-47 Transport Planes

1. The weights and physical dimensions of these trailers are such that both of them can be loaded into the C-47 Transport Plane without any modification or disassembly except removing the pullin and body racks on the 1-ton trailer and placing these parts in the trailer body. The 1/4-ton trailer was actually loaded by using the special wooden ramp (photograph 99355)* built for loading the 2-1/2 ton and 3/4 ton trucks, but the standard C-47 loading ramp can be used as well. The additional maneuverability afforded by using the special wooden ramp greatly facilitates loading the 1-ton trailer, but the standard C-47 loading ramp can be used if necessary. The 1-ton trailer is rolled backwards up the ramp and into the forward end of the cargo compartment in the plane. The 1/4-ton trailer can then be rolled into the plane, either end foremost and latched down behind the 1-ton trailer. Since the combined weight of both trailers is only 2050 lbs., an additional load of approximately 4000 lbs. can also be carried simultaneously. Loading diagram No. 61 and 64 shows the loading arrangement and designates the additional load that may be loaded in each compartment of the plane. Reference is also invited to Photographic 97764 showing the two trailers loaded into the plane. Estimated loading time of two trailers only with crew of 4 men is 15 minutes.

2. Unloading: Unloading is simply accomplished by manually rolling the trailer out of the plane and down the ramp. Estimated unloading time of the two trailers only with crew of 4 men is 10 minutes.

C. Materials used for installation:

1. Lumber
   a. Four pieces of planking, 2" x 6" x 48" under wheels.
   b. One block, 6" x 6" x 12" for blocking under trailer "A" frame.

2. Plane rigging: The rigging furnished with the plane proved entirely satisfactory and adequate.

3. No additional rigging was used.

D. Weights:

   1-ton trailer ........................................ 1500 lbs.
   1/4-ton trailer ....................................... 550 lbs.
   Total weight ...................................... 2050 lbs.
   Reasonable additional load ........................ 4000 lbs.

* See Test No. 40.
LOADING OF ONE (1) TON CARGO TRAILER INTO B-17 BOOMER

A. Loading of the one-ton Cargo Trailer into this plane is impractical because the physical dimensions of the Trailer body are such that it must be cut into at least two pieces to permit installation. Since this trailer body is not supported by sills, it cannot be welded or bolted together sufficiently well to maintain its structural strength after it is once divided.
LOADING 1-TON AND 1/4-TON CARGO TRAILERS INTO B-24 BOMBER

A. Description.

Loading and transporting these trailers in the B-24 Bomber requires that both of them be completely disassembled. See A.P.O. Photographs Nos. 99254 and 99261. The cargo body of the 1-Ton trailer can then be loaded edgewise into one side of the rear bomb bay, manually filled with all the disassembled parts, and lashed into place as shown in Photograph 99777. A second 1-Ton trailer can also be loaded on the opposite side of the rear bomb bay. The cargo body of the 1/4-Ton Trailer is loaded edgewise into one side of the forward bomb bay, manually filled with all the disassembled parts and lashed into place as shown in A.P.O. Photograph No. 99785. A second 1/4-Ton trailer is similarly loaded in the opposite side of the forward bomb bay. The bomb hoists furnished with the plane are entirely adequate and satisfactory for lifting the trailer bodies into place. Loading diagrams Nos. 63 and 66 show the loading arrangement of these trailers in the plane.

B. Unloading.

Unloading is accomplished manually with the aid of the bomb hoists.

C. Materials used for installation.

1. Lumber.
   a. Eight (8) pieces of planking, 2" x 4" x 60"
   b. Eight (8) pieces of planking 2" x 4" x 36"
   c. 10 ft. of 2" x 4" planking cut to length for blocking.
   d. 200 ft. of 3/8" rope for lashing.
   e. 20 ft. of 5/16" wire cable.
   f. Eight 5/16" cable clamps.

D. Weights.

Two 1-Ton Cargo Trailers ...................................... 3,000 lbs. each
Two 1/4-Ton Cargo Trailers ..................................... 1,100 lbs. each
Total ................................................................. 4,100 lbs.

E. Estimated Time.

<table>
<thead>
<tr>
<th></th>
<th>1-Ton</th>
<th>1/4-Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disassembly</td>
<td>30 min.</td>
<td>30 min.</td>
</tr>
<tr>
<td>Loading</td>
<td>30 min.</td>
<td>30 min.</td>
</tr>
<tr>
<td>Unloading</td>
<td>30 min.</td>
<td>30 min.</td>
</tr>
<tr>
<td>Reassembly</td>
<td>30 min.</td>
<td>30 min.</td>
</tr>
<tr>
<td>Total</td>
<td>2 hrs.</td>
<td>2 hrs.</td>
</tr>
</tbody>
</table>

Note: In addition to armed crew and cargo load, 9 soldiers may be carried.

[Restriction: 11-]
A. (1) Description.

Loading and transporting the Clark fork-lift mover in the C-47 transport plane requires partial disassembly of the unit to the extent of removing the fenders, fork-lift and outer tires from the dual front wheels. Total weight of the unit disassembled for installation was 6100 lbs. minus the fenders, which can be dispensed with for this operation.

(2) Loading.

Loading of the tractor proper was accomplished by backing it under its own power into the cargo compartment of the plane over a special wooden ramp. See A.P.G. Photograph No. 99355 under Test No. 49 and A.P.G. Photograph No. 09765. Loading of the fork-lift hoist assembly onto the ramp was accomplished by using the "A" frame mounted on the front end of a 3/4 ton 4 x 4 truck equipped with winches. It was then slid into its tie-down position on 2" x 12" timbers placed on the floor of the plane, using a black and tackle as shown in A.P.G. Photograph 99803. The two outer tires and rims removed from the dual front wheels, as well as the two lift forks were lifted onto the ramp by the "A" frame on the 3/4 ton truck and placed in proper position in the plane by hand. The Evans tie-down equipment furnished with the plane was used to lash down the equipment as shown in A.P.G. Photograph 99804.

B. Material Required for Installation.

1. Lumber
   a. Two pieces of planking, 2" x 10" x 8' under wheels.
   b. Four pieces of planking, 2" x 10" x 4' under hoist.

2. Block and tackle.

3. Special ramp as used for loading 2-1/2 ton and 3/4 ton trucks.

C. Weights

<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor</td>
<td>2400 lbs</td>
</tr>
<tr>
<td>Hoist</td>
<td>1000 lbs</td>
</tr>
<tr>
<td>Tires and rims</td>
<td>300 lbs</td>
</tr>
<tr>
<td></td>
<td>6100 lbs (minus fenders)</td>
</tr>
</tbody>
</table>

D. Estimated time (4-man crew)

<table>
<thead>
<tr>
<th>Task</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disassembly</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Loading</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Unloading</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Reassembly</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>

In addition to assumed A/C crew, 1 soldier may be carried.
TESTS Nos. 66 and 67

INSTALLATION OF CLARK FORK LIFT IN B-17 AND C-24

A. This installation was found to be entirely impractical since a complicated disassembly procedure is required for loading into the bomb bays of these ships.
INSTALLATION OF ONE COMPLETE SET OF RADIO EQUIPMENT IN C-47 AIRCRAFT

A. The complete set of radio equipment consisted of 5 SCR-284, SCR-608, SCR-610, SCR-234, and SCR-104 and related equipment consisting of reel carrier, reel stand, antenna mountings and spare parts. This complete set was mounted starting 21 inches in rear of loading zone D and was entirely contained in Zone E.

1. The SCR-284 and SCR-608 were placed on the sides and blocked on the front and against a 2" x 4" x 3'4" and 2" x 10" x 6'4". These planks were lashed to hooks on the corners and blocked forward against a center floor eye bolt. The SCR-610 was placed against the SCR-284 in two pieces and the two sets lashed to the side hooks and center eye bolts.

Two canvas covered boxes of spare parts were placed next to SCR-284 and these were lashed to the side hooks and center eye bolts. The antenna in its canvas carrier was also lashed on top of the SCR-284. All of the above equipment was blocked from the rear by 2" x 10" and 2" x 4" against a center eye bolt. Two small generators were mounted and firmly blocked to the 2" x 10" piece immediately in rear of SCR-284.

2. The reel carrier complete with a heavy reel was mounted on a 2" x 10" piece under each wheel with the drum or tongue across the ship's floor. This piece was blocked at the wheels immediately in rear of the SCR-608. The tongue was lashed down to a center eye bolt. The small reel was placed under the carrier and blocked against the wall. This blocking also held the antenna mounting brackets. The SCR-104 came in two pieces and was lashed directly to the handle bars which extended across the windows. If the SCR-603 is also to be used it may be lashed down across the tongue or the reel carrier. This equipment was not on hand for test. The stationary reel stand was lashed between the wheeled reel carrier and the wall. All parts with the reel carrier were lashed tight to the side hooks.

3. All 2" x 10" and 2" x 4" boards running transversely were blocked on the side in the direction of the axis of the fuselage. Spare parts must be carried loose and not in carton boxes and may be tied up in a tarpaulin and lashed to the side. Reference is made to P. G. Photograph No. 99356.

B. Unloading Operations:

1. Since all the above equipment was not nailed down but lashed to the sides and the sector it may be removed from the rear, piece by piece, as soon as the ropes are removed. The reel carrier is the bulkiest piece and will come out first. Since the spare parts are loose and consist of radio tubes, fuses, and batteries care should be taken in handling these parts outside of the plane. In general all of this equipment may be removed in the reverse order of placing it.
C. Materials for Installation:

1. Three pieces of planing 2" x 10" x 6' 4", three pieces 2" x 4" x 6' 4", one piece 2" x 4" x 2' 11" approximately, one piece 2" x 4" x 1' 9", one piece 1" x 4" x 3' 0", and two dozen two-penny nails.

2. Plane rigging:

Four lengths 1/2" plane rigging for lashing material to floor, each length 15 feet, three lengths 3/8" rope, three feet long for lashing tongue of reel carrier and 2 x 4's to the side hooks.

D. Weights:

<table>
<thead>
<tr>
<th>Item</th>
<th>Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio set SCR-264</td>
<td>230</td>
</tr>
<tr>
<td>Radio set SCR-610</td>
<td>50</td>
</tr>
<tr>
<td>Radio set SCR-606</td>
<td>275</td>
</tr>
<tr>
<td>Radio set SCR-194</td>
<td>23</td>
</tr>
<tr>
<td>Reel carrier with two reels</td>
<td>75</td>
</tr>
<tr>
<td>Spare parts</td>
<td>15 (maximum)</td>
</tr>
<tr>
<td>Lumber</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>760</td>
</tr>
</tbody>
</table>

E. This is only a part of many other loadings and may be superimposed upon any other typical loading where space permits.

F. Time of operation:

Loading time                     . . . . . . . . . . . . . 40 minutes
Unloading time                   . . . . . . . . . . . . . 20 minutes
3 each 2" x 10" x 76" and 2" x 4" x 76"
blocked against center eyes

SCR 261 with antenna and spare parts

Two hand generators blocked

2" x 4" blocking

Reel Carrier with spare reel and stationary reel stand lashed to center and sides.

C. G. = 15.5 Index Unit
Cargo Wt. = 760 lbs.

SCR 608 and SCR 610

Weights
SCR 608 - 275 lbs.
SCR 610 - 50 lbs.
SCR 261 - 265 lbs.
SCR 194 - 26 lbs.

Fuel carrier and related equipment - 75 lbs.
Spare parts - 15 lbs. max.
Lumber - 50 lbs. approximately
Total - 780 lbs.

Note: SCR 194 in two parts lashed to side hand railing (not shown)
Other spare parts in tarpaulin also lashed to side (not shown)

TEST NO. 70
A. As a result of lack of time and the fact that the complete radio sets were light and easily assembled it was only believed necessary to find a method of mounting the bulky real carrier in this ship. A 2" x 10" plank was placed along the full length of the catwalk and mounted two 2" x 10" pieces from this one to the side frame. These pieces about 20" long, form an angle of approximately 45 degrees with the horizontal. These 2" x 10" pieces were placed under the axle with the hub of the wheel against one bulkhead. Two 2" x 4" blocks were placed on either side of the wheels and two 2" x 10" pieces blocked the wheels from the inside. The tongue of the carrier was lashed to the roof of the bomb bay section. The wheels were blocked in front and rear with two pieces of 1" x 10" x 3'2" of planking and the axle was lashed to the 2" x 10" pieces in the center. The large reel was also carried on the real carrier. Reference A.P.14, Photograph No. 99852 which shows the carrier installed.

B. The real carrier may be unloaded by removing the lashing rope and lowering the tongue to the ground. Reels are then picked up from the blocking and they are also lowered to the ground. It may be rolled out from under the plane with the bomb bay doors open. The blocking and wood frame are then removed.

C. Materials used:
   - One piece of 2 x 10 x 15 feet, approx.
   - Two pieces of 1 x 10 x 30 inches, approx.
   - Two pieces of 2 x 4 x 30 inches, approx.
   - Two pieces of 1 x 4 x 38 inches
   - Two pieces 1/2" hemp rope, four feet long.

D. Weights:
   - Reel carrier with spare reel ....................... 75 lbs.
   - Lumber ............................................. 15 lbs.
   - Total weight ..................................... 90 lbs.

E. This report is only to indicate one position in which this item can be carried and has no relation to entire cargo capacity of the airplane.

F. Time of Operation:
   1. Loading Time .................. 1/2 hour
   2. Unloading Time .......... 5 min.

Restricted
Penn No. 71
Installation of Reel Real Carrier for Radio Equipment in B-24 Aircraft


12/22/44

Restricted

-117-
One piece 2" X 10" X 16'

Two pieces 2" X 4" X 35" approx.

Two pieces 2" X 10" X 35" Approx.

Wheels blocked front and rear
with two pieces 1" X 4" X 38"

Weights
1 Mobile Reel Carrier with spare reel - 75 lbs.
Lumber - 15 lbs.
Total - 90 lbs.

C. G. = 50.5 Index Units
Cargo Wt. = 90 lbs.

B-24D, E, G, H, I, J
PD4Y-1

Note: Axle of reel carrier lashed to two
2" X 10" pieces. Tongue lashed
to roof of bomb bay section.

TEST NO. 71
A. As a result of lack of time and the fact that the complete radio sets were light and easily assembled, it was only believed necessary to find a method of mounting the bulky reel carrier in this ship. This was done by removing the spare reel and pulling the carrier into the rearmost door of the fuselage. The wheels were placed on the floor next to the bulkhead immediately in rear of the door with the tongue pointing to the tail of the ship. The axle was lashed to two vertical structural members and the wheels were lashed to the floor boards. The tongue was lashed to a bulkhead to the rear. No blocking was used for this installation.

B. The reel carrier may be unloaded by removing the lashing ropes and carrying it out the door in the reverse manner of emplacing.

C. Materials used:

Four pieces 3/8" hemp rope five feet long

D. Weights:

Reel carrier without spare reel . . . . 65 lbs. total

E. Time of Operation:

1. Time of loading . . . . . . . . . 15 min.
2. Time of unloading . . . . . . . . 5 min.
B-17G

Notes:
- Axle lashed to two vertical structural members.
- Wheels lashed to floor.
- Tongue lashed to rear bulkhead.
- No blocking used.

Trip No. 72

RESTRICTED
APPENDIX 3

No. of Airplanes by type required to move Corps and Division Artillery
Section I

Analysis and inspection indicate that the 155 mm Gun, the 9.4 cm howitzer, the 6.5 cm gun, and the 21 cm howitzer (All Corps Artillery) are too large and heavy to be carried in C-47's, B-17's, and B-24's. Therefore, the tables below have been prepared to indicate the weight of men and material only in light or medium artillery battalions of reduced strength. In each case only the minimum prime movers, fire control equipment, and signal equipment considered necessary to initiate and maintain fire have been included. It is obvious that these estimates are subject to considerable revision, depending upon the exact mission to be accomplished. But, since the principal weights are in the guns, prime movers, and ammunition, the calculations on the number of aircraft required will be significant. (Tables Nos. 1 and 2, showing battalion weights, are attached).

Section II

The table below has been prepared to indicate the number of aircraft necessary to transport both 105 mm and 155 mm Howitzer Battalions.

Table No. 3

Number of aircraft of various types required to carry a 105 or 155 mm Battalion.

<table>
<thead>
<tr>
<th>Total Aircraft Required</th>
<th>105 mm Gun</th>
<th>155 mm Gun</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-47's</td>
<td>B-17's</td>
<td>Total C-47's B-17's Total</td>
</tr>
<tr>
<td>or B-24's</td>
<td>or B-24's</td>
<td>or B-24's</td>
</tr>
<tr>
<td>100% C-47's</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>75% C-47's</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>25% B-17's or B-24's</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>67% C-47's</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>33% B-17's or B-24's</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>52% C-47's</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>50% C-17's or B-24's</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

Note (1) Using Tables 1 and 2, a proportion of less than 50% C-47's will not be practical because of the necessity for carrying vehicles and gun carriages in C-47's.
Note (2) Only normal material is included. Such items as chemical mortars, Clark lift trucks, and 3" AT guns are elsewhere considered.

(a) In order to prepare the table and make the necessary calculations, the following assumptions were made:

1. 100 rounds per gun carried for the artillery.
2. 1/2 unit of fire for all other weapons.
3. Anti-aircraft and anti-tank protection are necessary.
4. The smallest possible prime mover is desirable.
5. All aircraft to be loaded to maximum weight carrying ability.
6. Division and Corps HQ and HQ Battery will not be carried.

(b) All personnel, and items such as ammunition, tools, radios, etc., can be loaded into either the C-47, B-17, or B-24. However, prime movers must be loaded into C-47's and some parts of the heavy weapons may be carried by the heavy bombers. Since a breakdown of the precise loading is neither necessary nor desirable in this case, the following method will be used to calculate the number of necessary aircraft:

1. The C-47 will be assumed to carry 6000 lbs. not loaded; the B-17 15,000 lbs., and the B-24 15,000 lbs.
2. The aircraft are grouped into several combinations of C-47's and heavy bombers to facilitate evaluation of various types of loading.
3. The aggregate carrying ability of the above group is determined, and divided into the total battalion weight. From this the total number of aircraft is recorded in tabular form.

Section III - Aircraft Required for 105 mm Battalion

Since the vehicles must be carried in C-47's, the proportion of C-47's to heavy bombers will be determined by the number of necessary vehicles. Listed below is a breakdown of the number of aircraft necessary to carry a 105 mm Howitzer Battalion, using the minimum number of C-47's.

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>No. C-47's</th>
<th>Total Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 trucks 3/4 Ton</td>
<td>4</td>
<td>23,000</td>
</tr>
<tr>
<td>8 trucks 1/2 Ton</td>
<td>4</td>
<td>18,000</td>
</tr>
<tr>
<td>6 tractors, Clark, 20HP</td>
<td>6</td>
<td>21,510</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>62,510</td>
</tr>
</tbody>
</table>

Note: Only normal material is included. Such items as chemical mortars, Clark lift trucks, and 3" AT guns are elsewhere considered.
<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
<th>Lbs. each</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MG and ML Battery (1)</td>
<td>113</td>
<td>220</td>
<td>24,900</td>
</tr>
<tr>
<td>Firing Batteries (1)</td>
<td>212</td>
<td>220</td>
<td>53500</td>
</tr>
<tr>
<td>Service Battery (2)</td>
<td>0</td>
<td>220</td>
<td>0</td>
</tr>
<tr>
<td>Medical Detachment (3)</td>
<td>12</td>
<td>210</td>
<td>2520</td>
</tr>
<tr>
<td>Ordnance Equipment (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest, Tools</td>
<td>3</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>Gun and tripod, Cal. 50, HE</td>
<td>17</td>
<td>131</td>
<td>2262</td>
</tr>
<tr>
<td>Cables, Aiming</td>
<td>7</td>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>Howitzer, 105 mm, 1/2</td>
<td>12</td>
<td>1650</td>
<td>59400</td>
</tr>
<tr>
<td>Launcher, Rocket 12, 13</td>
<td>30</td>
<td>25</td>
<td>750</td>
</tr>
<tr>
<td>Telescopes, 5,3</td>
<td>4</td>
<td>75</td>
<td>300</td>
</tr>
<tr>
<td>Vehicles (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck 3/4 T, command</td>
<td>4</td>
<td>5750</td>
<td>23000</td>
</tr>
<tr>
<td>Truck, 1/4 T, 4 x 4 (5)</td>
<td>8</td>
<td>225</td>
<td>1800</td>
</tr>
<tr>
<td>Tractor, Engineers, Clark, 2HP</td>
<td>6</td>
<td>2135</td>
<td>12180</td>
</tr>
<tr>
<td>Trailer, 1/4 T, 2 wheel</td>
<td>6</td>
<td>550</td>
<td>3300</td>
</tr>
<tr>
<td>Signal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest 5c-5</td>
<td>1</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Panel Sets</td>
<td>12</td>
<td>25</td>
<td>300</td>
</tr>
<tr>
<td>Radio SCR 28k</td>
<td>1</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Radio SCR 6cQ</td>
<td>1</td>
<td>275</td>
<td>275</td>
</tr>
<tr>
<td>Radio SCR 610</td>
<td>10</td>
<td>50</td>
<td>500</td>
</tr>
<tr>
<td>Reel, RA, 1 per 3/4 T truck</td>
<td>1</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Reel, BB5</td>
<td>5</td>
<td>115</td>
<td>575</td>
</tr>
<tr>
<td>Misc. headsets, etc.</td>
<td>1</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Switchboard B371</td>
<td>1</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Telephones H3B</td>
<td>10</td>
<td>80</td>
<td>800</td>
</tr>
<tr>
<td>Quartermaster</td>
<td></td>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>Picks, shovel, and misc. equip</td>
<td></td>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>Ammunition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cal. 50 (1/2 unit/2m)</td>
<td>17 cases</td>
<td>90</td>
<td>1530</td>
</tr>
<tr>
<td>Inj. Rocket 12, 3/Launcher</td>
<td>30</td>
<td>7</td>
<td>210</td>
</tr>
<tr>
<td>105 How. complete round</td>
<td>1200</td>
<td>51</td>
<td>61200</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dinette (average)</td>
<td></td>
<td>10000</td>
<td>10000</td>
</tr>
<tr>
<td>Water, gasoline, etc.</td>
<td></td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>29158</td>
</tr>
</tbody>
</table>

-128-
The 2-17's can carry 6000 lbs. each, a total of 12,000 lbs., and hence would be loaded as with:

- Ammunition, Cal. .50
- Ammunition, AT, Rocket
- Machine Guns, Cal. .30
- Medical Detachment (12 men)
- Ballistic Lens (17)

Total: 64,000 lbs.

Balance of the battalion is composed of: Howitzers, ammunition, and equipment weighing 210,675 lbs. Since B-17's and B-24's can carry 15,000 lbs. each, 15 will be required, and there will be more than enough to carry one howitzer per plane. Thus:

<table>
<thead>
<tr>
<th>No. B-17's or B-24's required</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Howitzers-105 mm (1 per plane, 1590 lbs.)</td>
<td>12</td>
</tr>
</tbody>
</table>

(12 B-17's or B-24's can carry a total of 180,000 lbs.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammunition 105 mm 2000 lbs./plane</td>
<td>12</td>
<td>3120</td>
</tr>
<tr>
<td>Signal and water-master equipment 215 lbs. per plane</td>
<td>12</td>
<td>2575</td>
</tr>
<tr>
<td>Miscellaneous Ordinance equipment 170 lbs./plane</td>
<td>12</td>
<td>2070</td>
</tr>
<tr>
<td>Personnel 300 lb. (24/plane)</td>
<td>12</td>
<td>4320</td>
</tr>
<tr>
<td>Miscellaneous ordnance etc. 1700 lbs./plane</td>
<td>12</td>
<td>21,400</td>
</tr>
</tbody>
</table>

Average loading/plane 15,000 lbs. Total 120,000 lbs.
The total weight thus far is 27,000 plus 100,000 or 261,000 lbs., and the balance of the equipment is yet to be carried. This can be done in 3 B-17's or B-24's as follows:

<table>
<thead>
<tr>
<th></th>
<th>No. B-17's or B-24's</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personnel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 men (1/plane)</td>
<td>3</td>
<td>4850</td>
</tr>
<tr>
<td><strong>Ammunition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 mm Howitzer (10,000 lbs. per plane)</td>
<td>3</td>
<td>30000</td>
</tr>
<tr>
<td><strong>Trailers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2 ton (2/plane)</td>
<td>3</td>
<td>3300</td>
</tr>
</tbody>
</table>

Average Loading/plane 12,000 lbs. 37,000 lbs.

Summary: A typical loading of a reduced 105 mm Howitzer Battalion has been shown. 16 C-47's and 15 B-17's or B-24's are required. The loading of a 155 mm Battalion would be similar except that the howitzers would necessarily be carried disassembled in two aircraft, and the total number of aircraft would be larger.
## Table No. 2

Table of Major Items to be carried by air for a 155 mm Howitzer or 1.5" Gun BN.

<table>
<thead>
<tr>
<th>Item</th>
<th>No. Units</th>
<th>Stat. each</th>
<th>Total Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How. &amp; Radio Battery (1)</td>
<td>24</td>
<td>220</td>
<td>21120</td>
</tr>
<tr>
<td>Firing Batteries (1)</td>
<td>219</td>
<td>220</td>
<td>57000</td>
</tr>
<tr>
<td>Service Battery (2)</td>
<td>20</td>
<td>120</td>
<td>3600</td>
</tr>
<tr>
<td>Medical Equipment (2)</td>
<td>10</td>
<td>240</td>
<td>2400</td>
</tr>
<tr>
<td><strong>Ordnance Equipment (1 L)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Howitzer, 355 mm, 12</td>
<td>32</td>
<td>1250</td>
<td>40000</td>
</tr>
<tr>
<td>(or Gun 1.5&quot;, 12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Launcher, Rocket, 12, 12</td>
<td>12</td>
<td>1260</td>
<td>15000</td>
</tr>
<tr>
<td>Telescopes, 12</td>
<td>4</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td><strong>Vehicles (1 L)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck, Cargo, 2-1/2T, 6 x 6</td>
<td>6</td>
<td>11000</td>
<td>66000</td>
</tr>
<tr>
<td>Truck, 3/4 T, Command</td>
<td>4</td>
<td>5750</td>
<td>23000</td>
</tr>
<tr>
<td>Truck, 1/4 T, 4 x 4</td>
<td>8</td>
<td>2325</td>
<td>18600</td>
</tr>
<tr>
<td><strong>Signal (4 L)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest DC-5</td>
<td>1</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Radio Sets (4 L)</td>
<td>12</td>
<td>25</td>
<td>300</td>
</tr>
<tr>
<td>Radio, SCR 260</td>
<td>1</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Radio, SCR 6X6</td>
<td>1</td>
<td>275</td>
<td>275</td>
</tr>
<tr>
<td>Radio, SCR 20</td>
<td>10</td>
<td>50</td>
<td>500</td>
</tr>
<tr>
<td>Truck, 12, 4 per 3/4 T-truck</td>
<td>4</td>
<td>89</td>
<td>356</td>
</tr>
<tr>
<td>Truck, 12, 6</td>
<td>5</td>
<td>165</td>
<td>825</td>
</tr>
<tr>
<td>Misc. head sets, etc.</td>
<td></td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Switchboard 20 ft</td>
<td>1</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Telephones 2E-8</td>
<td>10</td>
<td>80</td>
<td>800</td>
</tr>
<tr>
<td><strong>Quartermaster</strong></td>
<td></td>
<td></td>
<td>20000</td>
</tr>
<tr>
<td>ricks, shovels, &amp; misc. equip.</td>
<td>10</td>
<td>200</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Ammunition</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cal. .50 (1/2 unit/Gun)</td>
<td>17</td>
<td>90</td>
<td>1530</td>
</tr>
<tr>
<td>Proj. Rocket 12 3/launcher</td>
<td>90</td>
<td>700</td>
<td>6300</td>
</tr>
<tr>
<td>155 How. exp. rounds</td>
<td>1200</td>
<td>1120</td>
<td>132000</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuhrage (average)</td>
<td>12000</td>
<td>12000</td>
<td>12000</td>
</tr>
<tr>
<td>Water, gasoline, etc.</td>
<td>20000</td>
<td>20000</td>
<td>20000</td>
</tr>
</tbody>
</table>

**Total** 480000
Notes for Tables 1 and 2

(1) Less 11 basics, 6 truck, drivers, 2 mechanics for each battery.
(2) It is assumed that the service battery is unnecessary for this operation.
(3) Because of reduced Battalion size 2 enlisted men are eliminated. 20 lbs. per man allowed for medical supplies.
(4) Equipment has been reduced to the minimum estimated for successful fire.
(5) Tricks, 1/17, 4 x 4 could be substituted for this item to save weight but produce less drawbar pull. This tractor is equipped with dozer blade.
| Ammunition                  | Weights Crated | Uncrated | No. Per | | Crated for Overseas Shipment | Area for Domestic Shipment | | Length | Width | Ht. | Ft. | Length | Width | Ht. | Ft. | Remarks |
|-----------------------------|----------------|----------|---------|---------|-----------------------------|---------------------------|---------|-------|-----|-----|---------|-------|-----|-----|---------|
| R/C Shell, H.E., 4.2", M3   | 67.5           | 67.5     | 2       | 23-1/8" | 11"   | 7"   | 1.12  | 26-1/2" | 11"   | 7"   | 1.12  | In boxes |
| R/C Shell, Ass., H.E., 3", M3| 153            | 158      | 4       | 3.44'   | .96'  | .96' | 3.33  | 3.44'   | .96'  | .96' | 3.33  | In boxes |
| R/C Shell, H.E., 105-mm, M1 | 172            | 147      | 3       | 3.14'   | 1.10' | .95' | 3.47  | 2.00'   | .88'  | .62' | 2.47  | In boxes |
| Shell, H.E., 4.5", M25      | 55.2           | 55.2     | 1       | 1.03'   | .42'  | .42' | .77   | 1.93'   | .42'  | .42' | .77   | In boxes |
| Charge, Prop., M7           | 61             | 39       | 3       | 2.49'   | 1.03' | .99' | 2.56' | 2.15'   | .92'  | .76' | 1.76  | In boxes |
| Charge, Prop., M8           | 73             | 49       | 3       | 2.49'   | 1.23' | 1.03 | 3.06  | 2.15'   | .99'  | .76' | 2.13  | In boxes |
| Fuze, F.D.O., Mk1Al, Assembled w/KZ111 Booster | 77             | 77       | 25      | 1.45'   | 1.32' | .75' | 1.92  | 1.45'   | 1.32' | .75' | 1.92  | In boxes |
| Primer, F.G. 21 Gr. Mk1Al   | 1.80           | 1.80     | 50      | 5-3/4"  | 3.00" | 1.05" | 3.36" | 6-3/4"  | 3.00" | 1.05" | 3.36" | In boxes |
| Shell, H.E., 105-mm, M107   | 96.1           | 96.1     | 1       | 2.23'   | .55'  | .55' | 1.23  | 2.23'   | .55'  | .55' | 1.23  | In boxes |
| Charge Prop., M3            | 79             | 53       | 6       | 3.26'   | 1.23' | 1.06' | 4.00  | 2.92'   | .99'  | .93' | 2.49  | In boxes |
| Charge Prop., M4            | 79             | 58       | 3       | 2.32'   | 1.42' | 1.23' | 3.28  | 1.93'   | 1.16' | 1.09' | 2.33  | In boxes |
| Fuze, F.D.O., Mk1Al, Assembled w/KZ111 Booster | 77             | 77       | 25      | 1.45'   | 1.32' | .75' | 1.92  | 1.45'   | 1.32' | .75' | 1.92  | In boxes |
| Primer, F.G. 21 Gr. Mk1Al   | 1.80           | 1.80     | 60      | 5-3/4"  | 3.00" | 1.05" | 3.36" | 5-3/4"  | 3.00" | 1.05" | 3.36" | In boxes |
### Acquisition for 6,500 lb. Load

<table>
<thead>
<tr>
<th>Type of Ammunition</th>
<th>No. of Units</th>
<th>Auto. Per Unit</th>
<th>Wt. Per Unit lbs.</th>
<th>Total Wt.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round, Complete, Shell, H.E., M3, with Fuze, P.D., M3, for 4.2&quot; Chemical Mortar</td>
<td>97</td>
<td>2</td>
<td>67</td>
<td>6,499</td>
<td>Boxes</td>
</tr>
<tr>
<td>Round, Complete, Projectile, A.P.C., H.E., M62, w/O.D. Fuze, M64AL, for 3&quot; A.T. Gun, M5.</td>
<td>41</td>
<td>4</td>
<td>158</td>
<td>6,478</td>
<td>Boxes</td>
</tr>
<tr>
<td>Round, Complete, Shell, H.E., M1, with M2AL, P.D. Fuze, for 105 mm How., M2/or M3.</td>
<td>38</td>
<td>3</td>
<td>172</td>
<td>6,536</td>
<td>Fiber Containers Crated.</td>
</tr>
<tr>
<td>Shell, H.E., M65, with lifting plug, for 4.5&quot; Gun, M1.</td>
<td>81</td>
<td>1.</td>
<td>55</td>
<td>4,455</td>
<td>Uncrated</td>
</tr>
<tr>
<td>Charge Propelling, M7 (Normal) for 4.5&quot; Gun, M1.</td>
<td>13</td>
<td>3</td>
<td>61</td>
<td>793</td>
<td>Fiber containers Crated.</td>
</tr>
<tr>
<td>Charge Propelling, M8, (Super) for 4.5&quot; Gun, M1.</td>
<td>14</td>
<td>3</td>
<td>73</td>
<td>1,022</td>
<td>Fiber containers Crated.</td>
</tr>
<tr>
<td>Fuze, P.D., M51AL, with M21AL, Booster</td>
<td>4</td>
<td>25</td>
<td>77</td>
<td>221</td>
<td>Boxes</td>
</tr>
<tr>
<td>Primer, Percussion, 21 Grain, Ex III</td>
<td>2</td>
<td>50</td>
<td>2</td>
<td>4</td>
<td>Tin Containers</td>
</tr>
</tbody>
</table>

**Total Weight of Ammunition Components for 4.5" Gun, M1**

6,495

(continued on next page)
<table>
<thead>
<tr>
<th>Type of Ammunition</th>
<th>No. of Units</th>
<th>Avg. Per Unit</th>
<th>Wt. Per Unit lbs.</th>
<th>Total Wt. lbs.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell, M19, 155 mm Low-Prong, direct fire</td>
<td>57</td>
<td>1</td>
<td>96</td>
<td>5,472</td>
<td>Uncrated.</td>
</tr>
<tr>
<td>Charge propelling, 40, (Green), for 155 mm How. A1</td>
<td>5</td>
<td>6</td>
<td>75</td>
<td>375</td>
<td>Fiber container Crated.</td>
</tr>
<tr>
<td>Charge propelling, 24, (White), for 155 mm How. A1</td>
<td>9</td>
<td>3</td>
<td>79</td>
<td>721</td>
<td>Fiber container Crated.</td>
</tr>
<tr>
<td>Fuse, 1.5, M1211 with M2131 Scooter</td>
<td>3</td>
<td>25</td>
<td>77</td>
<td>221</td>
<td>Boxes</td>
</tr>
<tr>
<td>Primer, percussion, 21 Grain, Mk 11A1</td>
<td>2</td>
<td>50</td>
<td>2</td>
<td>4</td>
<td>Tin containers</td>
</tr>
</tbody>
</table>

Total weight of ammunition components for 155 mm How., A1: 6,782 lbs.
TRUCK, 3/4 TON, 4x4 ARRIER, W/WINCH

Dashboard

Chassis: 3065 lbs. Total
a. 2615 lbs. in D
b. 1150 lbs. in E

Body, Fenders, etc.
950 lbs. in F

Rear Axle
450 lbs.

Spare Wheel
150 lbs.

C-47
R4D-1, a-5

C. of G. - 35.6 Index Units
Cargo Weight - 5515 lbs.

EXTERNAL STORAGE
PACKS - FORWARD
PROPS - REAR
CENTER
REAR

FWD - NO SCALE REQUIRED

TEST NO. 52
MEMORANDUM FOR Director, Defense Technical Information Center,  
ATTN: DTIC-RSM (FOIA 98-93) (Kelly Akers),  
8725 John Kingman Road, STE 0944, Fort Belvoir,  
VA 22060-6218  

SUBJECT: FOIA Request for First Report on Determination of Possible Movement of Corps  
and Division Artillery Utilizing C-47, B-17, and B-24 Air Planes (ATI 40075)  

1. We have released the report to the requestor:  
   Mr. Ian D. W. Sutherland, First Assistant Prosecuting Attorney  
   Courthouse  
   100 Court Street  
   Jackson, Missouri 63755  

2. Please remove the distribution limitation from the report.  

3. Point of contact for this action is David A. O'Steen, (410) 278-2350.  

FOR THE COMMANDER:  

JUDITH L. SHELLEY  
Director of Services  

CF:  
AMSTE-TM-I (Mrs. Matthews)  
Department of the Army Freedom of Information and Privacy Acts Office  
(Ms. Christensen)