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REPORT

of

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THE ARMY AIR FORCES BOARD

ORLANDO, FLORIDA

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TESTS CONDUCTED BY

AAF PROVING GROUND COMMAND

EGLIN FIELD, FLORIDA

94-01880
6/1/95

SUBJECT

TEST OF TALL BOY BOMB INSTALLATION IN B-29 AIRPLANE
(S. T. NO. I-45-22)

Project 4P6 1-45-22

PROJECT No 4474C471.6

DATE

COPY No. 162

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30 June 1945

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TEST OF TALL BOY BOMB INSTALLATION IN B-29 AIRPLANE
(S. T. NO. 1-45-22)

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By Authority of the
President AAF Bd

30 June 1945 JAK
Date Initials

THE ARMY AIR FORCES BOARD
Orlando, Florida

30 June 1945

ARMY AIR FORCES BOARD PROJECT NO. 4474C471.6

TEST OF TALL BOY BOMB INSTALLATION IN B-29 AIRPLANE
(S. T. NO. 1-45-22)

1. Inclosed herewith is copy of final report of the AAF Proving Ground Command, Eglin Field, Florida, dated 15 June 1945, subject as above.

2. This project was initiated at the request of the Air Technical Service Command, 24 February 1945.

3. The AAF Board concurs in the conclusions and recommendations of the AAF Proving Ground Command as stated in the above report, except for the following:

a. It is the opinion of the AAF Board that the cutaway bomb bay doors in their present form are unsatisfactory.

b. The reduction in airplane performance after the "Tall Boy" bomb has been released is excessive. Present tests have shown that the original estimates in this respect, as stated in preliminary report on subject project, dated 27 May 1945, were conservative since the reduction in true air miles per fuel gallon has been found to be approximately 5.5 per cent with the bomb on board, and approximately 11.8 per cent without the bomb, for all altitudes tested.

c. The AAF Board strongly recommends re-designing the bomb bay doors so that the gap may be closed after the "Tall Boy" bomb has been released. It is now estimated that the combat radius of the airplane can thereby be increased from 1320 miles to 1500 miles.

4. It is the opinion of the AAF Board that, in the interest of placing these very heavy bombs into combat in the shortest possible time, and due to the limited number of targets and high degree of specialization required by the unit employing these bombs, that for the present only one group of B-29 aircraft should be modified for the installation of the 12,000-lb. "Tall Boy" bomb.

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5. The AAF Proving Ground Command is presently testing a B-29 modified to carry both the 12,000-lb. "Tall Boy" and the 22,000-lb. "Grand Slam" bomb. Should this new installation prove to be functionally reliable, it is believed that this installation would be more desirable than the B-29 modified to carry only the 12,000-lb. "Tall Boy" bomb.

6. The AAF Board recommends that:

a. One B-29 group be immediately equipped for employment of the 12,000-lb. "Tall Boy" bomb.

b. The personnel for this group be chosen with due regard to their past experience and present efficiency.

c. This group be trained as a unit and taken into combat as such.

d. This highly specialized group be employed only for the use of the 12,000-lb. "Tall Boy" bomb.

e. The above recommendations be extended to include the employment of the 22,000-lb. "Grand Slam" bomb by the same aircraft and personnel should the installation mentioned in paragraph 5, above, prove functionally reliable.

7. The AAF Board has completed Project No. 4614A471.6, entitled: "Study of the Requirements, Employment, and Effectiveness of Large Bombs". It is recommended that this report be studied in connection with the inclosed report on the "Tall Boy" bomb installation in the B-29.

8. The AAF Board strongly recommends thorough and complete testing of the 12,000-lb. "Tall Boy" and the 22,000-lb. "Grand Slam" bombs in order to determine their relative effectiveness versus present standard AAF Bombs, and establish whether or not a requirement exists for carrying these very large bombs in all bombardment aircraft which have sufficient load-carrying capacities.

DTIC QUALITY INSPECTED 5

FOR THE ARMY AIR FORCES BOARD:

A. C. STRICKLAND
Brigadier General, U. S. Army
President

OFFICIAL:

Robert C. Walker Jr

ROBERT C. WALKER, Jr.
1st Lt., Air Corps,
Recorder

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Directive From Headquarters

Air Technical Service Command

Dated 24 February 1945

ATSC 452.26

H. E. Rifenbark/hml
Ext. 2-7152

TSENG (TSEPL-2D)

SECRET
AUTH: DIR., ATSC
INITIALS R.E.J.
DATE 24 FEB 1945

Request for Test of Tall Boy Bomb Installation in B-29 Airplane.

The President,
Army Air Forces Board,
Orlando, Florida

1. B-29 Airplane, Serial No. 42-63577, is being modified at the Bell Aircraft Corporation, Marietta, Georgia, to incorporate provisions for hoisting, carrying and releasing one 12,000 pound Tall Boy Bomb. It is desired that functional tests be conducted to determine the suitability of this installation when the modification is completed.

2. This installation has been made in accordance with CTI-2065 Addendum 5, dated 15 December 1944, subject: "Program for Large Bombs in VHB Aircraft", and will make possible the carrying of a longer and heavier bomb than could previously be carried in B-29 aircraft.

3. It is expected that the modified B-29 airplane will be delivered to the Army Air Forces on 22 February 1945. First phase of testing will consist of airplane performance tests to be conducted at Eglin Field by Wright Field personnel. Second phase of testing will consist of functional tests which are covered by Experimental Test Requirements, three copies of which are inclosed.

4. It is recommended that the second phase of testing be conducted by Eglin Field personnel. This will require the use of one flight crew and a ground crew for bomb loading.

5. It is expected that each phase of the test can be completed in a period of two weeks. It will be possible to start the second phase of the test on approximately 22 March 1945, at which time a sufficient number of bombs will be available.

6. The ATSC project engineer for the second phase of this test is Mr. H. E. Rifenbark, Bombing Branch, Armament Laboratory, Engineering Division. Telephone Extension 2-7152.

For the Director:

/s/ F. O. Carroll
F. O. CARROLL,
Brigadier General, U. S. A.
Chief, Engineering Division

1 Incl:
Test Req. & Manual (in trip.) Not Included

Distribution per Office
Memorandum No. 181-1.

Field Test Report

Army Air Forces Proving Ground Command

HEADQUARTERS
ARMY AIR FORCES PROVING GROUND COMMAND
Eglin Field, Florida.

SECRET
Auth. of
CO AFPGC
6-16-45 JEC
Date Initial

FINAL REPORT

ON

TEST OF TALL BOY BOMB INSTALLATION IN B-29 AIRPLANE.

Serial No. 1-45-22 No. of Pages: 12 Date: 15 June 1945
AAF Bd. Proj. No. 4474C471.6.

for Floyd H. Wattles, C.O.A.C.
JOHN F. WHITELEY,
Colonel, Air Corps,
Commanding.

S.T.R. 1-45-22 0-1229 26 May 45

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Page No.: 1
AAF Bd. Proj. No. F 4474

1. OBJECT:

To determine the operational suitability of the installation in the B-29 type airplane for hoisting, carrying and releasing one 12,000-lb. Tall Boy bomb.

2. INTRODUCTION:

Description.--The equipment tested was the B-29 airplane, Serial No. 42-63577, modified to incorporate provisions for hoisting, carrying and releasing one 12,000-lb. Tall Boy bomb.

The Tall Boy is a 12,000-lb. bomb, 252 inches long and 38 inches in maximum diameter. The bomb is streamlined in shape and is composed of three major parts: the bomb case, the tail cone, and the cowling. The bomb case has a solid steel nose piece and three fuze wells located in the base plate. The tail cone is attached by studs to the bomb case. Four fins are mounted on the tail cone and are adjusted to a five degree right hand helix. The cowling is located at the junction between the bomb case and the tail cone, and serves to form a smooth contour along the bomb surface. The bomb has no suspension lugs but is provided with a shallow positioning hole 2-1/8 inches in diameter at the center of gravity.

Modification of the B-29 type airplane for installation of the Tall Boy bomb consisted of trimming and strengthening the forward and aft bomb bay doors to provide clearance for the bomb, which is carried half inside and half outside the bomb bay. The fixed panel (under wing) between the fore and aft bomb bays has been reworked and two longitudinal bulkheads have been added to support the cut-out in the fixed panel. Certain items of equipment in this section, such as tubing, oxygen bottles and so forth, have been relocated. The catwalk longitudinal beams have been reinforced with a web approximately six feet long and special vertical stiffeners have been added to provide for satisfactory distribution of loads.

The supporting structure for the bomb is in the form of an "H" frame and is attached by four bolts to special fittings on the reinforced catwalk panel near the front wing spar. This removable structure provides sway bracing, a fore-and-aft centering and load-carrying pin, and fittings for a type A-4 bomb release and D-7 shackle. Two triple-width chains are used to support the load. Each chain is fixed at one end to the "H" frame with a turnbuckle to insure tightness upon installation of the bomb. A retracting device is provided for the chains; it consists of a flexible cable threaded through the chain links and leading to a small control windlass located near the navigator's station.

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Four commercial pendant-type manually operated hoists are used to hoist the bomb. The hoists are suspended from the four ends of the "H" frame and are removed after attachment of the bomb. Two special metal-hoisting slings with chocks are used to support the bomb during hoisting and to position the bomb on the ground prior to hoisting.

3. CONCLUSIONS:

a. The subject modified B-29 airplane is suitable for carrying and releasing one 12,000-lb. Tall Boy bomb.

b. The provisional bombing tables for the 12,000-lb. Tall Boy bomb are satisfactory for operational use.

c. The performance characteristics that may be expected of the subject airplane carrying one Tall Boy bomb are as follows:

(1) At target altitude gross weight, the operational ceiling (300 feet per minute rate of climb) is 27,000 feet density altitude.

(2) Approximately 50 minutes are required to climb from 5,000 feet to the operational ceiling at a starting gross weight of 118,000 pounds. (This gross weight is comparable to that of the normal combat airplane at the start of climb to altitude on a normal high altitude combat mission).

(3) A reduction in true air miles per fuel gallon of approximately 5.5 per cent can be expected with the bomb on board.

(4) A reduction of approximately 11.8 per cent in true air miles per fuel gallon can be expected on the return cruise without the bomb.

(5) Based on the above figures, the maximum radius of action with one Tall Boy bomb and a usable fuel load of 6,600 gallons is 1,320 air miles with a 600 gallon fuel reserve.

(6) No unusual flight characteristics are evident in the airplane with or without the bomb.

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d. The subject airplane is unsuitable for formation flight with conventional B-29 type airplane carrying standard bomb loads.

4. RECOMMENDATIONS:

a. The following changes be made in future conversions of the B-29 airplane for carrying one Tall Boy bomb.

(1) The present chain hoists be replaced by more suitable hoists having at least twice the rated load capacity and requiring less man power to operate.

(2) The bomb support assembly be reversed so that the fixed ends of the bomb support chains are on the left hand side of the support assembly.

(3) A method be devised for covering the gap in the bomb bay doors after the Tall Boy bomb has been released.

(4) Arming solenoids be provided for arming the three Tall Boy bomb tail fuzes.

5. RECORD OF TEST:

a. This test was conducted in accordance with the Test Program, appended as Inclosure 2, with the following exceptions:

(1) The test mission to release the second high explosive bomb was deleted because the bomb was not available.

6. DISCUSSION:

a. Tall Boy Bomb Installation.

(1) Photographs of the subject installation in the B-29 airplane are appended as Inclosure 3.

(2) The support assembly with type A-4 bomb release and type D-7 shackle is satisfactory for carrying and releasing the Tall Boy bomb. The bomb was loaded in the airplane and allowed to remain in place for 48 hours prior to take-off. The airplane was landed with the bomb in place, taxied at high speed and abruptly braked. No shifting of the bomb, slacken-

ing of the support chains or distortion of the support members was noted. There is no evidence of a serious whipping-action being imparted to the bomb support chains at the time of release. It is suggested for future modification of the B-29 airplane that the bomb support mechanism be reversed so that the fixed ends of the bomb support chains are on the left hand side of the support assembly. The tail fins of the Tall Boy bomb are set at a five degree angle to rotate the bomb in a clockwise direction. With the present installation, the bomb is released from the left and it is possible that a small rotating force is applied to the bomb as it rolls off the support chains. This rotating force, though apparently small, is opposite in direction to the rotation of the bomb, and may place an undue strain on the bomb tail section as the slip stream acts on the tail fins to start the bomb rotating in a clockwise direction.

(3) Difficulty was encountered with minor structural failures in the cut-out portion of the under wing panel between the fore and aft bomb bays. Several of the structural members in this section were not sufficiently stressed to withstand the vibration caused by air buffeting when the bomb is not in place. The members were strengthened as shown in the photographs appended as Inclosure 4 and no further difficulty was experienced.

(4) The hoisting arrangement for the bomb was not considered satisfactory for the following reasons:

(a) Each of the four hoists has a rated load capacity of only 3,000-lbs., which does not allow a sufficient safety factor.

(b) Two men are required to operate each of the four hoists and one man is needed to direct the hoisting and center the bomb in the rack.

The bomb hoisting procedure with the chain-fall hoists is not smooth; consequently, the load on each of the hoists has a tendency to shift overloads to one or more of the hoists. As shown in the photographs of the loading procedure (Inclosure 5), the men operating

the hoists are in a dangerous position in the event of a hoist failure. To give adequate safety, each hoist should have a rated load capacity of at least three tons, plus an additional operating overload capacity of three tons, and require less man power to operate.

(5) Trimming the bomb bay door to conform to the contour of the Tall Boy bomb does not appreciably affect operation of the doors. Two door malfunctions were encountered; one was the result of a failure of the rear bomb bay door limit switch and the other was a failure of a pressure line valve. Neither of the malfunctions was directly attributed to the Tall Boy bomb installation.

(6) The only method for arming the Tall Boy bomb is the arming feature incorporated in the type D-7 shackle. This is not considered satisfactory because the distance from the arming wire access hole in the bomb tail section to the shackle is approximately five feet; and the fabrication of a special arming wire is required. Arming solenoids located in the vicinity of the access hole are believed essential for each of the three tail fuzes.

(7) Approximately 48 man hours were required to remove the Tall Boy bomb installation and return the airplane to conventional B-29 configuration. This time included removing the bomb support assembly, tail sway braces, bomb bay fuel tanks, covering the cut-out portion in the center section between bomb bays and replacing the normal doors and bomb shackles. Photographs of the bomb bay with the Tall Boy bomb installation removed are appended as Inclosure 6. A test was conducted to determine whether the change in the center section changed the air flow in the bomb bay of the airplane, and whether the change had affected standard bomb flight characteristics. A full load of 40 M38A2 practice bombs singly-suspended was released from 5,000 feet. There are no indications in the photographs and bomb plots that the change in the center section between the bomb bays causes additional adverse effects on the bomb flight characteristics.

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b. Bomb Loading.

(1) The method used for loading the Tall Boy bomb is shown by steps in the photographs appended as Inclosure 5. This was determined to be the most suitable method for loading the bomb utilizing standard AAF equipment. Using this method, nine men required 50 minutes to load the bomb.

(2) The center of gravity of the Tall Boy bomb is foreward of the center of gravity of the airplane. This necessitates carrying an auxility fuel tank in the rear bomb bay to restore the center of gravity of the loaded airplane to its normal position, and prohibits carrying standard type bombs on the conventional bomb racks. If the sway braces for the tail section of the Tall Boy bomb could be removed, both the fore and aft bomb racks in the rear bomb bay could be loaded with standard type bombs to adjust the center of gravity of the airplane. They could be released after the Tall Boy bomb on short combat operational flights. Subsequent tests will be accomplished on the B-29 airplane modified to carry either the Tall Boy or Grand Slam bomb to determine whether this operational procedure can be recommended.

c. Airplane Performance.

(1) Maximum continuous power climbs were made from a density altitude of 5,000 feet to service ceiling, starting at a gross weight of 118,000 pounds. (Gross weight comparable to that of a normal combat airplane at start of climb to altitude on a combat operational mission.) The climbs were plotted in terms of altitude vs. time, and the point at which the rate of climb fell to 300 feet per minute was taken as the operational ceiling of the airplane. In each case the operational ceiling was found to be 27,000 feet density altitude, plus or minus 200 feet. In each of the climbs 50 minutes plus or minus one minute were required to reach the operational ceiling. This time is approximately 15 minutes longer than is required by a conventional B-29 type airplane to reach the same altitude.

Moreover, the operational ceiling of the B-29 airplane carrying the Tall Boy bomb is reduced from that of a conventional airplane by approximately 3,000 feet.

(2) The reduction in true air miles per fuel gallon at all altitudes is approximately 5.5 per cent with the bomb on board and approximately 11.8 per cent without the bomb. These figures are based on a direct comparison of the subject airplane equipped to carry the Tall Boy bomb and the same airplane with standard bomb bay doors and bomb racks. However, the airplane had no test instrumentation and was flown approximately 40 hours between the comparison test flights to determine the performance cost of the Tall Boy bomb installation. An attempt has been made to obtain as valid figures as possible for the performance loss with the Tall Boy installation, but no absolute values can be quoted. On this basis of comparison, with reservations as noted, the abovementioned reductions in true air miles can be expected. It can be seen that the cavity remaining after releasing the bomb is approximately twice as costly in speed and fuel as the bomb itself. It is believed highly important that some method be devised to cover the gap left in the bomb bay doors.

(3) An actual range mission was not flown to determine the maximum radius of action of the B-29 carrying one Tall Boy. However, on the basis of a limiting take-off gross weight of 135,000 pounds, a reasonable radius of action was computed to be 1,320 air miles. This figure is based on the fact that, with the mentioned take-off weight limitation, it is impossible to have more than 6,600 gallons of usable fuel after allowing for a 600 gallon fuel reserve. The abovementioned reductions in true air miles per fuel gallon and the 6,600 gallons of available fuel make such a radius of action possible. It should again be pointed out that the gap left in the bomb bay doors without the bomb on board is the major factor limiting range.

(4) All normal types of operational flying were accomplished with the subject airplane both with and without the

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bomb in place. No unusual flight characteristics were noted other than the necessity of using relatively high power settings for a given air speed and the inability of the airplane to reach 30,000 feet easily. The airplane has a tendency to nose up on bomb release which requires retrimming the elevators. However, the change in attitude is not serious. Measurement of Ballistic Camera plates indicated that the airplane gained 100 feet over a period of six seconds after the Tall Boy bomb had been released at 30,000 feet altitude.

(5) The large gap in the bomb bay doors and in the center section of the airplane after the Tall Boy bomb has been released is extremely undesirable from an aerodynamic point of view, inasmuch as the internal drag of the airplane is greatly increased. It is believed that it would be possible to increase the radius of action of the airplane to at least 1,500 air miles if some means of covering the gap in the bomb bay doors could be devised. It is realized that any such device will increase the basic weight of the airplane. However, such an increase in weight would be preferable to the present large increase in drag without the bomb in place.

(6) The basic differences in performance between the B-29 airplane modified to carry the Tall Boy bomb and the standard B-29 type airplane prohibit flying the two airplanes together on combat operational flights.

d. Tall Boy Bomb Characteristics.

(1) The bombing accuracy obtained with the Tall Boy bomb was exceptionally good. Fourteen inert bombs sand-loaded to weight were released from the B-29 airplane. The average circular error for all inert bombs was 7.27 mils. The average circular error for two bombs released at 10,000 feet was 5.06 mils. The average circular error for seven bombs released at 20,000 feet was 9.3 mils. The average circular error for five bombs released at 30,000 feet was 5.3 mils. A record of the above releases is appended as Inclosure 7.

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(2) Several of the Tall Boy bombs were observed to have yawing characteristics. However, it is apparent from the high bombing accuracy attained that the yawing characteristic does not appreciably affect the accuracy of the bomb.

(3) To determine and compare bomb penetration, two inert Tall Boy, two inert 2000-lb. G.P. and two inert 2000-lb. S.A.P. bombs were released on a sandy soil range from 10,000 feet and recovered. All bombs were located in an area within a 300 foot radius; soil characteristics were approximately the same throughout the area. The Tall Boy bombs penetrated the sandy soil to a depth of 23.2 feet and 26.2 feet, and the angle of rest of the bombs was 8.5 degrees and 21 degrees from the horizontal, respectively. The 2000-lb. G.P. bombs penetrated to a depth of 13.2 feet and 15.6 feet. The angle of rest from the horizontal was 29.5 degrees and 80 degrees respectively. The 2000-lb. S.A.P. bomb penetrated the sandy soil to a depth of 14.8 feet and 16.9 feet. The angle of rest from the horizontal was 25.5 degrees and 39 degrees respectively.

(4) One high explosive Tall Boy bomb (torpex D-1) fuzed with a Mk-58 pistol and Mk-1 detonator (.14 seconds delay) was released onto a sandy soil range. The bomb detonated high order with proper delay. Crater dimensions and volume of earth displaced will be included in S. T. 1-45-43, AAF Board Project No. F 4664, "Test of Tall Boy and Grand Slam Installation in B-29 Airplane."

(5) Range bombing data for all releases of the Tall Boy bomb has been forwarded to the Ballistic Research Laboratory, Aberdeen Proving Ground, for computation of ballistic data and verification of the provisional bombing tables. Results of test drops to date indicate that the provisional tables are satisfactory for immediate operational use. However, it is suggested that the tables be revised by Aberdeen Proving Ground if discrepancies are found after the range bombing data has been evaluated.

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7. INCLOSURES:

Inclosure 1 - Test Historical Data.
Inclosure 2 - Test Program.
Inclosure 3 - Photographs.
Inclosure 4 - Photographs.
Inclosure 5 - Photographs.
Inclosure 6 - Photographs.
Inclosure 7 - Bomb Release Chart.
Inclosure 8 - Photographs.

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TEST HISTORICAL DATA

1. INTRODUCTION:

This test was requested by 1st Indorsement, AAF Board, Orlando, Florida, dated 5 March 1945, to Commanding General, AFPOC, Eglin Field, Florida, to letter, ATSC, Wright Field, Dayton, Ohio, dated 24 February 1945, to President, AAF Board, Orlando, Florida, subject: "Request for Test of Tall Boy Bomb Installation in B-29 Airplane."

2. DATE OF ACTIVATION:

9 March 1945.

3. DATE EQUIPMENT RECEIVED: B-29 airplane, Serial No. 42-63577, arrived 23 March 1945.

4. DATE TEST PROGRAM STARTED: 20 March 1945.

5. DATE TEST PROGRAM COMPLETED: 17 April 1945.

6. DATE TESTING STARTED: 26 March 1945.

7. DATE TESTING COMPLETED: 5 June 1945.

8. DELAYS: Tests were delayed intermittently due to cloud conditions unfavorable for Ballistic Camera operation.

9. DATE ANALYSIS STARTED: 22 May 1945.

10. DATE ANALYSIS COMPLETED: 25 May 1945.

11. DATE PRELIMINARY REPORT STARTED: 24 May 1945.

12. DATE PRELIMINARY REPORT MAILED: 28 May 1945.

13. DATE FINAL REPORT STARTED: 4 June 1945.

14. DATE FINAL REPORT COMPLETED: 12 June 1945.

15. DATE FINAL REPORT MAILED: 15 June 1945.

16. A) FLYING HOURS: 61:30
    B) GROUND HOURS: 53

Inclosure No. 1
AAF Bd. Proj. No. F 4474

SECRET
By Authority of
CG AFPGC
4/16/45 WSS
Date Initials

Headquarters
ARMY AIR FORCES PROVING GROUND COMMAND
Eglin Field, Florida

17 April 1945

SUBJECT: Program for Test of Tall Boy Bomb Installation in B-29 Airplane. (S.T. No. 1-45-22) AAF Board Project No. F 4474.

TO: Commanding Officer, Flight Test Section, 610th AAF Base Unit, H, Eglin Field, Florida.

1. GENERAL:

a. Description.--The equipment to be tested is a B-29 type airplane modified to incorporate provisions for hoisting, carrying and releasing one 12,000-lb. Tall Boy bomb.

The Tall Boy is a 12,000-lb. bomb, 252 inches long and 38 inches in maximum diameter. The bomb is streamlined in shape and is composed of three major parts; the bomb case, the tail cone, and the cowling. The bomb case has a solid steel nose piece and three mechanical-type tail fuzes fitted into the base plate. The tail cone is attached by studs to the bomb case. Four fins are mounted on the tail cone and are adjusted to a five degree right hand helix. The cowling is located at the junction between the bomb case and the tail cone, and serves to form a smooth contour along the bomb surface. The bomb has no suspension lugs but is provided with a shallow positioning hole 2-1/8 inches in diameter at the center of gravity.

Modification of the B-29 type airplane for installation of the Tall Boy bomb consisted of trimming and strengthening the forward and aft bomb bay doors to provide clearance for the bomb, which is carried half inside and half outside the bomb bay. The fixed panel (under wing) between the fore and aft bomb bays has been reworked and two longitudinal bulkheads have been added to support the cut-out in the fixed panel. Certain items of equipment in this section, such as tubing, oxygen bottles and so forth, have been relocated. The catwalk longitudinal beams have been reinforced with a web approximately six feet long and special vertical stiffeners have been added to provide for satisfactory distribution of loads.

The supporting structure for the bomb is in the form of a

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"H" frame and is attached by four bolts to special fittings on the reinforced catwalk panel near the front wing spar. This removable structure provides sway bracing, a fore-and-aft centering and load-carrying pin, and fittings for a type A-4 bomb release and D-7 shackle. Two triple-width chains are used to support the load. Each chain is fixed at one end to the "H" frame with a turnbuckle to insure tightness upon installation of the bomb. A retracting device is provided for the chains; it consists of a flexible cable threaded through the chain links and leading to a small control windlass located near the navigator's station.

Four commercial pendant-type mechanically-operated hoists are used to hoist the bomb. The hoists are suspended from the "H" frame and are removed after attachment of the bomb. Two special metal-hoisting slings with removable chocks are used to support the bomb during hoisting and to position the bomb on the ground prior to hoisting.

b. Priority: FIRST.

c. Project Officer: Major James C. Barclay.

d. Test Officer: Lt. C. D. Becnel.

2. OBJECT:

a. To determine the operational suitability of the installation in the B-29 type airplane for hoisting, carrying and releasing one 12,000-lb. Tall Boy bomb.

b. To determine the performance of the modified B-29 type airplane.

c. To obtain range bombing data for computation of ballistic data and verification of provisional bombing tables for the 12,000-lb. Tall Boy bomb.

3. METHOD OF CONDUCTING TEST:

a. Preliminary Phase.

(1) The following instruments will be removed and calibrated:

(a) All air speed indicators.

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(b) All altimeters.

(c) All free air temperature gages.

(2) The airplane will be weighed under the following load condition:

(a) Full fuel load (main wing tanks only).

(b) Full oil load.

(c) No bombs or ammunition.

The temperature and specific gravity of fuel in tanks at the time of weighing will be determined.

(3) The airplane will be flown under the following load condition to calibrate the air speed system:

(a) Full fuel load (main wing tanks only).

(b) Full oil load.

(c) Full ammunition load.

(4) An empty Tall Boy bomb will be test-loaded in the airplane to familiarize personnel with the installation and with the correct procedure for loading and unloading the bomb. The following factors will be checked for suitability:

(a) Supporting structure ("H" frame).

(b) Release mechanism.

(c) Hoisting equipment.

(d) Bomb bay door operation.

(e) Bomb bay door clearance around contour of bomb.

(f) Bomb tail fin clearance.

(5) A Tall Boy bomb, sand-loaded to weight, will be loaded in the airplane and the following tests will be accomplished:

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(a) Brakes will be applied while the airplane is taxiing at various speeds. Test personnel will note any shifting of the bomb or slackening of the support chains.

(b) The bomb, without tail section, will be released from the airplane over a sand pit. The action of the support chains will be carefully observed.

b. Main Phase:

(1) The airplane will be flown under the following conditions:

(a) Load:

1. Fuel - 4200 gallons.

2. Oil - 340 gallons.

3. Bombs - none.

4. Ammunition - 6,000 rounds cal. .50.

5. Crew - complete (11 men).

(b) Method:

Take-off and climb immediately to 30,000 feet pressure altitude. Upon arrival at altitude a stabilized speed run will be made at maximum continuous power (42.5"mp and 2400 rpm). Following this speed run, a let-down will be made to 20,000 feet. This let-down will be made at 200 feet/minute and 190 mph IAS. The power setting required to hold this IAS and rate of descent will be determined. After reaching 20,000 feet pressure altitude, the power setting necessary to hold 195 mph IAS in level flight will be determined. The following data will be recorded on all speed runs and during the let-down:

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1. IAS.

2. MP and RPM.

3. FAT.

4. Pressure altitude.

5. Cowl flap position and intercooler flap position.

6. Cylinder head temperature

7. Carburetor air temperature.

8. Duration of speed run.

9. During let-down, time at start of let-down and upon arrival at 20,000 feet will be recorded.

(2) The airplane will be flown under the following conditions:

(a) Load:

1. Fuel - 6300 gallons (full main wing tanks plus 830 gallons in center section).

2. Oil - 340 gallons.

3. Bombs - None.

4. Ammunition - 6000 rounds cal. .50.

5. Crew - complete (11 men).

(b) Method:

Take-off and climb to 5,000 feet. Upon arrival at 5,000 feet pressure altitude, a stabilized speed run will be made. The power setting necessary to maintain an IAS of 205 mph will be determined. All pertinent data as stipulated under paragraph b. (1) (b), above, will be recorded.

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(3) The airplane will be flown under the following conditions:

(a) Load:

1. Fuel - 4300 gallons (600 gallons in aft bomb bay tank plus 3700 gallons in main wing tanks.)

2. Oil - 340 gallons.

3. Bombs - one Tall Boy bomb.

4. Ammunition - 6000 rounds cal. .50.

5. Crew - complete (11 men).

(b) Method:

Take-off and climb to 5,000 feet pressure altitude. Upon arrival at altitude determine the power setting necessary to maintain level flight at 205 mph IAS. Following this speed run, a climb will be made to 30,000 feet pressure altitude. All data required under paragraph b. (1) (b), above will be recorded. In addition, the time at the start of climb and at each 1,000 feet during the climb will be recorded. The FAT will be recorded at 5,000, 10,000, 15,000, 20,000, 25,000 and 30,000 feet during climb. The airplane will be climbed at 195 mph IAS and 2400 RPM and 42.5" MP. After reaching 30,000 feet, a speed run will be made at 2300 RPM and 39" MP. All pertinent data stipulated above will be recorded. Following this speed run the airplane will let-down and land with the bomb on board.

(4) The following aerial test missions will be conducted releasing inert Tail Boy bombs sand-loaded to the correct weight:

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(a) Mission I.

1. Altitude - 10,000 feet.

2. Release - Salvo.

3. IAS - 190 mph.

(b) Mission II.

1. Altitude - 10,000 feet.

2. Release - Selective (Normal).

3. IAS - 190 mph.

(c) Mission III.

1. Altitude - 20,000 feet.

2. Release - Salvo.

3. IAS - 200 mph.

4. Airplane will climb to a FAT altitude below freezing; descend to a FAT altitude above freezing and return to freezing altitude before bomb release.

(d) Mission IV.

1. Altitude - 30,000 feet.

2. Release - Selective (Normal).

3. IAS - 190 mph.

4. Airplane will climb to a FAT altitude below freezing, descend to FAT altitude above freezing and return to freezing altitude before release.

(e) Mission V.

1. Altitude - 10,000 feet.

2. Release - Selective (Normal).

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3. IAS - 220 mph.

(f) A maximum of 20 additional test missions will be conducted to obtain range bombing data for computation of ballistic data and verification of provisional bombing tables for the 12,000-lb. Tall Boy bomb. Tests will be coordinated with representatives of the Ballistic Research Laboratory, Aberdeen Proving Ground, in order that they may obtain and record necessary range bombing data on all releases of the Tall Boy bomb including missions III thru V above. Bombs will be released under the following conditions:

1. Altitude: 30,000 feet (number of releases as necessary to obtain required data).

2. Altitude: 20,000 feet (number of releases as necessary to obtain required data).

3. IAS: 190 mph.

(5) The following aerial test missions will be conducted releasing high explosive Tall Boy bombs.

(a) Mission I.

1. Altitude - 15,000 feet.

2. Release - Selective (Normal).

3. IAS - 190 mph.

(b) Mission II.

1. Altitude - 25,000 feet.

2. Release - Selective (Normal).

3. IAS - 195 mph.

c. Final Phase:

(1) The airplane will be returned to a standard configuration.

(a) Airplane performance tests will be repeated as in the Main Phase, paragraphs 1 and 2.

(b) Aerial test missions will be conducted releasing standard type bombs from the conventional bomb

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rack system to determine whether the Tall Boy modification effects the normal bombing characteristics of the B-29 type airplane.

(2) Two 2,000-lb. G. P. and two 2,000-lb. SAP bombs each will be released on the same target area as the 12,000-lb. Tall Boy bomb. The above bombs will be recovered including two 12,000-lb. Tall Boy bombs to obtain comparative ground penetration data.

4. RECORDS:

a. The following test records will be turned over to the Project Officer upon completion of the test:

(1) Photographic record of the Tall Boy bomb installation in the B-29 type airplane.

(2) Photographic record of the procedure for loading the Tall Boy bomb.

(3) Motion picture records of bomb releases.

(4) Ballistic camera records.

(5) A detailed record of the man-hours required to load the Tall Boy bomb.

(6) A detailed record of the man-hours required to return the airplane to the standard configuration.

(7) An account of all malfunctions of the equipment and possible causes of the malfunctions.

(8) Bombardiers' 12C forms and bomb plots for all bomb releases.

b. All records for computation of ballistic data and verification of the provisional bombing tables for the 12,000-lb. Tall Boy bomb will be turned over to representatives of the Ballistic Research Laboratory, Aberdeen Proving Ground.

c. A daily progress report will be maintained by the Project Officer in the office of the Bombing Projects Section, Proof Division.

BY COMMAND OF BRIGADIER GENERAL GARDNER:

/s/ Alvin E. Hebert
ALVIN E. HEBERT,
Lt. Col., Air Corps,
Chief, Testing Branch.

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Prepared by: /s/ James C. Barclay
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Bombing Projects Section,
Project Officer.

Concurred in: /s/ J. T. Harker
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1st Lt., Air Corps,
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Concurred in: /s/ C. D. Becnel
C. D. BECNEL,
1st Lt., Air Corps,
Flight Test Section,
Test Officer.

Concurred in: /s/ W. F. Joyce
W. F. JOYCE
Captain, Air Corps,
Photographic Section,
Test Officer.

Approved by: /s/ E. F. Stoddard
E. F. STODDARD,
Lt. Col., Air Corps,
Actg. Chief, Bombing Projects Section.

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S.T.R. 1-45-22 G-6197 19 May 45

B-29 airplane ready for take-off loaded with one Tall Boy bomb.

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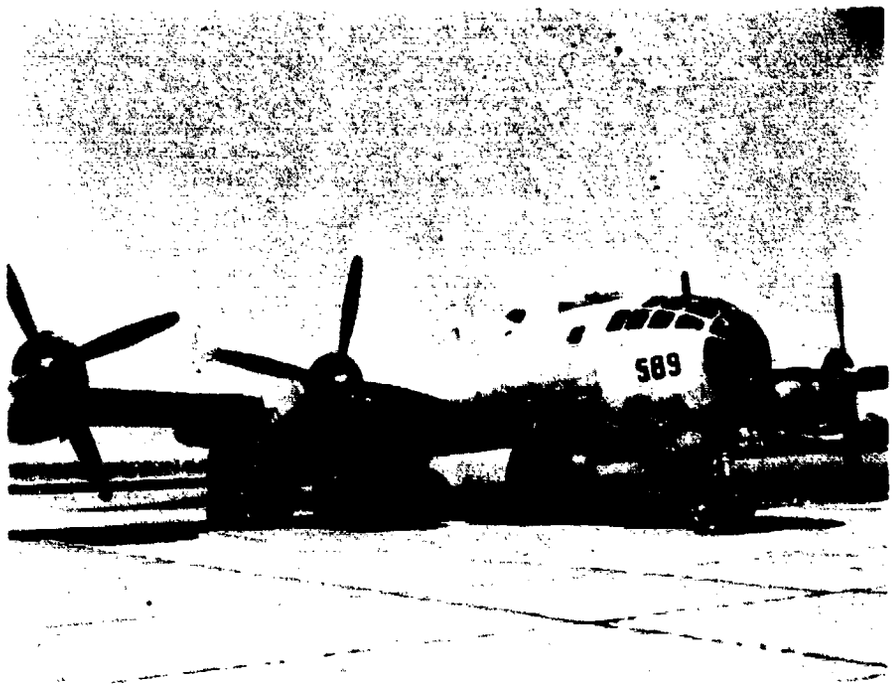

B-29 airplane with Tall Boy bomb in place with bomb bay doors open. Note how the doors are cut to comform to the contour of the bomb.

S.T.R. 1-45-22 G-6194 19 May 45

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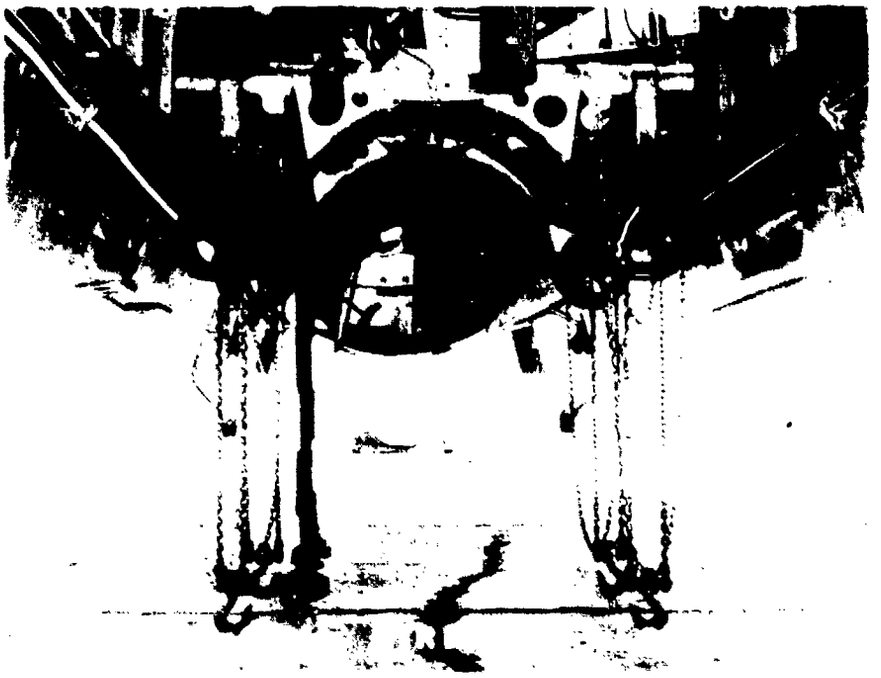
AAF Bd. Proj. No. F 4474



S.T.R. 1-45-22 G-6184 19 May 45

Support assembly for the Tall Boy bomb in the forward bomb bay of the B-29 airplane. The doors in the center section between bomb bays are used to prevent buffeting of the rear bomb bay doors. The doors are in the down position when the bomb is in place. The air blast closes the doors when the bomb is dropped.

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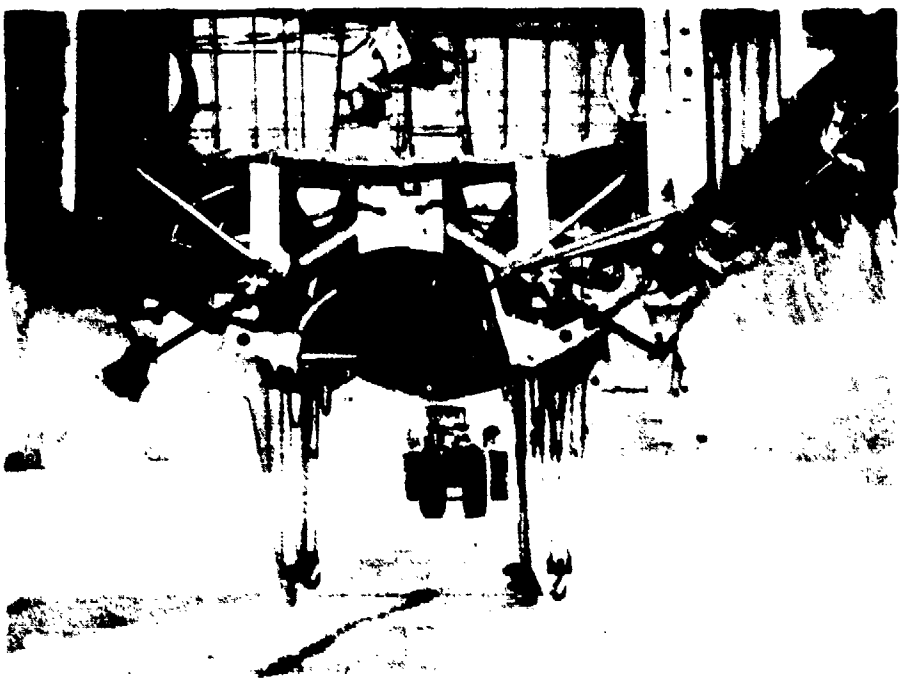

Photograph of the Tall Boy installation from the rear bomb bay. Note bomb tail section sway braces.

S.T.R. 1-45-22 G-6179 19 May 45

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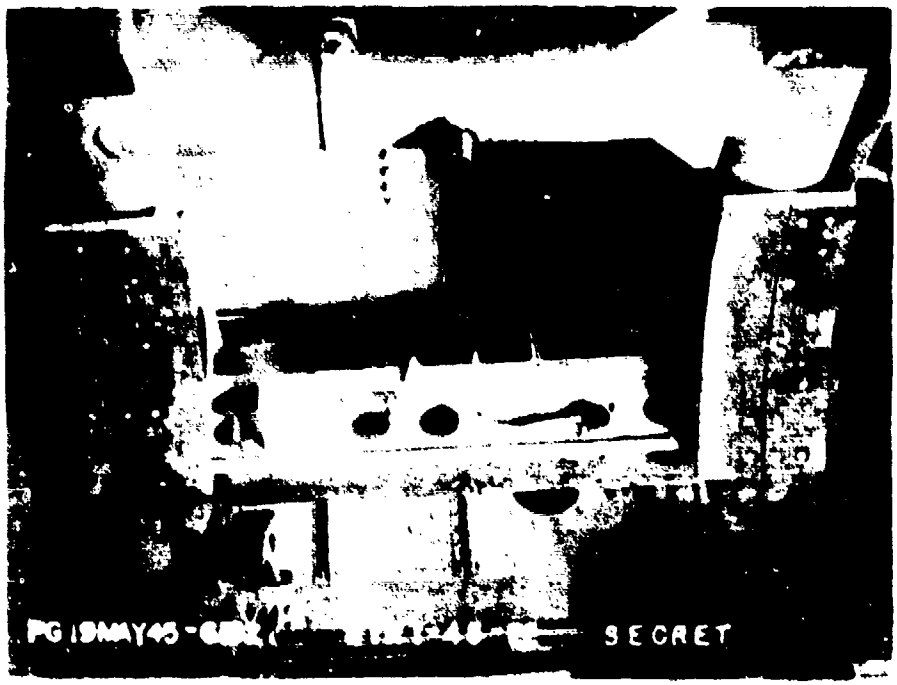

S.T.R. 1-45-22 G-6192 19 May 45

Photograph of the release assembly (A-4 release with D-7 shackle). Note positioning and bomb load carrying pin at the center of "H" frame.

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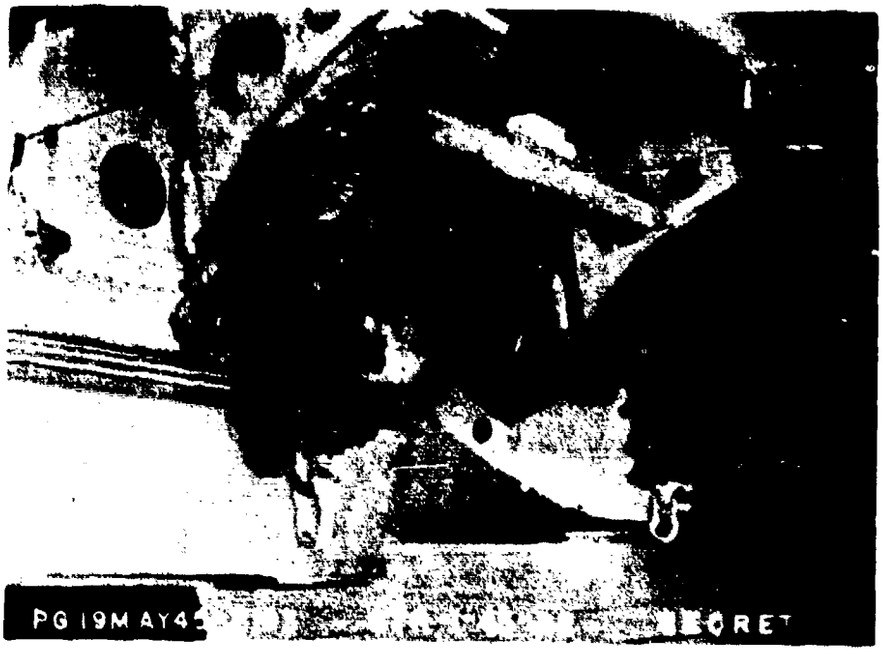

S.T.R. 1-45-22 G-6193 19 May 45

Bomb support chains in the retracted position. A small steel cable is threaded through the support chains and leads to a small windlass in the navigator's compartment.

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S.T.R. 1-45-22 G- 6191 19 May 45

Windlass in the navigator's compartment for retracting the bomb support chains.

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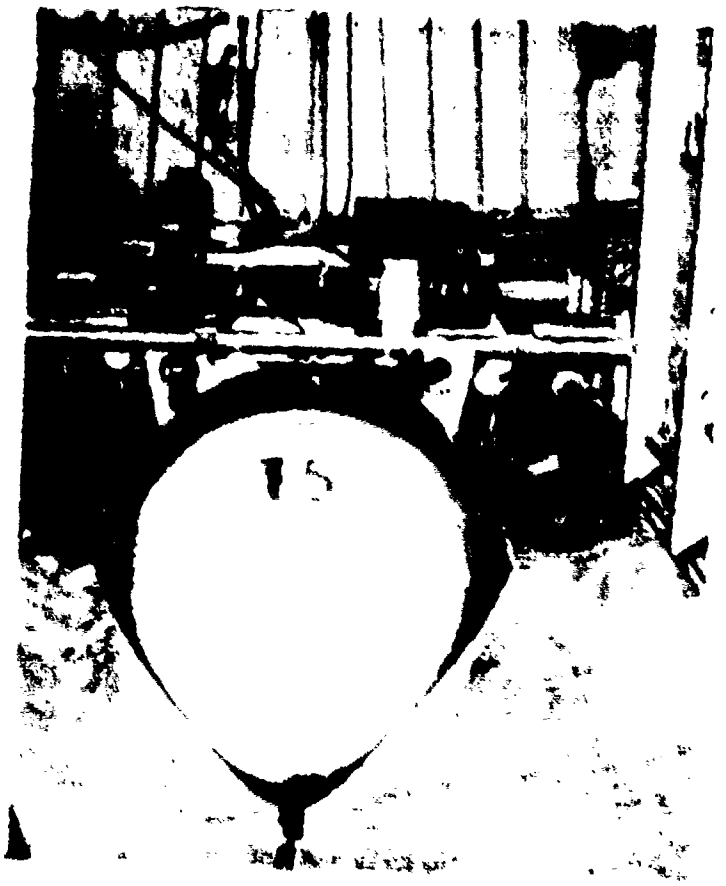

S.T.R. 1-45-22 G-6174 19 May 45

Photograph of the Tall Boy bomb in place with the bomb bay doors closed.

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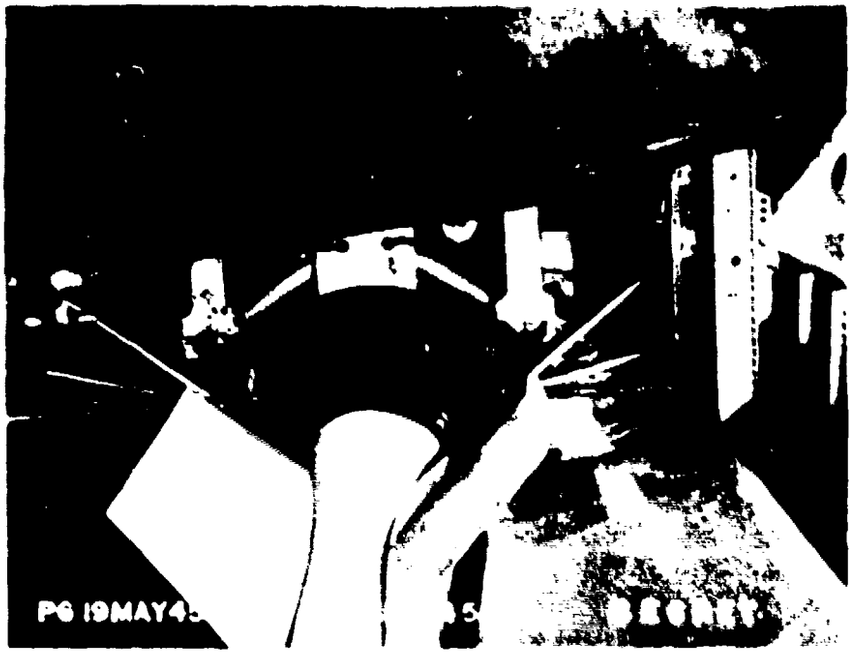

Photograph of the tail section of the Tall Boy bomb in place with the bomb bay doors closed.

S.T.R. 1-45-22 G-6181 19 May 45

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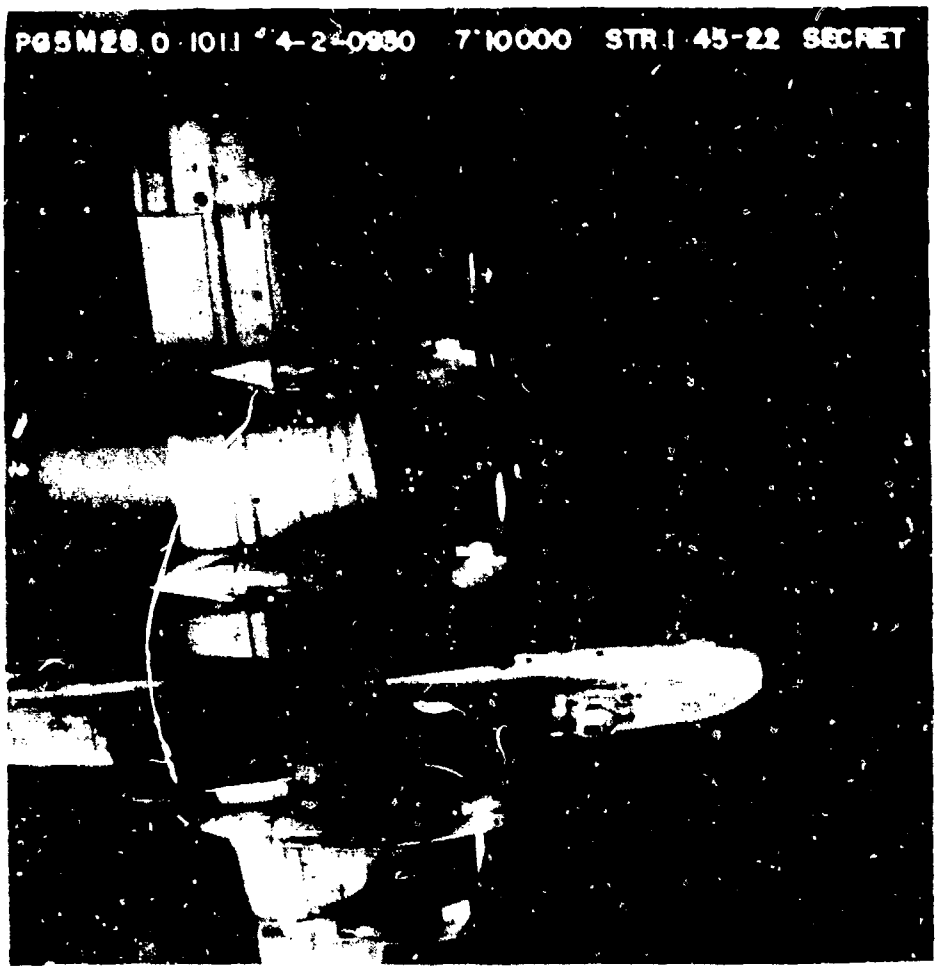

S.T.R. 1-45-22 0-1011 2 Apr 45

Photograph of the B-29 airplane in flight with the bomb bay doors open. Note the position of the Tall Boy bomb in the open bomb bay.

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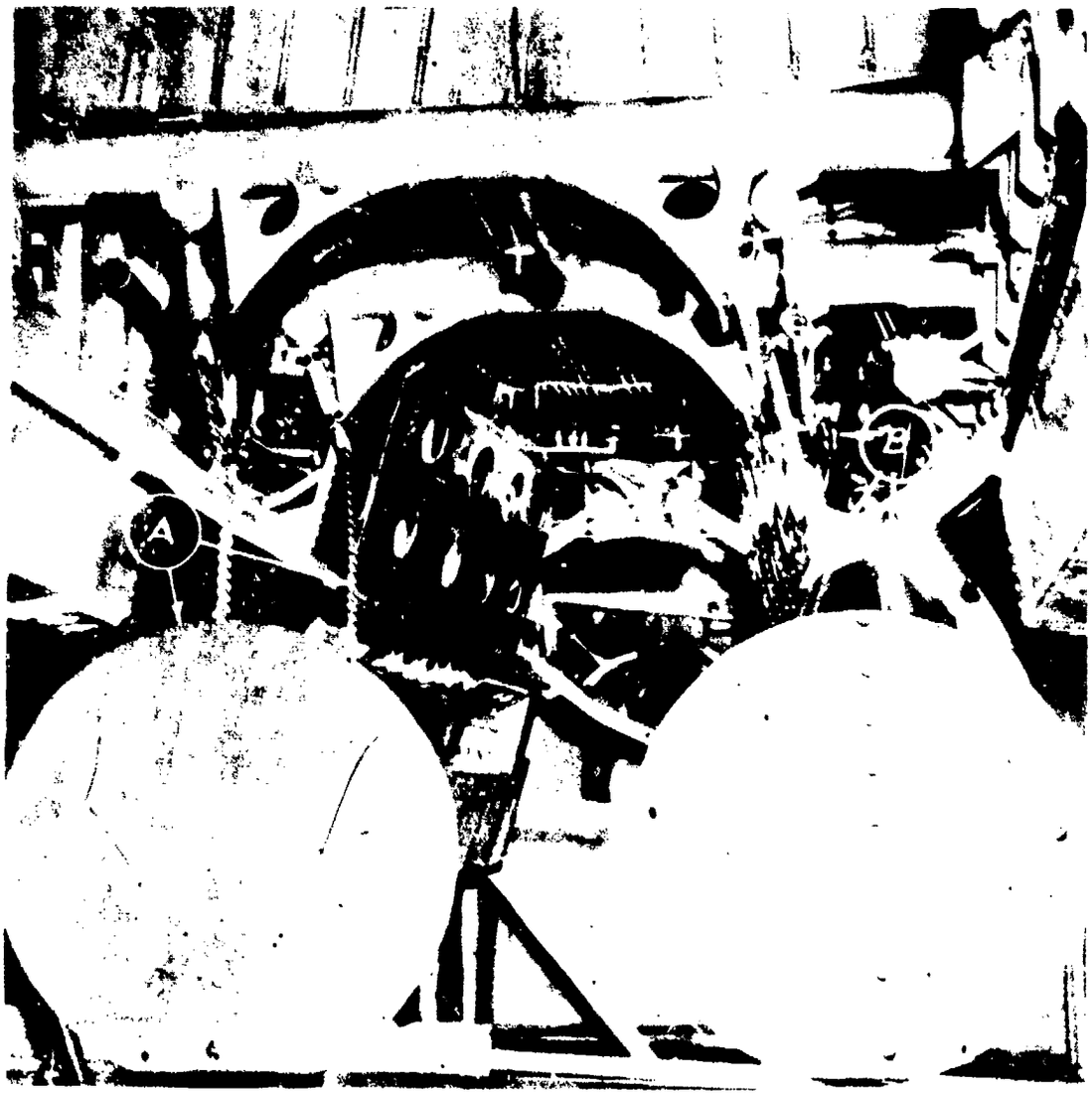

STR. 1-45-22

Photograph of the structural failures at the forward end of the bomb bay center section. This section was strengthened as indicated in page 2 of this inclosure. The failures were the result of air buffeting in this section occurring when the bomb was not in place.

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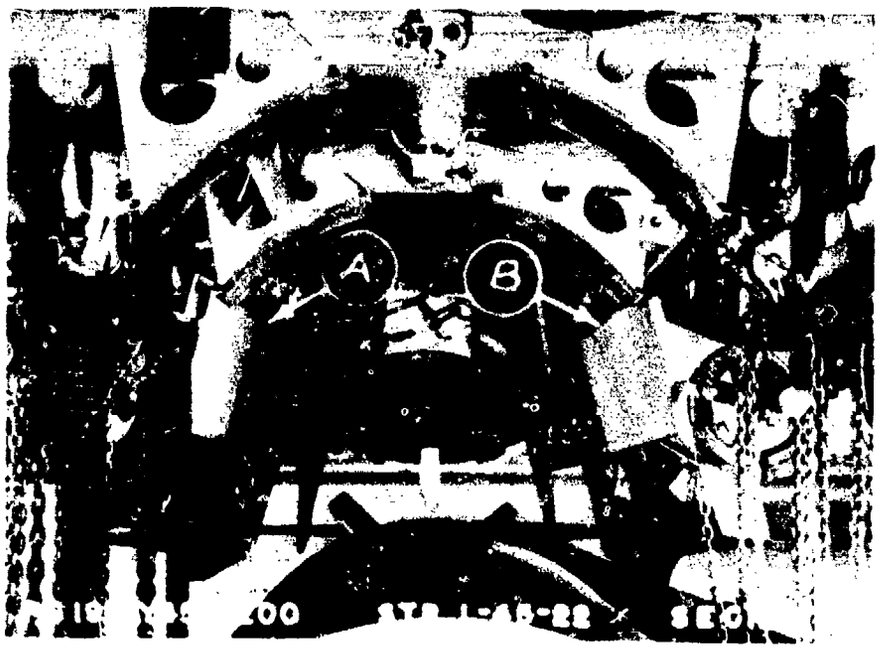

STR. 1-45-22
G-6200 19 May 1945

The center section at points "A" and "B" was reinforced as shown in the above photograph. Additional bracing was also added in back of the longitudinal members.

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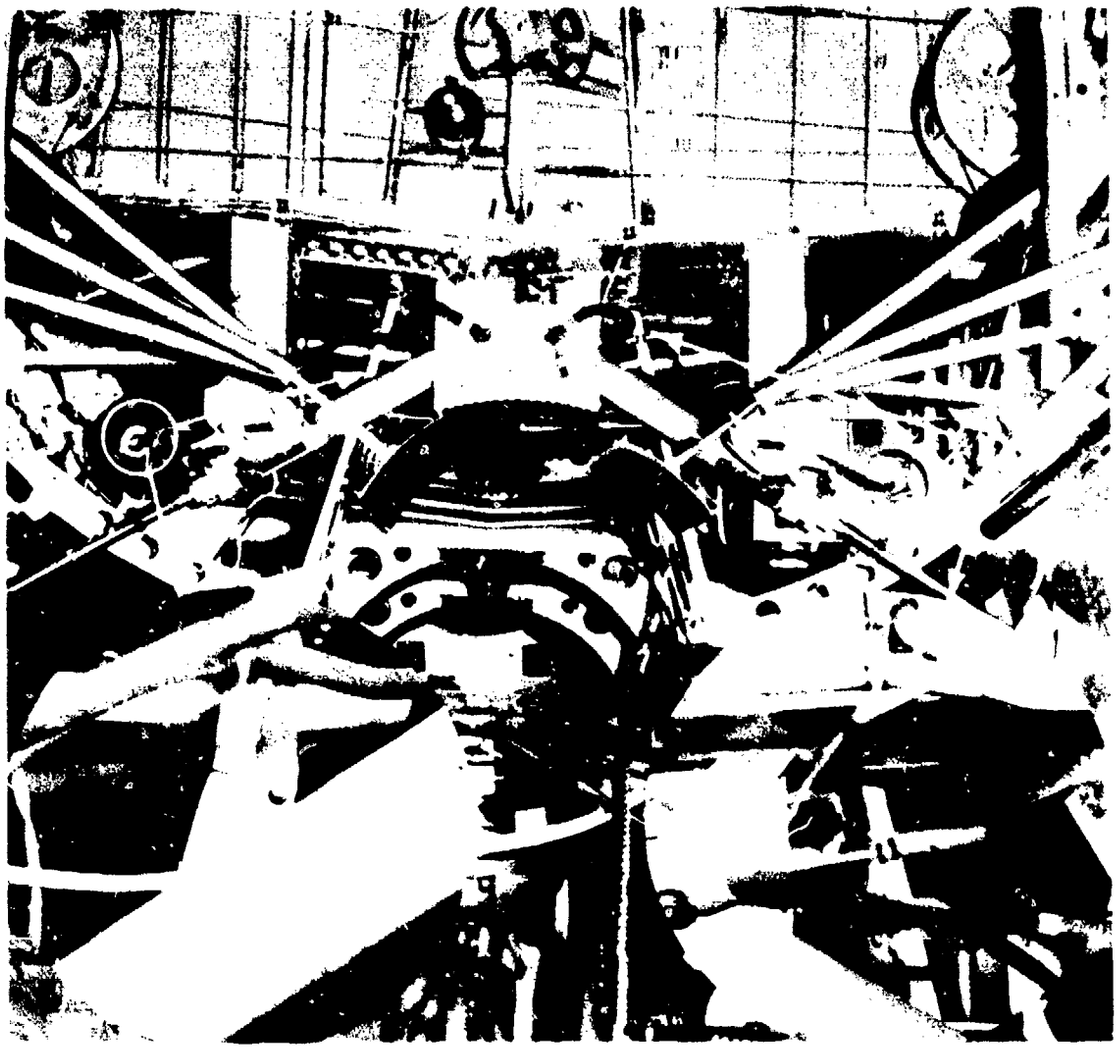

STR. 1-45-22

Photograph of the structural failures at the rear end of the bomb bay center section. The members were reinforced as shown in page 4 of this inclosure.

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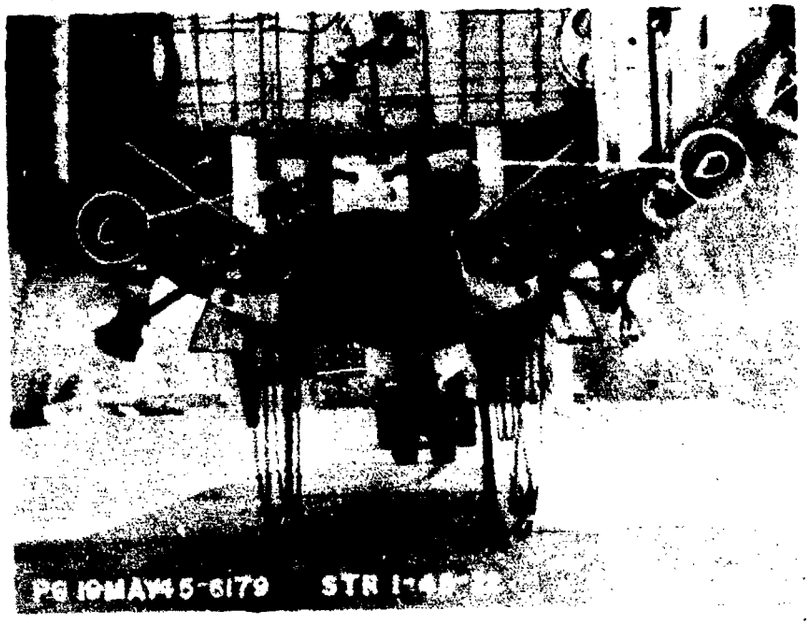

STR. 1-45-22
G-6179 19 May 1945

The points "C" and "D" as shown in the preceding photograph were reinforced as shown in the above photograph.

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S.T.R. 1-45-22 G-6182 19 May 45

The Tall Boy bomb is placed on a low wooden cradle with sufficient clearance to adjust the hoisting slings on the loading ramp directly behind the airplane. This is done by means of a type M-2, 20 ton, mobile crane. The bomb is placed so that the centering hole is directly upward. The airplane is then backed over the bomb as shown in the photograph.

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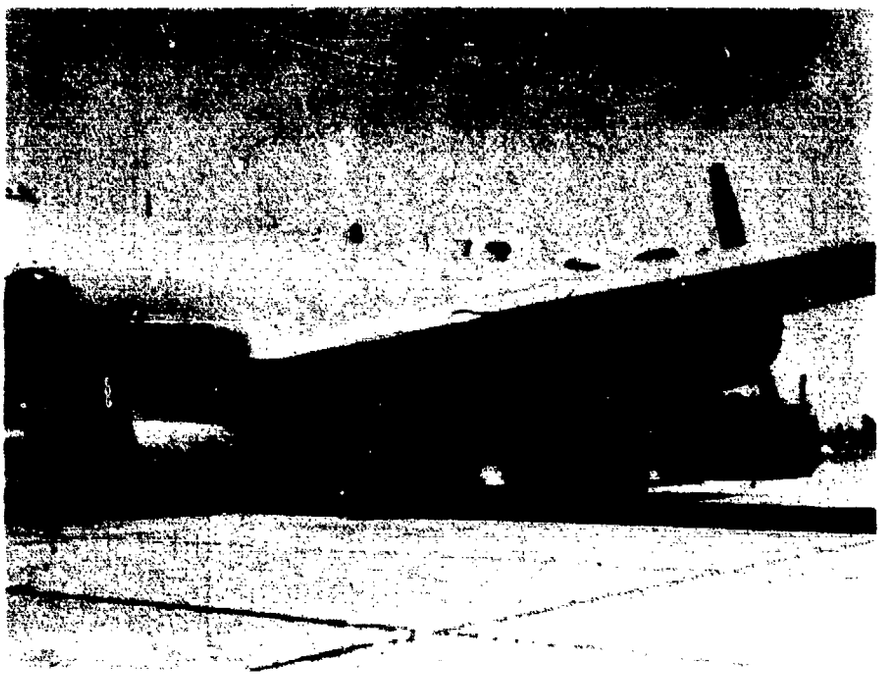

S.T.R. 1-45-22 G-6198 19 May 45

The airplane is backed over the bomb by means of a standard Cletrac.

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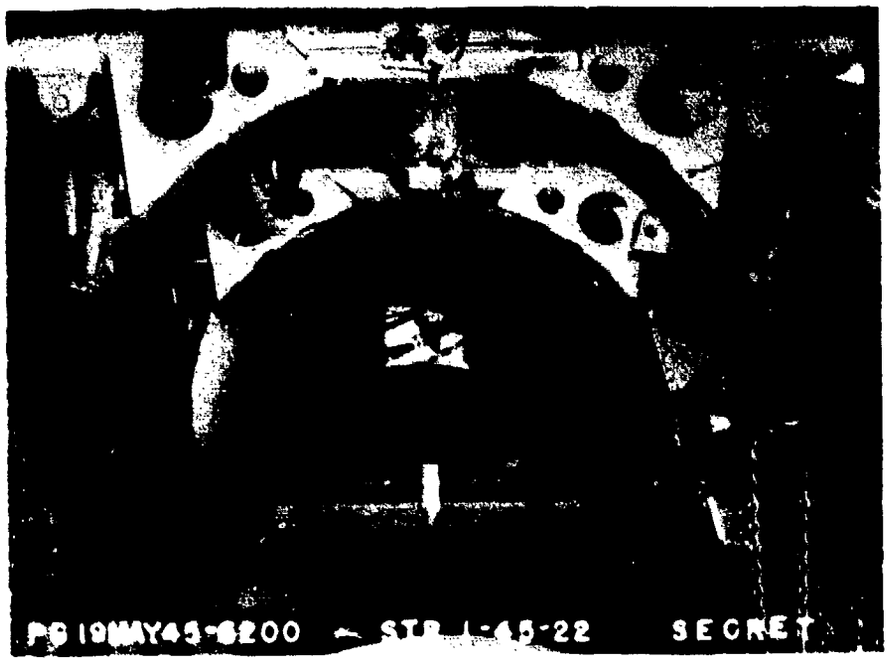

S.T.R. 1-45-22 G-6200 19 May 45

The bomb is positioned by means of a plumb-bob so that the centering pin on the "H" frame is directly above the centering hole in the bomb. The bomb must be exactly centered fore and aft. If the bomb is slightly off to one side, this is automatically corrected as the bomb is lifted out of the wooden cradle with the hoists.

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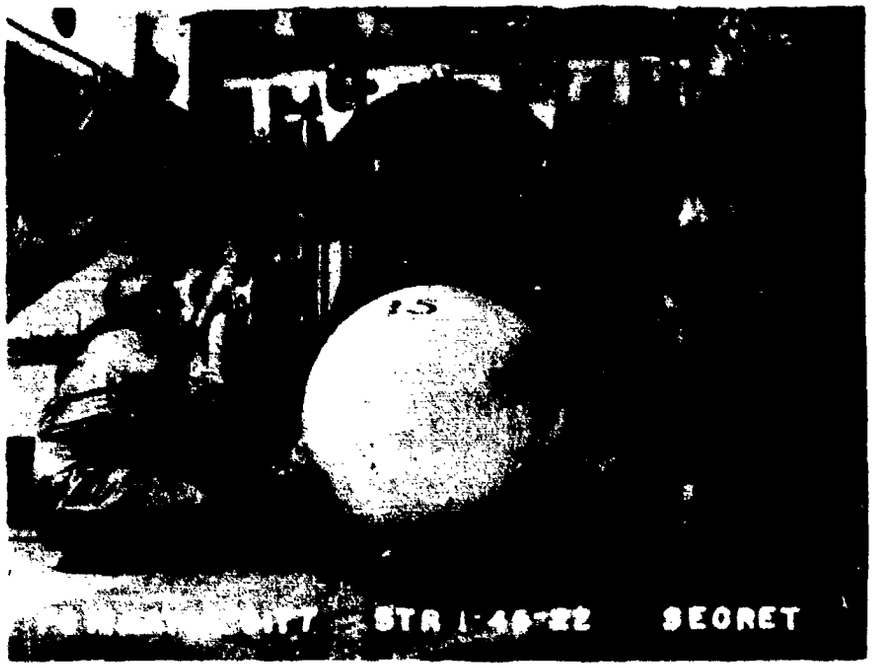

S.T.R. 1-45-22 G-6177 19 May 45

The chain hoists are attached to the hoisting slings. The two slings are positioned so that the center lines of the slings are 15 inches fore and aft of the bomb centering hole.

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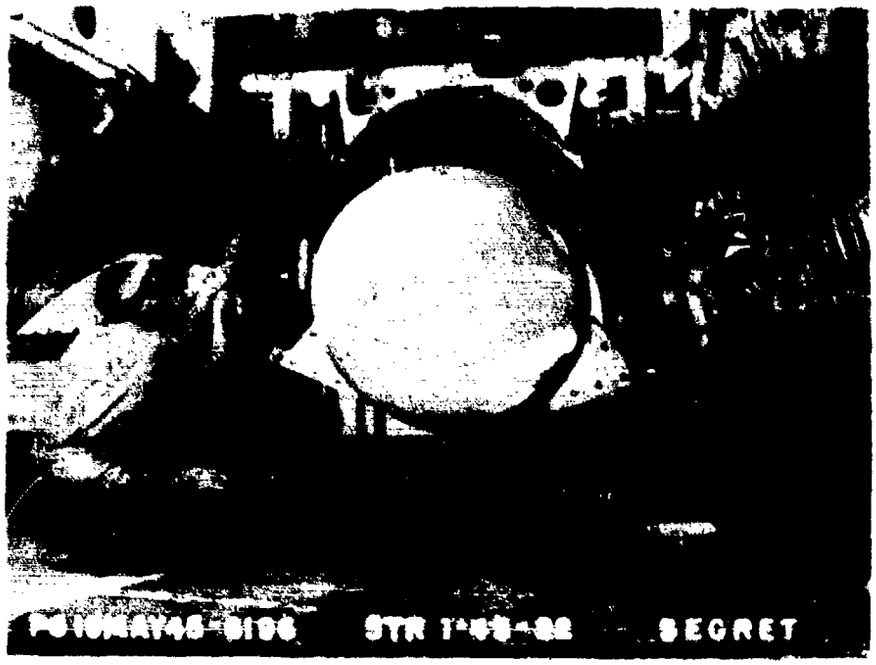

S.T.R. 1-45-22 G-6196 19 May 45

The bomb is then hoisted into position. Two men are required to operate each of the four chain hoists. Note the position of the men in the event of a hoist failure.

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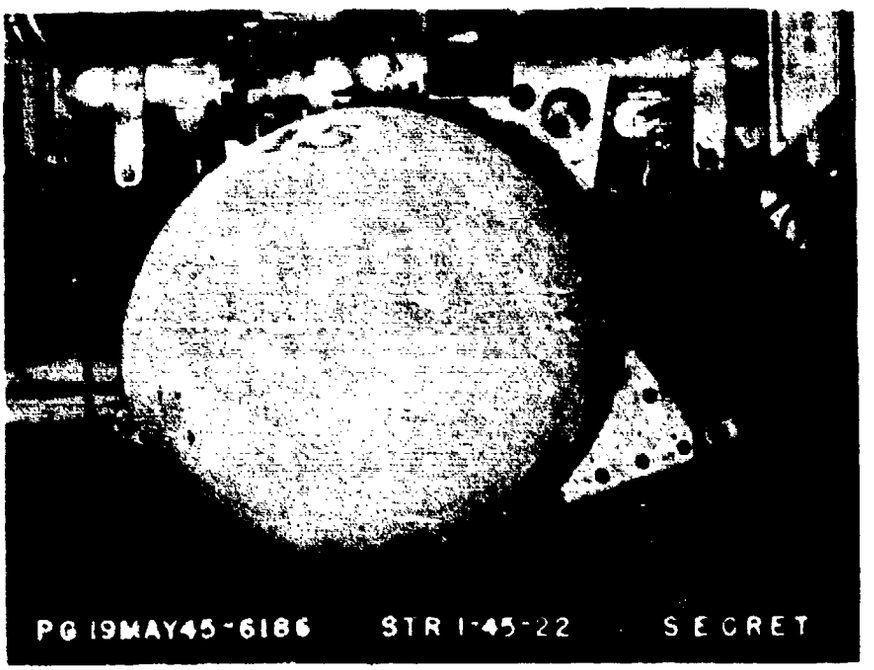

S.T.R. 1-45-22 G-6186 .9 May 45

The bomb is hoisted tight in position in the rack before attachment of bomb support chains.

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S.T.R. 1-15-22 6-6175 19 May 45

The bomb support chains are placed around the bomb and fastened in the D-7 shackle.

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S.T.R. 1-45-22 G-6173 19 May 45

The fixed ends of the bomb support chains are tightened with a ten inch wrench and safetied.

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The sway braces in the rear bomb bay are tightened down against the tail section of the bomb.

S.T.R. 1-45-22 G-6199 19 May 45

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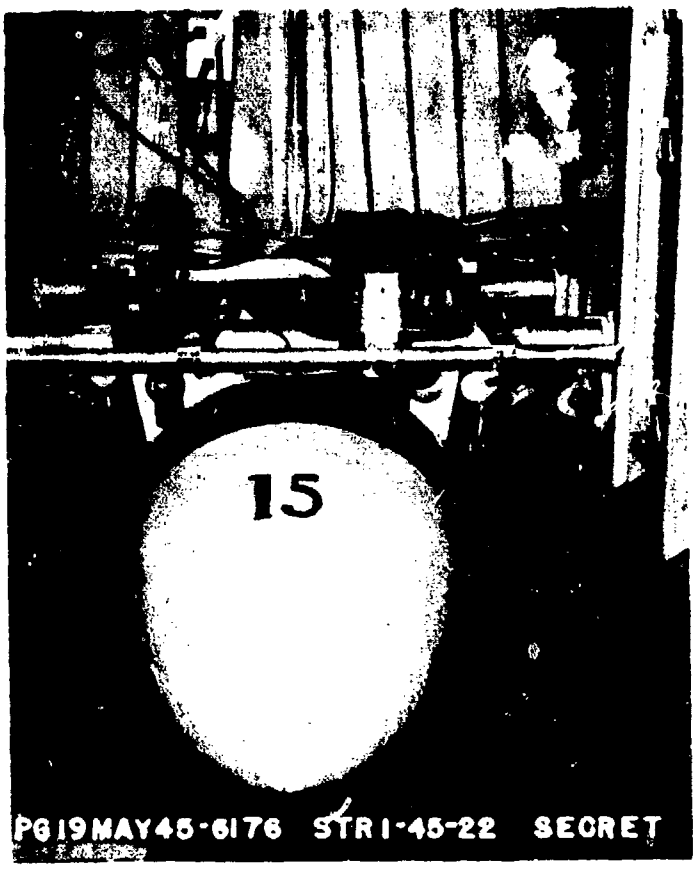

The chain hoists and suspension straps are removed from the "H" frame.

S.T.R. 1-45-22 G-6176 19 May 45

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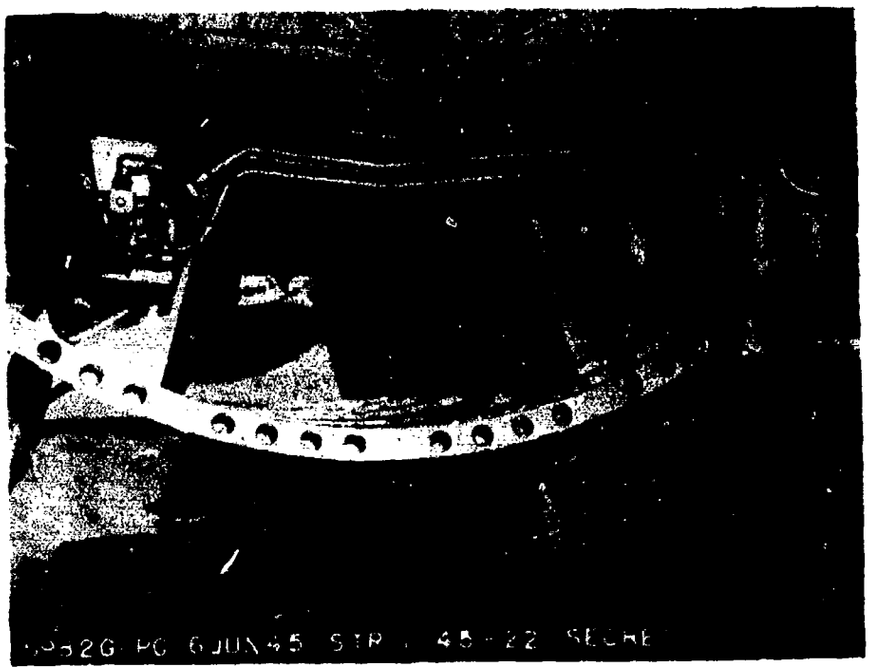

Center section between fore and aft bomb bays after the Tall Boy installation was removed. The photograph was taken from the front bomb bay.

S.T.R. 1-45-22 1. G-6982 6 June 45

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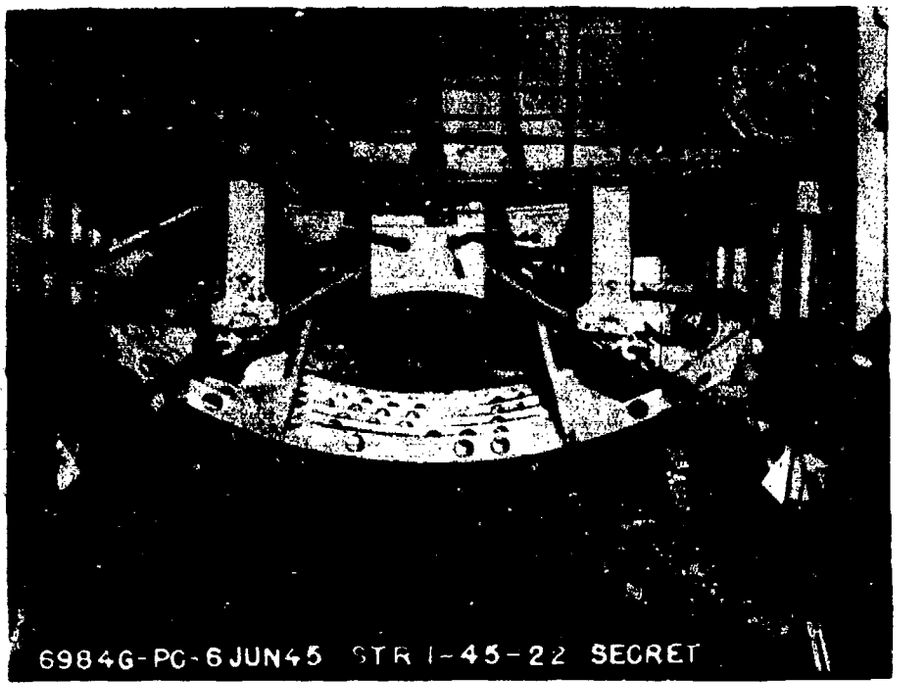

S.T.R. 1-45-22 G- 6984 6 JUNE 45

Center section between fore and aft bomb bay after the Tall Boy installation was removed. Photograph was taken from the rear bomb bay. The change in the center section caused no additional adverse effect on bomb flight characteristics.

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TALL BOY RELEASE RECORD

10,000 Ft. Altitude

Rel. No.	Cal. True Alt. Above Sea Level	Cal. IAS	TAS	Temp. °C	Disc Speed	Trail Mile	Tang. of Drop. Angle	Drift	Compass Heading	Sight. Time Sec.	Weather	Visibility	Turb.	Date	Range #	Measured Range Short	Over	Left	Right	Correction	CEP:	Remarks
1	10,060	190	225	+12	211.9	8	0.65	12R	260	100	Clear	Good	Smooth	2/4/45	51		50		10		51.0	Elevation of target - 60 feet.
2	10,060	190	226	+12	211.9	7	0.78	0	275	100	Clear	Good	Smooth	3/4/45	51		50		5		50.1	
													AVERAGE ERROR (FT)			50		7.5			
													MPI				50		7.5			

20,000 Ft. Altitude

Rel. No.	Cal. True Alt. Above Sea Level	Cal. IAS	TAS	Temp. °C	Disc Speed	Trail Mile	Tang. of Drop. Angle	Drift	Compass Heading	Sight. Time Sec.	Weather	Visibility	Turb.	Date	Range #	Measured Range Short	Over	Left	Right	Correction	CEP:	Remarks
3	20,200	190	264	-6	149.5	9	0.50	3L	280	30	3/10 Clouds	Good	Smooth	5/3/45	66	242.5		246.0			242.5	Elevation of target - 146.2 feet.
4	20,200	190	263	-9	149.5	9	0.55	3L	282	120	5/10 Clouds	Hazy	Smooth	7/3/45	66	65.0		48.0			77.5	
5	20,200	190	263	-6	149.5	9	0.64	3L	295	100	3/10 Clouds	Hazy	Smooth	14/3/45	66		32.0		46.0		39.0	Releases 5, 6 and 7
6	20,200	190	263	-5	149.5	9	0.50	4R	274	200	Clear	Good	Smooth	17/3/45	66		97.0	140.0			118.0	Bomb sight telescope slightly out
7	20,200	190	263	-6	149.5	9	0.57	3L	275	180	Clear	Good	Average	18/3/45	66		33.0	278.0			280.0	of vertical.
8	20,200	190	264	-4	149.5	9	0.58	4L	280	180	Clear	Hazy	Smooth	18/3/45	66		132.0	298.0			274.0	
9	20,200	190	263	-5	149.5	9	0.66	4R	94	45	Clear	Good	Smooth	19/3/45	66		83.0			28.5	61.0	
													AVERAGE ERROR (FT)			94.9		159.9			145.7
													MPI				7.1	151.6				

CEP with Center at MPI: ----------155.7
MEP with Center at MPI: ---------- 85.1
DEP with Center at MPI: ----------93.21

30,000 Ft. Altitude

Rel. No.	Cal. True Alt. Above Sea Level	Cal. IAS	TAS	Temp. °C	Disc Speed	Trail Mile	Tang. of Drop. Angle	Drift	Compass Heading	Sight. Time Sec.	Weather	Visibility	Turb.	Date	Range #	Measured Range Short	Over	Left	Right	Correction	CEP:	Remarks
10	30,200	185	307	-32	121.5	12.0	0.50	3R	265	120	Clear	Good	Smooth	19/4/45	53	12			35		21	Elevation of target - 162 feet.
11	30,200	190	304	-30	121.5	12.5	0.51	3L	265	120	Clear	Good	Smooth	20/4/45	53	53			47		187	
12	30,200	190	307	-29	121.5	12.0	0.49	2L	268	60	Cloudy	Hazy	Smooth	27/4/45	53	316			38		358	
13	30,200	187	307	-31	121.5	12.0	0.50	2R	260	120	Clear	Good	to Smooth	27/4/45	53		106		146		126	
14	30,200	187	307	-30	121.5	12.5	0.42	6L	272	120	Clear	Good	Smooth	30/4/45	53		95	97			106	
													AVERAGE ERROR (FT)			106.4		70			203.4
													MPI			36			39.2			

CEP in reference to MPI: ----------199.4
MEP with center at MPI: ----------119.
DEP with center at MPI: ---------- 65.7

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Fig. 1

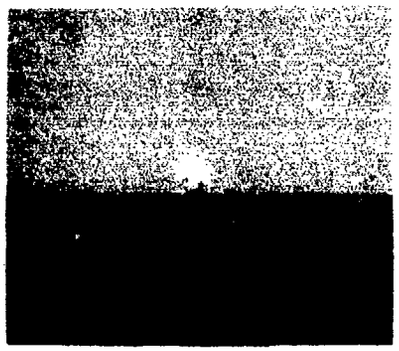

Fig. 2

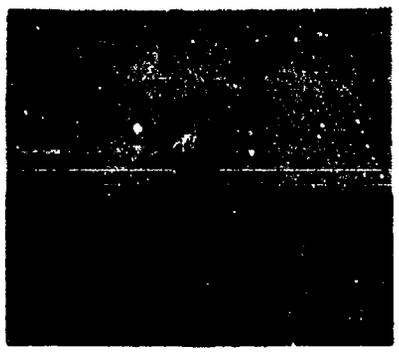

Fig. 3

Fig. 4

Fig. 5

Fig. 6

S.T.R. 1-45-22 1. G-6559 2. G-6566 3. G-6560 4. G-6570
5. G-6562 6. G-6574 26 May 45

Photographs of the explosion of a Tall Boy bomb. The explosive charge was Torpex D-1. The bomb was released from 15,000 feet. It was fuzed with a Mk-58 pistol with .14 second delay detonator.

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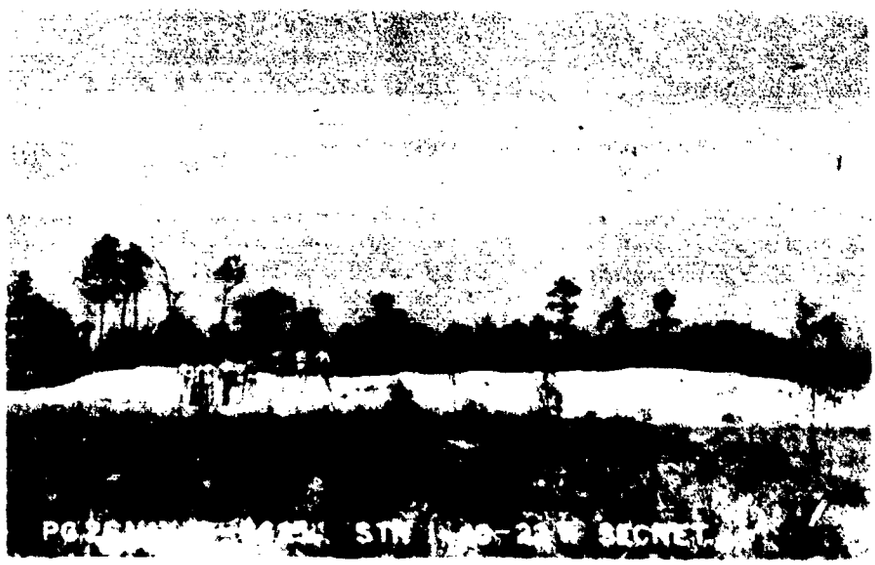

S.T.R. 1-45-22 1. G-6624 2. G-6625 26 May 45

Photographs of the crator made in sandy soil by the high explosive Tall Boy bomb.

Inclosure No. 8
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THE ARMY AIR FORCES BOARD
Orlando, Florida

30 June 1945

PROJECT DISTRIBUTION LIST

ARMY AIR FORCES BOARD PROJECT NO. 4474C471.6

TEST OF TALL BOY BOMB INSTALLATION IN B-29 AIRPLANE
(S. T. NO. 1-45-22)

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

JUN 23 2000

MEMORANDUM FOR DTIC/OCQ (ZENA ROGERS)
8725 JOHN J. KINGMAN ROAD, SUITE 0944
FORT BELVOIR VA 22060-6218

FROM: HQ AFMC/SCDP
4225 Logistics Avenue, Room A112
Wright-Patterson AFB OH 45433-5744

SUBJECT: Technical Reports Cleared for Public Release

1. The attached HQ AFMC/PAX 1st Ind, 21 Jun 00, clears the following reports for public release in accordance with AFI 35-101, 1 Dec 99, *Public Affairs Policies and Procedures* (Case AFMC 00-124).

- ADB972848
- ADB180373

2. Please direct further questions to Lezora U. Nobles, HQ AFMC/SCDP, DSN 787-8583.

Lezora U. Nobles

LEZORA U. NOBLES
AFMC STINFO Assistant
Directorate of Communications and Information

Attachment:
HQ AFMC/PAX 1st Ind, 21 Jun 00, w/2 Atch