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SC-4621(WD) RS 3423/571

INTERIM DEVELOPMENT REPORT FOR THE TX-53 BASIC ASSEMBLY AND TX-53 BOMB

(Title unclassified by itself, [redacted] DNA b(3)

ENGINEERING DEVELOPMENT

AEC ATOMIC WEAPON DATA

[redacted] DNA (b)(1)

Division 7144

April 1962

ABSTRACT

The TX-53 basic assembly and bomb are designed for carriage in the pods of the B-58 and B-47, and the B-52, respectively. This report describes the TX-5ɔ basic assembly, bomb, and ancillary handling and test equipment.

The test and development program discussed in the report is aimed at establishing the status of the TX-53 program at design release.

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FOREWORD

The requirement for the TX-53 basic assembly and TX-53 bomb evolved from the TX/XW-46 program. A letter from the Assistant Secretary of Defense to the Atomic Energy Commission, dated March 9, 1956, requested that the study for the TX/XW-46 be expanded to include a laydown feature.

This study by the Laboratories of the Atomic Energy Commission was completed on February 7, 1958, and the project was recommended for development.

On August 11, 1958, the Assistant Secretary of Defense, Research and Engineering, requested the Chairman, Atomic Energy Commission, to proceed with the Phase 3 development. The latter, however, decided not to implement Phase 3 authorization until the proposed Military Characteristics had been approved by the Military Liaison Committee. The Military Characteristics were approved by the Military Liaison Committee on November 25, 1958. On December 23, 1958, the AEC issued instructions to implement the Phase 3 authorization.

On September 8, 1959, the DMA concurred with the design agencies' recommendation to install the TX-53 basic assembly in the upper component of the B-58 two-component pod. In the same letter the DMA requested that information about the compatibility of the TX-53 with the B-70 be forwarded to the Military Liaison Committee. As a result of the information supplied, the B-70 application of the TX-53 was suspended by direction of ALO* on May 2, 1960 pending an Air Force future request to resume full development efforts in support of the B-70 program.

The intent of this report is to define the status of the TX-53 bomb and TX-53 basic assembly at complete design release.

Although this report describes the basic assembly in detail, it discusses only the application of the basic assembly to the TX-53 bomb for the B-47 and B-52 aircraft.

An Engineering Evaluation Application Report about the application of the basic assembly to the B-58 two-component pod systems (Mk/53 BLU 2B) is expected to be published approximately July 1962.

This report was reviewed by the Design Review and Acceptance Group of Field Command, DASA, on February 13, 1962. The review committee noted that all Military Characteristics were met except for some deviations, but all deviations were acceptable to the DOD. The committee further noted that all other operational, logistic and safety requirements of the DOD were met, except the possibility that the weapon might become armed in a fire environment. The committee concluded that the design would be acceptable when its safety in fire is demonstrated. A copy of the DRAAG letter is in Appendix A.

Design release of the TX-53 was complete except for the MC-1387 parachute assembly with stowage can and the rear case section containing the MC-1581 flexible linear-shaped charge at the cutoff time of this report, July 1, 1961.

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*Memorandum, P. W. Ager, ALO to J. P Molnar, Sandia Corporation, dtd May 2, 1960. Subject: Weapon Development Effort in Support of the B-70 Aircraft.

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SUMMARY

[redacted] The TX-53 bomb consists of the TX-53 basic assembly and the TX-53 bomb shape components. The bomb is 144 inches long, 50 inches in diameter, and weighs approximately 8850 pounds. It is capable of being converted back to the basic assembly and bomb shape components.

Design release of the TX-53 was complete at the cutoff time of this report, July 1961, except for the MC-1387 parachute assembly with stowage can and the rear case section containing the MC-1581 flexible linear-shaped charge. On May 1, the test program was approximately 70 percent complete and the following conclusions were drawn from the test results:

1. The TX-53 bomb is compatible with the MHU-29/C clip-in system and is capable of carriage and subsequent release from the B-47 and B-52 aircraft. Dual carriage capability in the B-52 has been demonstrated.
2. The TX-53 bomb will function as desired and survive the environments associated with laydown delivery as was demonstrated by full-scale tower tests and air-drop tests.
3. The ability of the laydown parachute system to meet the weapon deployment load and impact velocity and attitude conditions for [redacted] release has not been demonstrated, since tests have not yet been made with the final parachute design.
4. Although testing has not been completed, the TX-53 is expected to function as desired when delivered from high altitude in the free-fall or retarded conditions for either air or contact burst.
5. Components utilized in the TX-53 will function as desired in the environments anticipated in the Stockpile to Target Sequence as demonstrated by tests conducted under simulated environments. Environmental tests of the complete weapon assembly indicate satisfactory resistance to environment; however, testing has not been completed.

Analysis of the TX-53 system indicates the required safety levels have been achieved. [redacted]

CHAPTER I -- DESIGN OBJECTIVES OF THE WEAPON PROGRAM

General

[redacted] The TX-53 bomb and basic assembly are intended for application in SAC bomber aircraft (B-47, B-52, B-58, and B-70*) in the following delivery options:

High altitude delivered free fall air burst

High altitude delivered free fall contact burst

High altitude delivered retard air burst (except B-58)

High altitude delivered retard contact burst (except B-58)

Low altitude laydown delivery delayed burst.

The requirements derived from the Military Characteristics, Stockpile-to-Target Sequence and Ordnance Characteristics established by Sandia Corporation which dictated or influenced weapon design are outlined below.

Environmental Requirements

The weapon shall not be limited to any special storage environment and shall withstand, without damage, functional impairment, or reduction in reliability, the environment expected in the stockpile-to-target sequence (see Appendix B) with the exception of carriage in the B-70 aircraft (see Reference 9). To obtain an indication of the capability of the weapon to withstand the stockpile-to-target sequence, the weapon is required to withstand the applicable environmental tests specified in SC-4259(TR), Environmental Guide for Nuclear Ordnance Development.

The use of materials sensitive to radiation damage has been avoided in all components wherever possible, without serious compromise to other design requirements.

*Because of the high cost of developing components compatible with the anticipated high temperature environment of the B-70, and because of the partial suspension and uncertainty of the B-70 program, development to thermally upgrade the TX-53 for B-70 application was discontinued as of January 1960. Sandia Corporation advised that the TX-53 thermal upgrading development could be resumed and completed on time scales compatible with the B-70 program if authorization is received on reasonable time scales.

[redacted]

In the design of the TX-53, vulnerability to blast or fragment damage shall be minimized, and maximum protection aginst tampering or sabotage shall be afforded. [redacted] To meet this requirement, the basic assembly must be watertight.

The weapon is required to survive the impact loads associated with laydown.

Structural Requirements

The TX-53 structure is required to withstand loads imposed during handling, transportation, and flight, while being carried by the proposed carriers shown in Table I. After release from the carrier, the structure must withstand the aerodynamic loads, retardation parachute, laydown parachute loads, and impact loads.

Electrical System Requirements

The TX-53 is required to supply air burst, ground burst, and laydown delayed burst. These options shall be selectable in flight.

Compatibility Requirements

The TX-53 shall be compatible with the B-47 and B-52 bomb bays, including dual carriage in the B-52.

Safety Requirements

The probability of premature nuclear detonation from random component failures alone, for the environment specified, shall be less than the following:

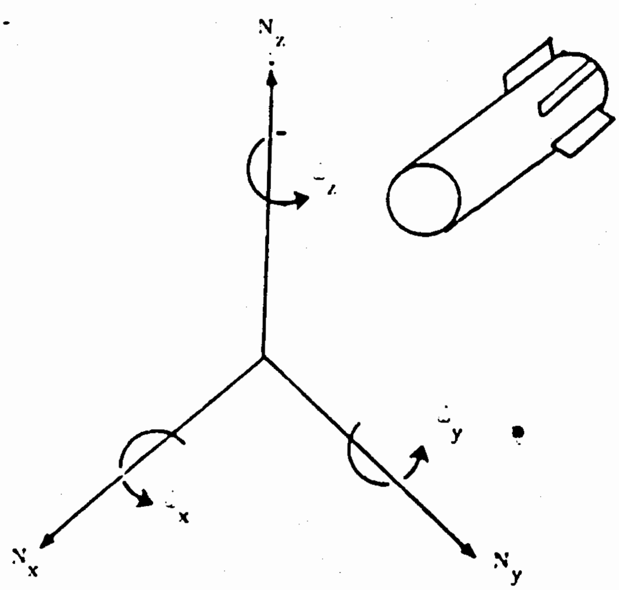
1. Storage, transportation, handling, and maintenance of the bomb and the basic assembly in a completely assembled condition, 1 in 10^6.
2. After drop, where a nuclear detonation might endanger aircraft or crew (exclusive of parachute failure), 1 in 2000.

Visual indication of a safe or unsafe condition shall be provided during ground handling. Release of the bomb in the unarmed condition must result in a nuclear dud. The bomb must be capable of remote arming and safing by the T-249, and provide positive indication of the armed or safe condit[illegible] the crew's compartment. Following a normal armed release, all accessible weapon safety devices sh[illegible] interlocks to prevent a simple means of disabling the weapon.

TABLE I

Design Loads

Condition	Inertia load factor (g) N_x	N_y	N_z	Angular acceleration (rad/sec^2) ω_x	ω_y	ω_z
B-47 and B-52 flight and landing (limit) (applied in combination)	±1.5	±1.5	+2.0 -5.0	0	±2.5	0
Hoisting (limit) (applied singly)	0	0	-4.0			
Transport (limit) (applied singly)	±6.0	±2.0	+3.5 -4.5			
Air transport emergency (ultimate) (applied singly)	±8.0	0	-6.7			
Laydown - initial impact (ultimate) (applied in combination)	+70	$\sqrt{N_y^2 + N_z^2} = 50$				
Laydown - secondary impact (ultimate) (applied in combination)	-50	0				
	0	$\sqrt{N_y^2 + N_z^2} = 100$				
	$\sqrt{N_x^2 + N_y^2 + N_z^2} = 100$					



Load factors and angular accelerations specified above are inertia load factors and angular accelerations acting at the CG of the weapon. The maximum value will be attained in not less than 0.03 second.

Sign convention -- all load factors and angular acceleration are positive as shown.

Reliability Requirements

[redacted] Fuze functional reliability is assumed to mean reliability of the bomb at the target, excluding LASL nuclear components, but including the parachute system.

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Continuity monitoring shall not be required immediately prior to takeoff. [redacted]

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Logistic Requirements

The weapon shall be designed to be safe, easy to assemble, store, transport, and test.

CHAPTER II -- WEAPON DESCRIPTION

General

[redacted] The complete bomb designed for B-47 and B-52 application weighs approximately 8850 pounds, is 50 inches in diameter, is 144 inches long (148 inches long at the peak of the automatic deployment closing cover).

The TX-53 bomb is composed of the TX-53 basic assembly and the TX-53 bomb shape components. T capability to assemble bomb shape components and the basic assembly into the bomb configuration and then to reconvert to the two previous configurations has been achieved in the design.

The TX-53 bomb (see Figure 1) consists of:

1. The TX-53 basic assembly.
2. The TX-53 bomb shape components.
   a. The automatic deployment cover.
   b. The rear case section.
   c. The parachute assembly with stowage can.
   d. The fins.
   e. The outer case segment system (cylindrical panels).
   f. The energy-absorbing nose assembly and nose fairing.
   g. The deformation switch.
   h. The cables and miscellaneous hardware.

TX-53 Basic Assembly

The TX-53 basic assembly consists of five principal items (see Figure 2):

1. The basic subassembly.
2. The end ca[redacted]
3. The [redacted]
4. The electrical component mounting ring assembly.
5. The closing plate.

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Figure 1. TX-53 Bomb Cutaway

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Figure 2. TX-53 Basic Assembly

Basic Subassembly

[redacted]

End Cap Assembly

[redacted]

Electrical Component Mounting Ring Assembly

The electrical component mounting ring assembly (see Figure 4) provides attachment for a majority of the electrical components. The components to which external access is required include the pressurization fill valve, the MC-1199 ground safing and retard/free-fall switch, the MC-1200 pullout device, the MC-1178 laydown timer, and five electrical connectors. These components are attached to the one-piece aluminum basic case (see Figure 5). All of the electrical components within the basic assembly are packaged in the space surrounding the end cap assembly (see Figure 6). The detachable electrical component mounting ring is used to prevent weakening the structural case by the large number of fastening features which would otherwise be needed to attach all components to the basic case structure. The removable electrical component mounting ring assembly allows flexibility for pre-assembly, test, and assembly.

Closing Plate

The honeycomb panel closing plate is approximately 1.375 inches thick and covers the aft end of the basic assembly. It provides bulkhead-type rigidity to the basic case structure to resist transverse loads during laydown, and provides a pressure bulkhead for an internal pressure of 30 psi absolute.

Bomb Shape Components

Automatic Deployment Cover -- The automatic deployment cover (Figure 7) is a sheet metal component. It is tent shaped to gain additional parachute volume without decreasing the aircraft bomb bay fall clearance. It attaches to the aft ring of the rear case section, and contains brackets to provide attachment for the pilot chute bridle lines.

Rear Case Section -- The rear case section assembly (see Figure 8) is principally a 50-inch-diameter honeycomb sandwich structure with doors to provide access to the basic assembly. The rear case section attaches to the outer case segments and to the flange of the basic case. A ring, at the interface between the rear case section and the outer case segments, extends 2 inches beyond the cylindrical diameter. This ring is used as a spoiler band to obtain aerodynamic stability after weapon release. A local thrust pad located at the top of the rear case section is provided to transmit the fore and aft flight loads between the clip-in suspension system and the weapon. The flight loads are distributed by the rear case section structure and transmitted to the outer case segments through the attachment.

The rear case section contains baro ports, structural mounts for the fins, a parachute load carrying ring, and three mild detonating fuze (MDF) systems for: (1) automatic parachute deployment, (2) separation of the laydown extraction parachute, and (3) release of the complete parachute system for the high altitude free-fall option.

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Figure 3. The End Cap Assembly

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Figure 4. Electrical Component Mounting Ring Assembly

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Figure 5. Components Attached to Basic Case

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Figure 6. Component Comartment

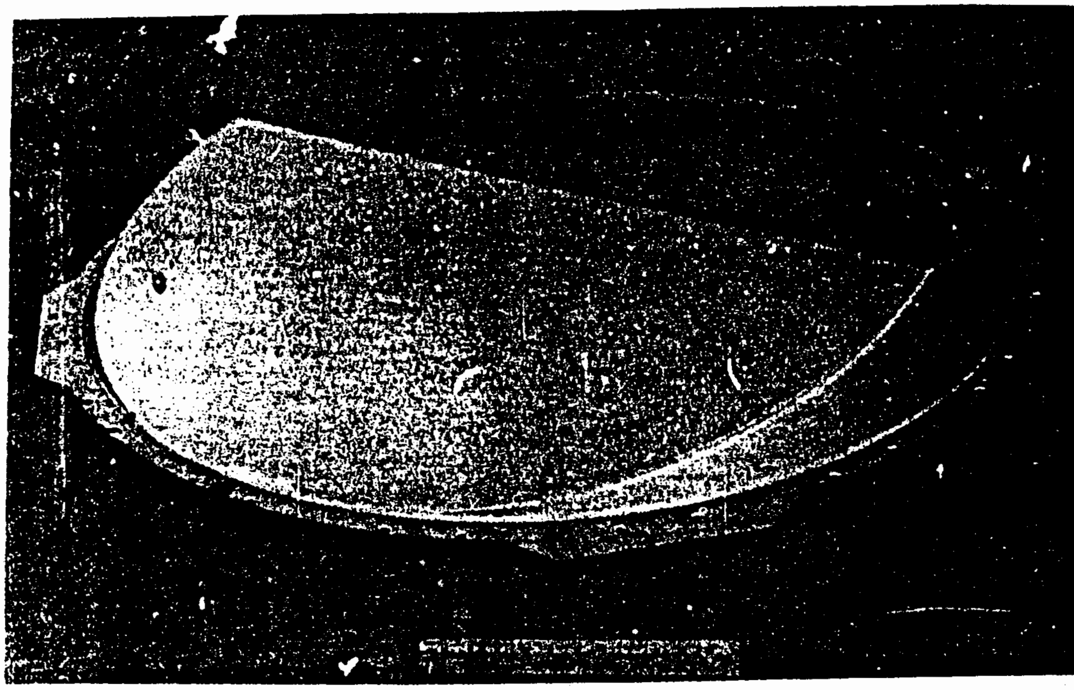

Figure 7. Automatic Deployment Cover

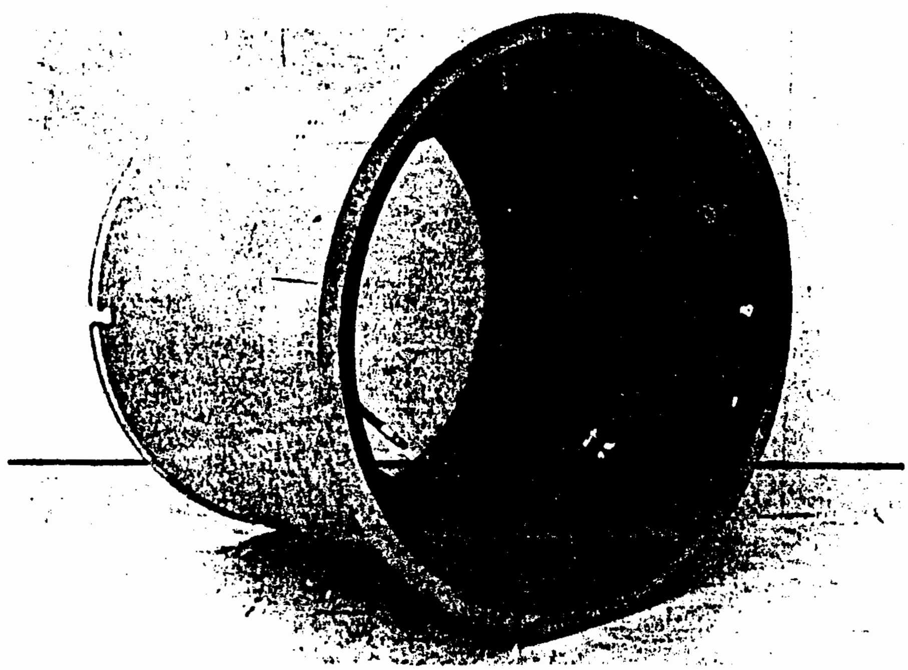

Figure 8. Rear Case Section

Molded rubber cups are provided to cover, but not to seal off, the baro ports. The cups are bonded to brackets which are made of a leaf-spring material. These brackets are attached to the aft ring of the rear case section. The MDF system associated with automatic deployment removes the aft ring in every delivery option, thereby automatically uncovering the baro ports.

MC-1387 Parachute Assembly with Stowage Can

The parachute system, MC-1387 (see Figure 9) consists of an Air Force supplied parachute system and a stowage can (MC-1388). The parachute system includes a 4-foot pilot chute, a 16.5-foot ribbon type chute permanently reefed to 12 feet (retard chute), and three 48-foot ribbon type chutes (laydown chutes), each reefed to 22.5 feet for two seconds after line stretch. Each parachute is packed into its associated deployment bag before assembly into the parachute stowage can.

The parachute stowage can is a honeycomb structure that provides a parachute volume of 26 cubic feet and contains two suspension line lug systems. One of the lug systems is used to attach the laydown chutes, and to provide a load-carrying path to the rear case section. The other lug system is used to attach the retard chute. It contains a cutting anvil to be used, in conjunction with the associated shaped charge mild detonating fuse system (flexible linear shaped charge) in the rear case section, to cut the retard chute suspension lines when the laydown option has been selected. Thus the retard chute deploys the laydown chute.

Fins -- The fins (see Figure 10) are double-wedge honeycomb panel structures. Four fins per weapon are used and, when mounted on the rear case section, they will fit into a square box 55.5 inches to a side. The fins are attached to local strong areas on the rear case section by externally accessible cap screws.

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Outer Case Segment System -- The outer case segment system (see Figure 11) consists principally of two 170-degree included-angle cylindrical segments and two 10-degree included-angle wedges. [redacted] The segments are positioned on the basic assembly and bolted together. The segments are tightened onto the basic case in a manner similar to a large two-piece clamp. The wedges, which are similar in construction to the segments, complete the encasement of the basic assembly within the outer case segment system. Cables from the deformation switch are routed beneath the wedges in the cable clamps shown in Figure 11. Each wedge is secured to the segments by attaching strips containing integral cam-lock-type fasteners.

Energy Absorbing Nose Assembly and Nose Fairing -- The energy absorbing nose assembly is an aluminum honeycomb sandwich structure which is contoured at the aft end to fit the hemispherical nose of the basic assembly (see Figure 12), and to accept a slip ring (see Figure 14) employed as a mounting ring. The forward end is configured to accept a nose fairing, which is an aerodynamic covering over the energy absorbing nose. Also, the energy absorbing nose accommodates attachment of a deformation switch in the shallow cylindrical well shown in Figure 13. The energy absorbing nose is designed to absorb the energy of impact resulting from a maximum velocity combination of 55 fps vertically and 51 fps horizontally and to limit longitudinal loading on the basic assembly to 70 g. The energy absorbing nose is attached to the basic assembly by 45 bolts and to the outer case segments through the slip ring (Figure 14) by 38 studs. Grooves and tunnels are provided for deformation switch cable routing.

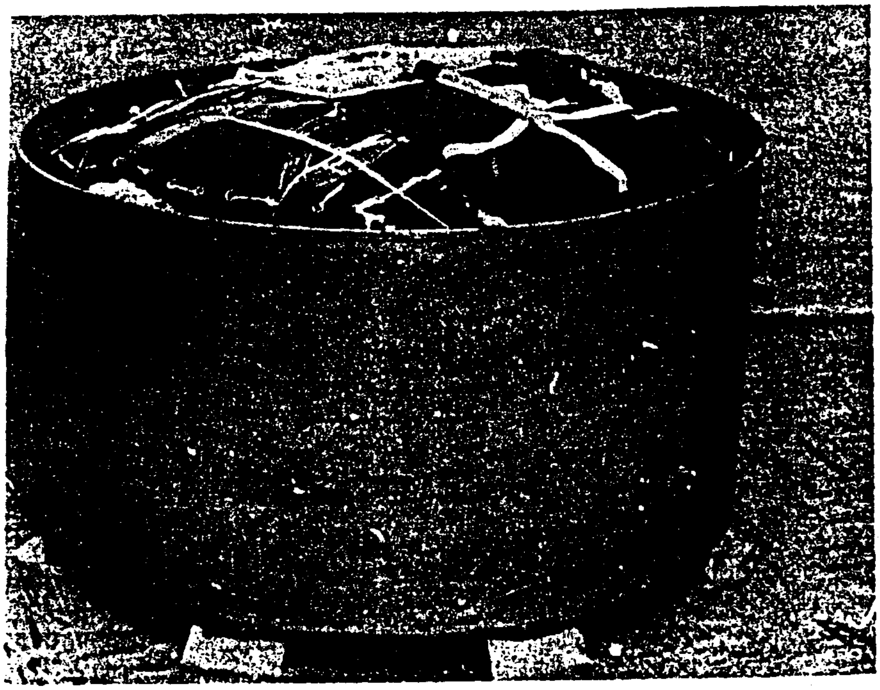

Figure 9. Parachute Assembly with Stowage Can

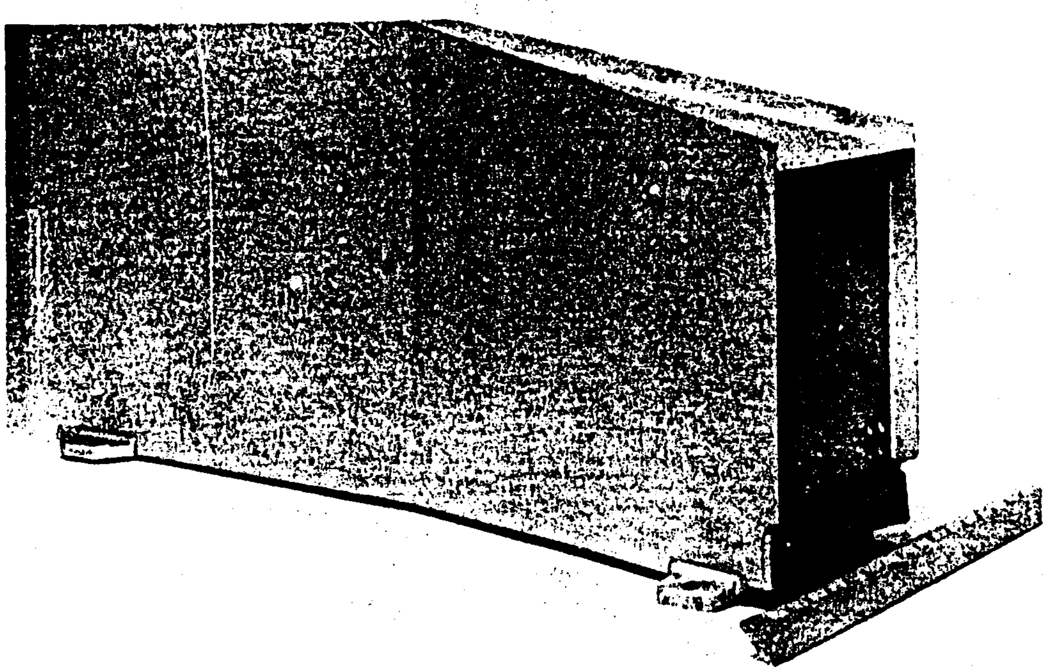

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Figure 10. Fins

Figure 11. Outer Case Segment System

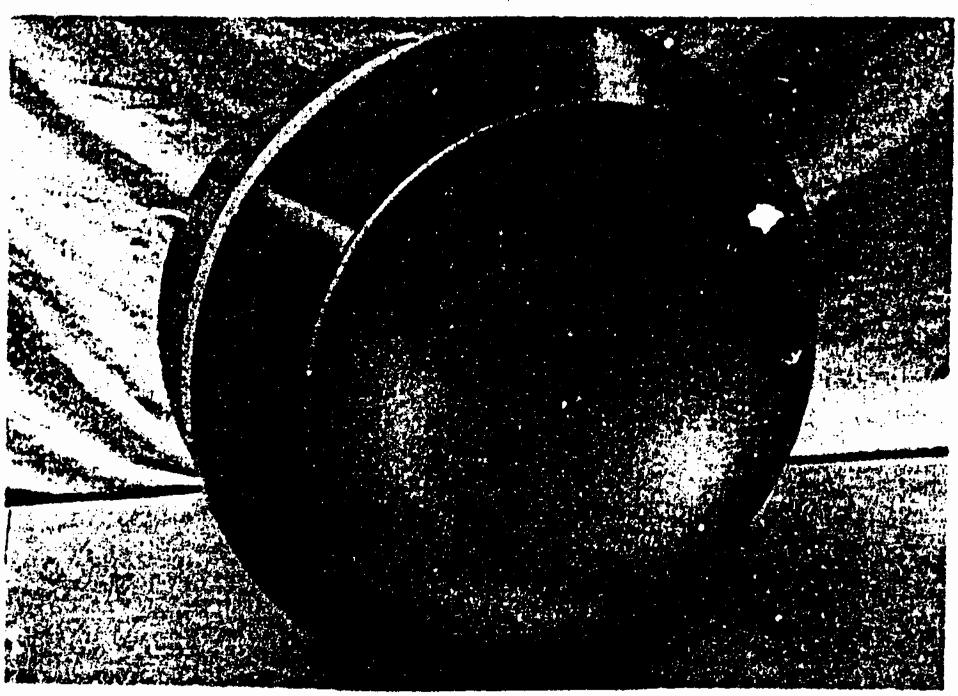

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Figure 12. Energy Absorbing Nose (Aft View)

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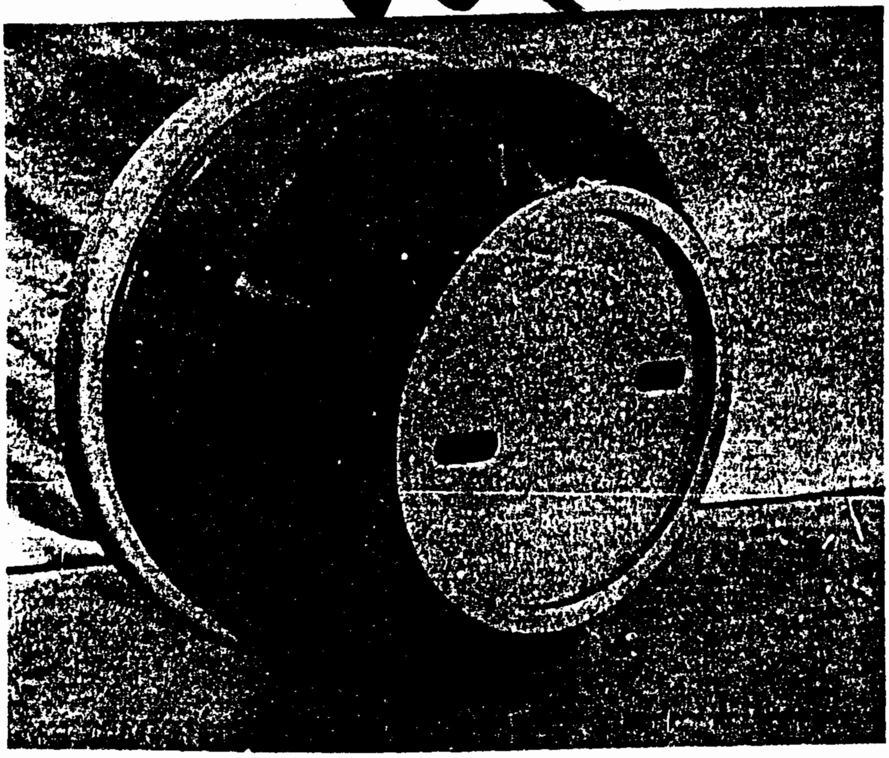

Figure 13. Energy Absorbing Nose (Front View)

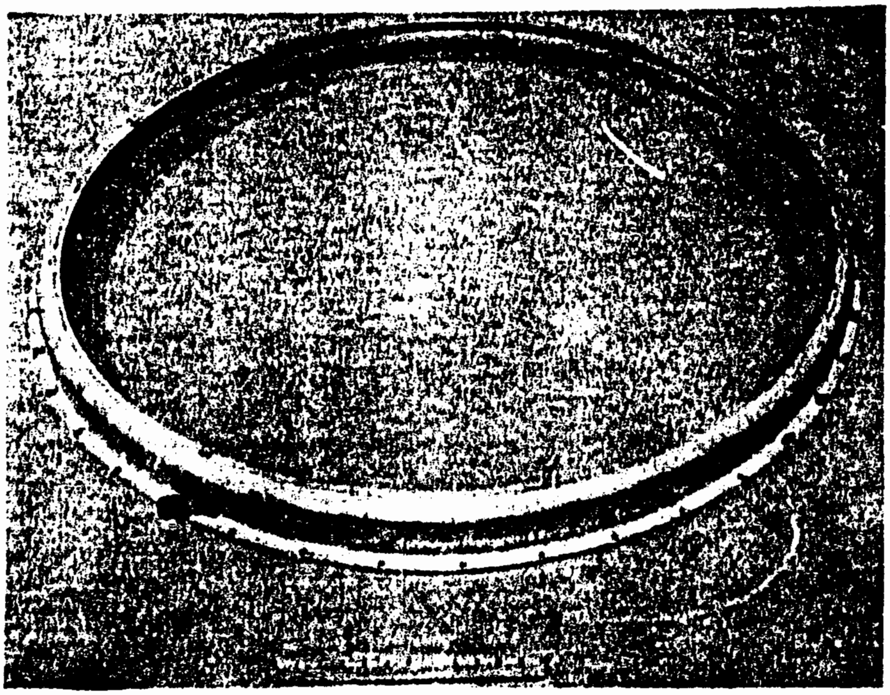

Figure 14. Slip Ring

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The nose fairing (Figure 15) is a 0. 125 inch thick steel aerodynamic fairing that attaches to the forward face of the energy absorbing nose by 12 bolts. The open end of the nose fairing slips over the outer case segments.

Electrical System Description

The TX-53 is designed to operate with the following fusing and firing options:

1. Air burst
2. Ground burst
3. Laydown delayed burst.

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[redacted]

In addition to selecting the method of fuzing, the MC-1202 option switch selects the laydown parachute deployment or the other parachute options. Delivery from low altitude always results in deployment of the laydown parachute system. Delivery from high altitude results in deployment of the retard parachute or removal of the entire parachute system, depending on selection of the retard or free-fall option prior to take-off.

<u>MC-1344 Firing Set</u>

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[redacted]

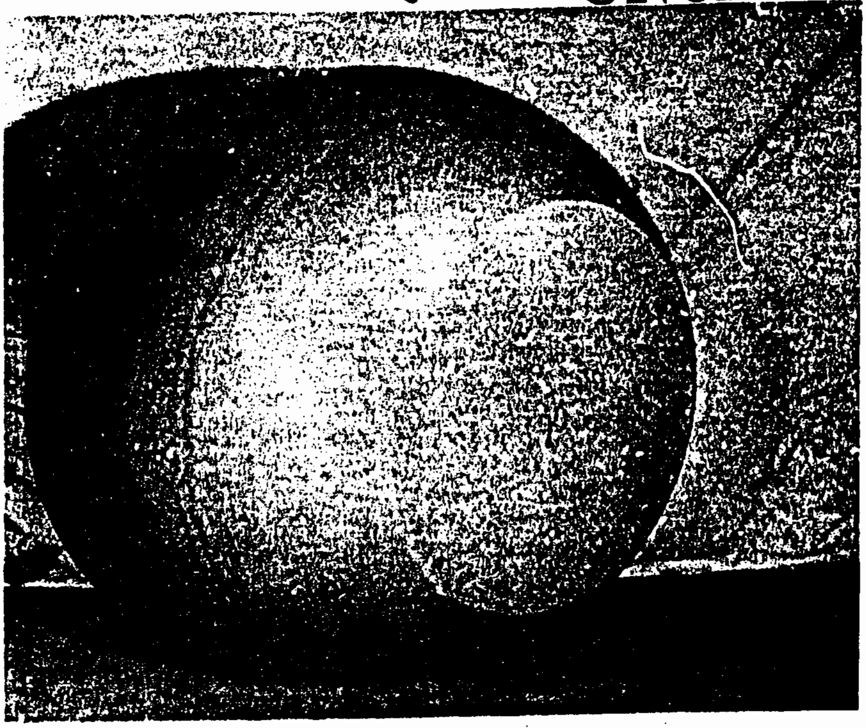

Figure 15. Nose Fairing

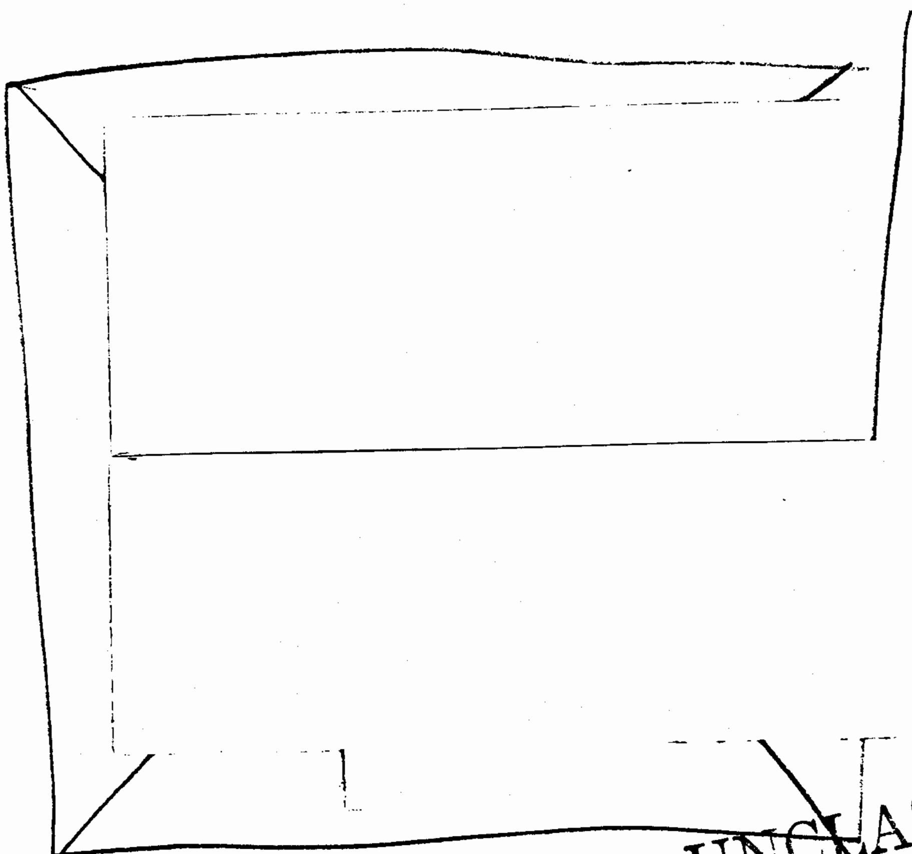

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Figure 16. MC-1344 Firing Set

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MC-1353 Neutron Generator

[redacted]

MC-1178 Laydown Timer

[redacted]

MC-1268 Trajectory Device

The MC-1268 (see Figure 19) includes two clusters of MC-1269 mercury switches and two SA-006 motor-driven timers. The MC-1268 is used to prevent nuclear detonation in the laydown option if the bomb has not traveled a normal trajectory. The mercury-switch cluster is arranged so that a certain threshold ratio of parachute drag to transverse weightlessness will switch power to the forward or arming field of the motor. A ratio of parachute drag to transverse weightlessness less than the threshold will result in power being applied to the reversing or safing field of the motor. Motor power is supplied by the 28-volt section of the MC-1262 thermal battery. The bomb must travel a proper trajectory for a net period of 4 seconds before the fuzing system will operate. The switches on the motor cam complete the circuits from the MC-1264 thermal battery to the laydown timer.

Deformation Switch

[redacted]

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Figure 17. MC-1353 Neutron Generator

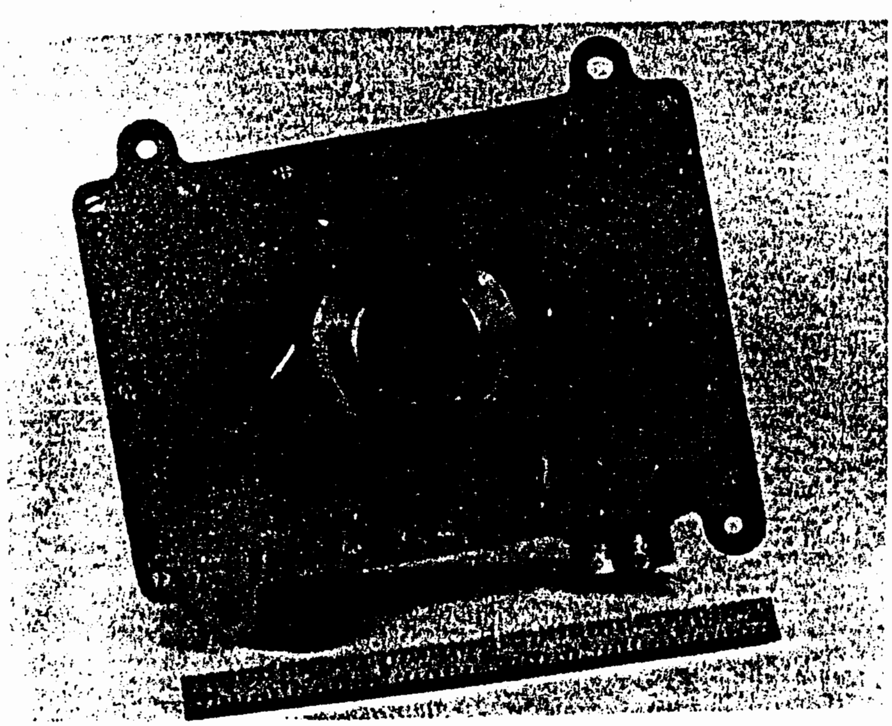

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Figure 18. MC- 78 Laydown Timer (Showing Dial)

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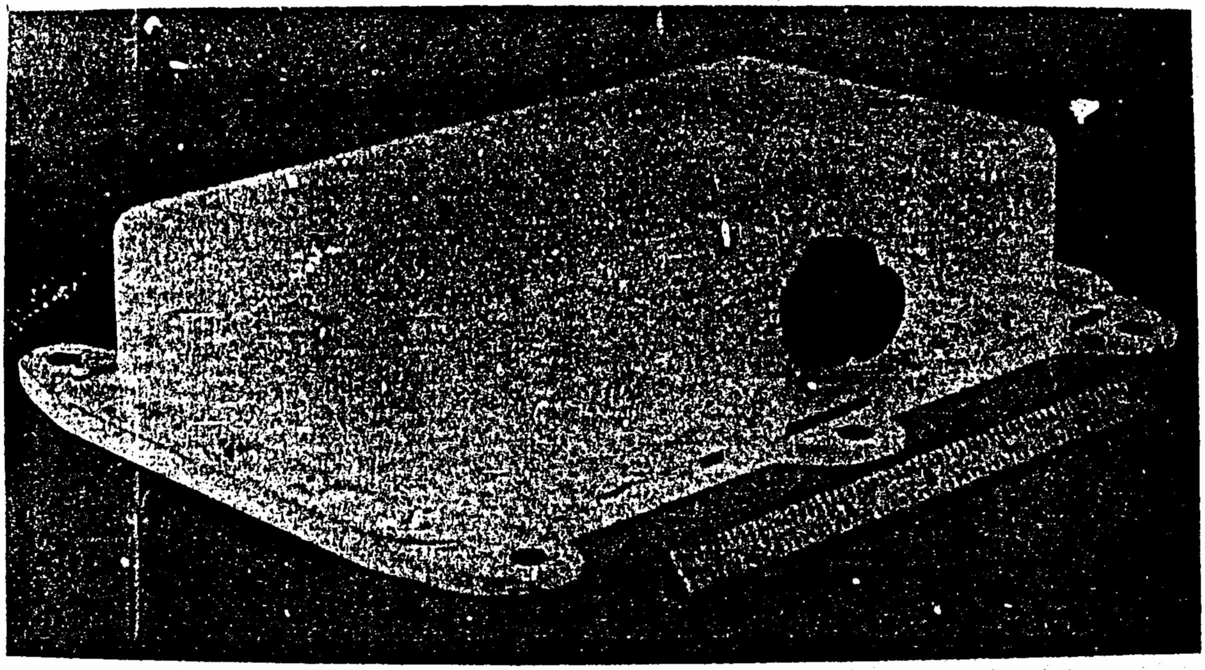

Figure 19. MC-1268 Trajectory Device

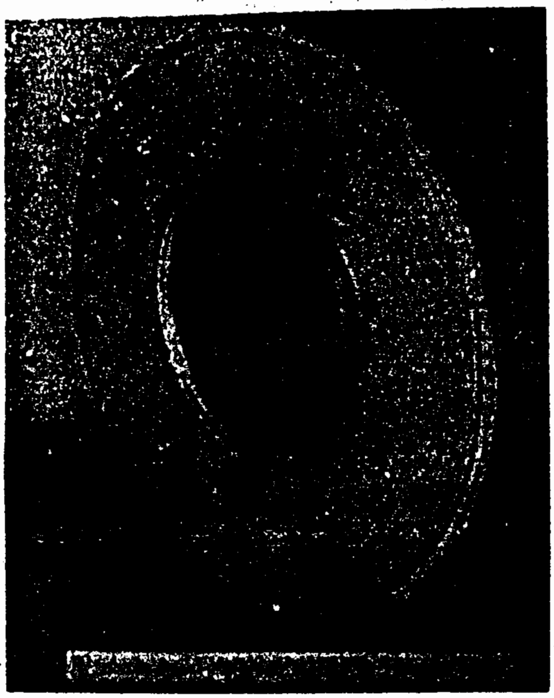

Figure 20. Deformation Switch (Forward Surface)

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MC-1204 Squib and Fuse Pack

The MC-1204 squib and fuse pack (Figure 21) is a single package containing all of the explosive switches and electrical fuses used in the TX-53. [redacted]

Upon receipt of a signal through closure of the arming baro elements, two of these explosive switches are actuated and carry the chopper-converter surge and operating current. In the same manner at fire baro closure, or laydown timer fire signal, two other explosive switches provide contact closure for the firing set pulse transformer.

MC-1266 Arm/Fire Baro

The MC-1266 arm/fire baro (see Figure 22) [redacted] in the MC-1204 when the weapon has been delivered from high altitude. Two of the elements, in conjunction with explosive switches, initiate X-unit charging when the MC-1266 senses a predetermined arming altitude. In the air-burst option, the other two elements in conjunction with explosive switches provide a signal to the MC-1343 firing pulse transformers when an altitude is sensed consistent with the baroswitch setting.

The MC-1266 is a repackaged, Army Ordnance Corps M-5 baro. [redacted]. The setting can be changed external to the basic assembly with a T-389 which operates a servo system built into the baro. The MC-1266 is mounted to the electrical component mounting ring.

MC-1199 Ground Safing and Retard/Free-Fall Switch

The MC-1199 has two separate functions:

1. In the safe position, it provides safety during handling and storage by preventing 28-volt thermal battery power from reaching the fuzing circuits.

2. In the armed position, it also selects between high altitude retarded and high-altitude free-fall deliveries.

The MC-1199 (see Figure 23) is manually operated external to the weapon. It has three control positions: safe, retard, and free-fall. The handle of the MC-1199 is mechanically locked in the safe position by a solenoid-operated pin until the following conditions are met:

1. The weapon must be electrically connected to the aircraft.

2. The T-249 aircraft monitor and control system must be in the safe position with the power turned on.

3. The MC-1200, as controlled by the T-249, must be in the safe position.

The MC-1199 may be operated to the safe position with or without aircraft power applied to the solenoid. The MC-1199 is also equipped with a squib-actuated lock which operates on a signal from the MC-1268 trajectory safing device when the MC-1268 senses a normal trajectory. This lock prevents manual switching of the MC-1199 to the safe position after laydown delivery has been executed.

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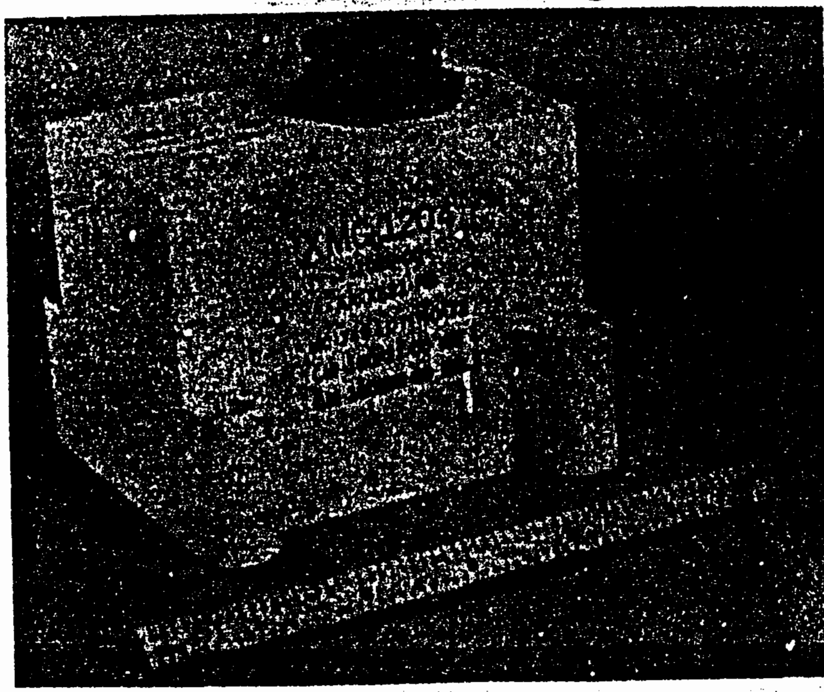

Figure 21. MC-1204 Squib and Fuse Pack

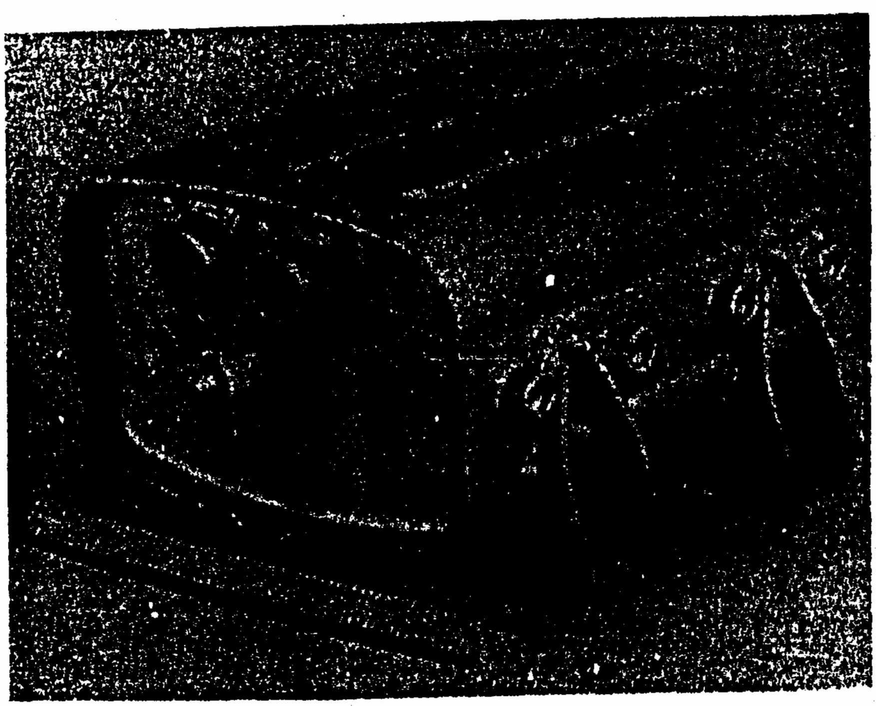

Figure 22. MC-1266 Arm/Fire Baro

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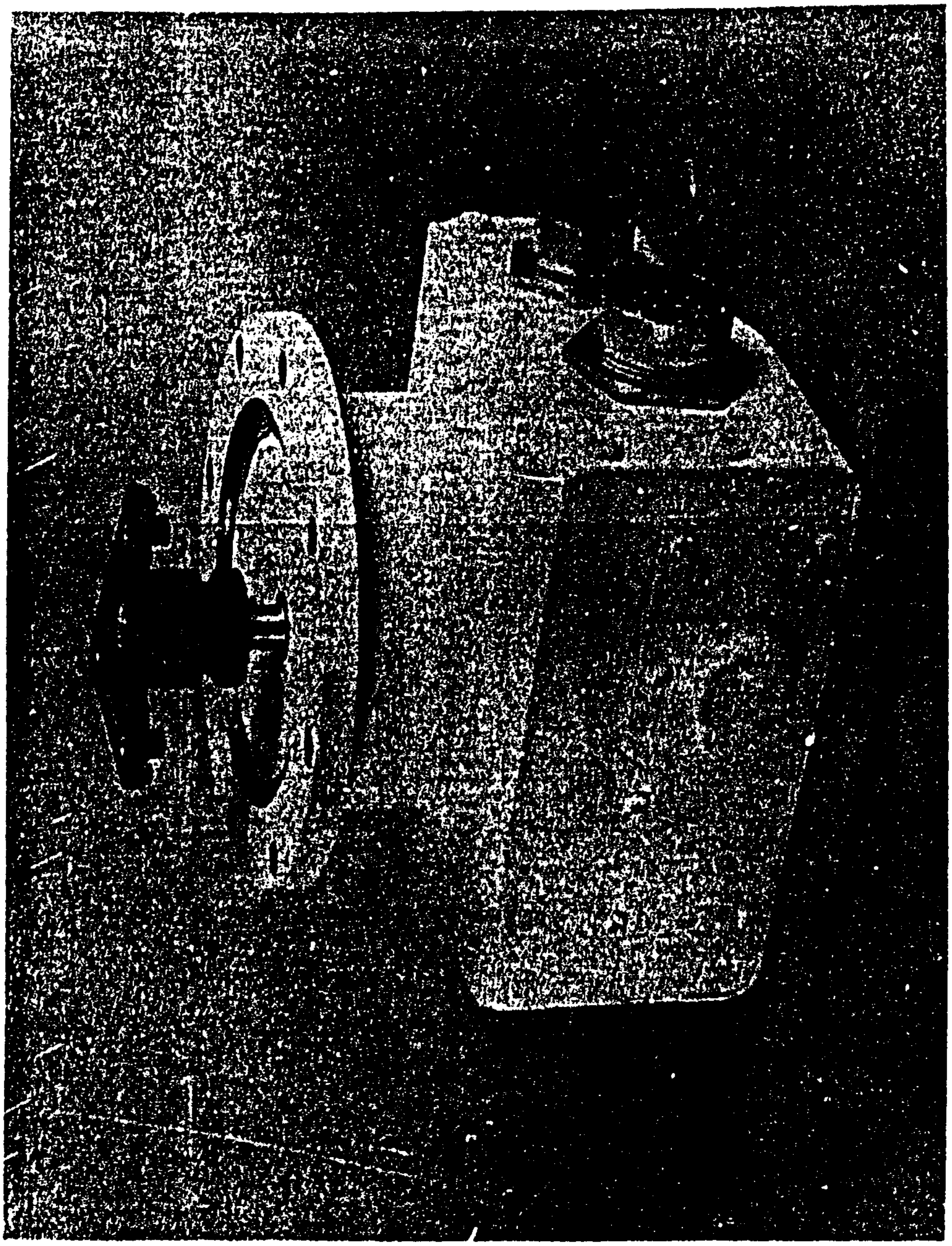

Figure 23. MC-1199 Ground Safing and Retard/Free-Fall Switch

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The handle of the MC-1199 extends through the case of the basic assembly. The remote control indicator shown in Figure 24 is used to extend the MC-1199 control handle to the outer skin of the bomb configuration. When the MC-1199 is moved to an armed position, a switch is operated which isolates the locking solenoid so that power will not be continuously applied to the solenoid after arming. One of the MC-1199 cam-operated switches completes a circuit in the T-249 aircraft monitor and control system, which allows a positive indication on the T-249 press-to-test lamp only if the MC-1199 is in an armed position.

MC-1200 Pullout Device

The MC-1200 (see Figure 25) performs three different functions:

1. [redacted]

DSWA b(1) 1.5(a)

2. At release of the weapon, switches are closed by extraction of the arming rods from the MC-1200. These switches connect the MC-1264 thermal battery output to the main fuzing system.

3. [redacted]

DSWA b(1) 1.5(a)

The position of the arming rods can be determined visually in either the bomb or basic assembly configuration.

MC-1264 Thermal Battery

Two MC-1264 thermal batteries (see Figure 26) are used in the TX-53 weapon system to provide dual-channel power for the fuzing system. [redacted]

DSWA b(1) 1.5(a)

MC-1202 Option Switch

[redacted]

DSWA b(1) 1.5(a)

Absence of a signal from the MC-1312 indicates that a laydown delivery is desired, and prevents the MC-1202 from moving out of the laydown option position.

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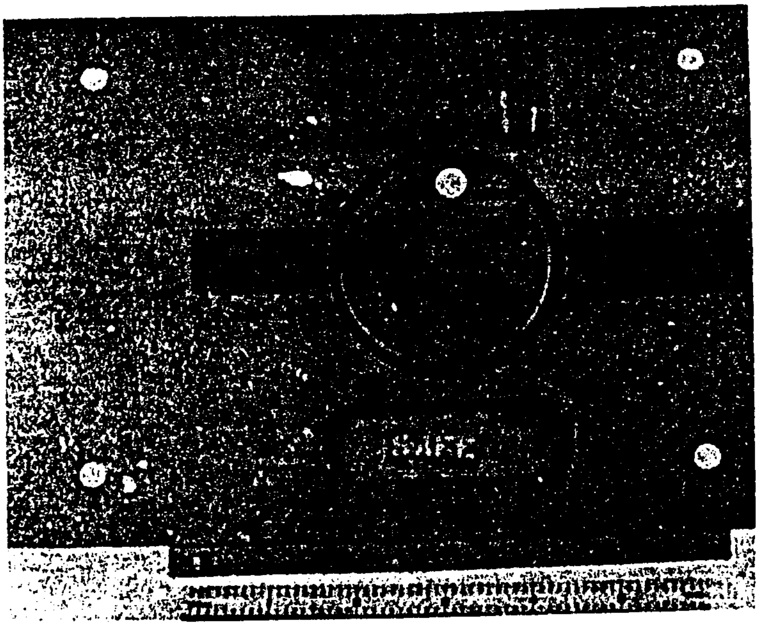

Figure 24. Remove Control Indicator (Ground/Safe Switch)

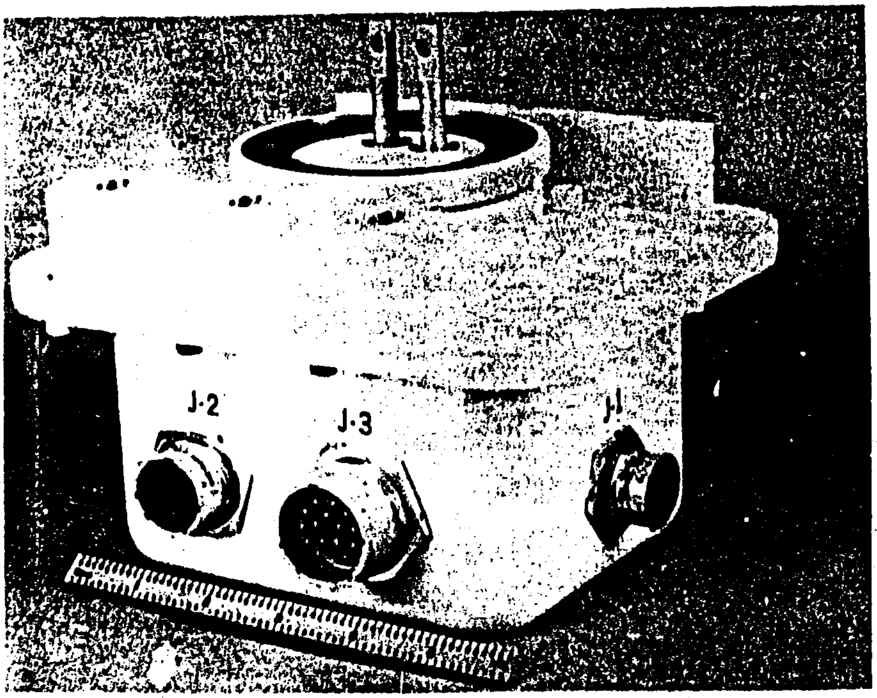

Figure 25. MC-1200 Pullout Device

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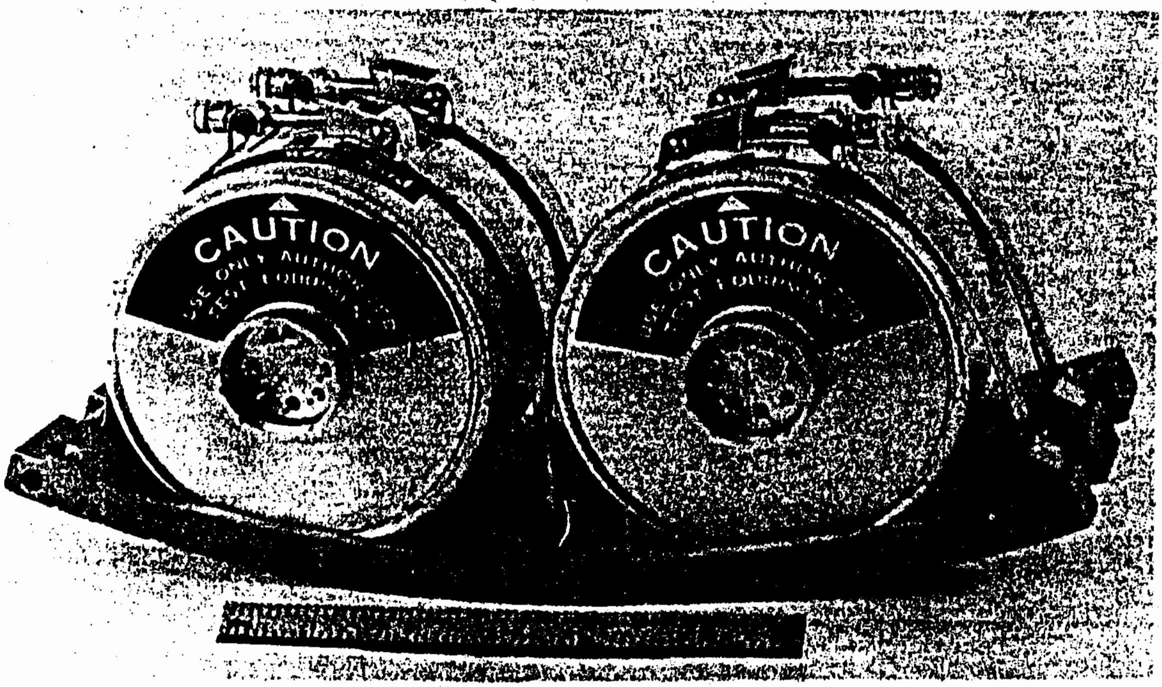

Figure 26. MC-1264 Thermal Battery and Battery Support

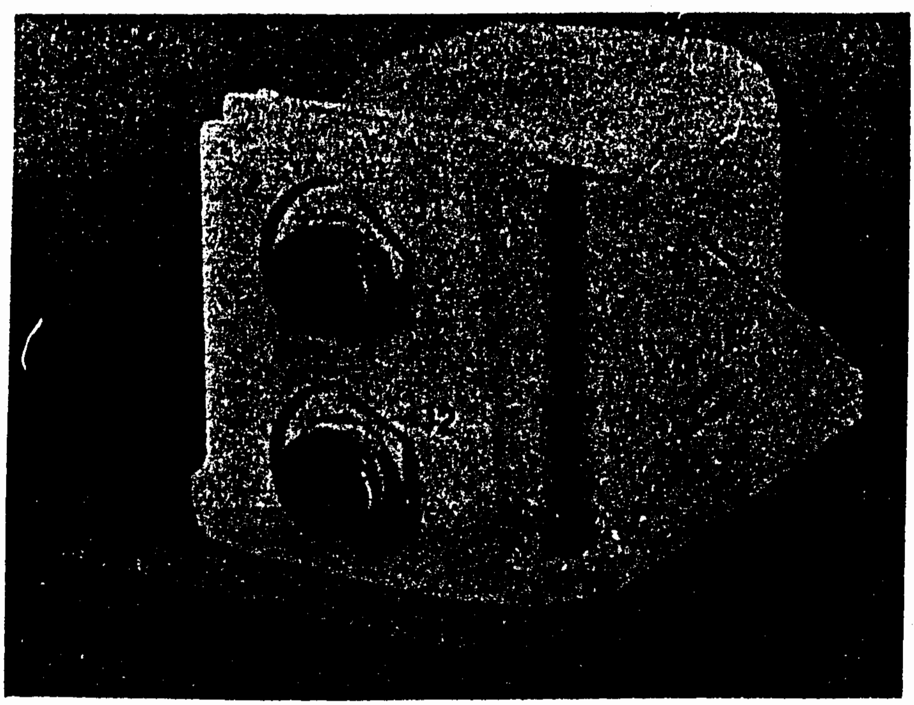

Figure 27. MC-1202 Option Switch

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The MC-1202 is a two-channel motor-driven switch housed in a sealed aluminum case. Each channel consists of a 12-volt DC motor which operates through a gearbox to drive an aluminum camshaft. [redacted]

MC-1312 Option Baro

The MC-1312 option baro (see Figure 28) completes the circuits between the MC-1262 fast rise thermal batteries and the MC-1202 option switch motors. [redacted]

The MC-1312 is a low-volume, four element baro. [redacted]

MC-1315 Parachute Timer

Two MC-1315 timers (see Figure 29) are used to complete the circuits between the MC-1262 fast-rise batteries and the parachute deployment systems. These circuits are completed 1 to 1.14 seconds after the MC-1315 receives a pulse from the pulse generators in the MC-1200. The MC-1315 is a spring-wound escapement timer initiated by an MC-727 explosive motor. The MC-1315 has dual channel switching; therefore, each of the two MC-1315 timers connects both fast-rise batteries to the dual channel deployment systems.

MC-1262 Fast Rise Thermal Battery

Two MC-1262 fast rise thermal batteries (see Figure 30) are used in the TX-53 weapon system. The MC-1262 is a two-section thermal battery containing a 12-volt fast rise section and a 28-volt power section. Basically, it is two batteries in a single case with a common negative terminal. [redacted]

Electrical connections to the MC-1262 are made through the SA-870-1 sealed connector. The 12-volt section of the battery is designed to activate quickly and furnish short duration pulse currents. The 28-volt section is designed for slower activation and delivery of a high current for a relatively longer time.

MC-1203 Interconnecting Box

The MC-1203 interconnecting box (see Figure 31) is a pigtail type interconnecting box which completes the circuits between components in the aircraft monitor and control system and the parachute deployment systems. [redacted]

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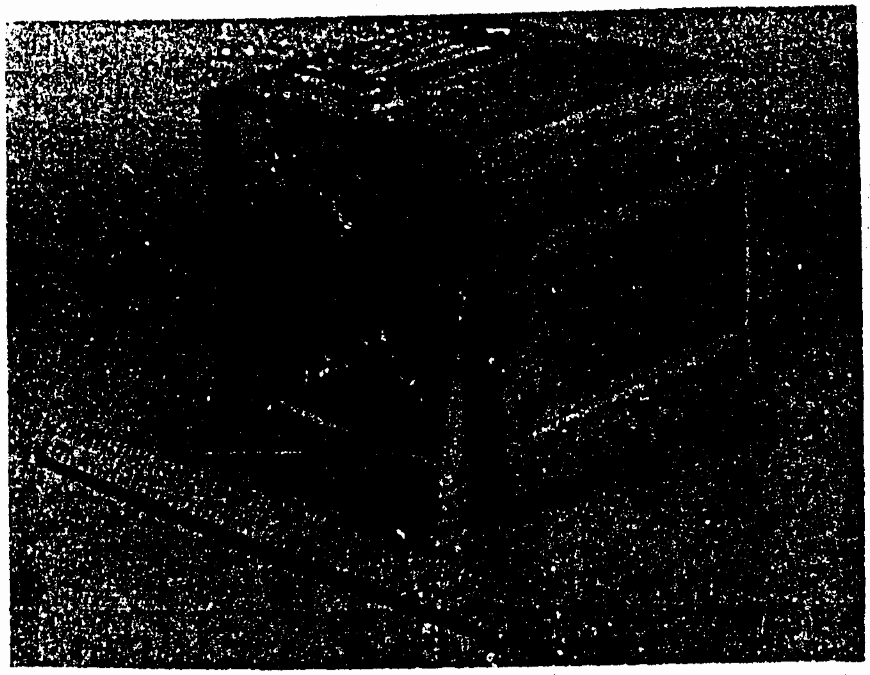

Figure 28. MC-1312 Option Baro

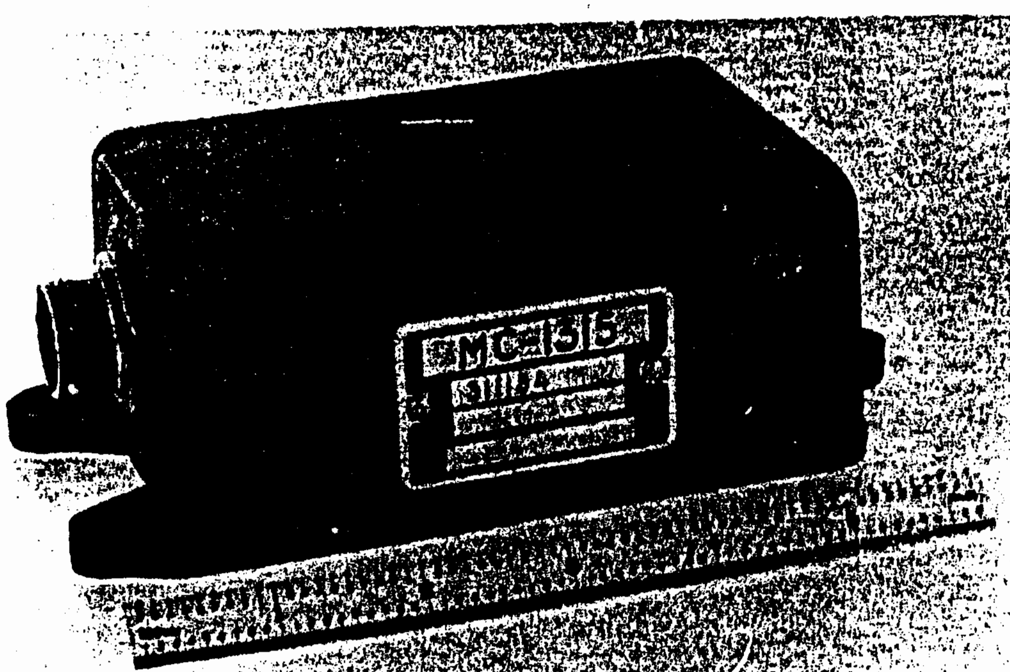

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Figure 29. MC-1315 Parachute Timer

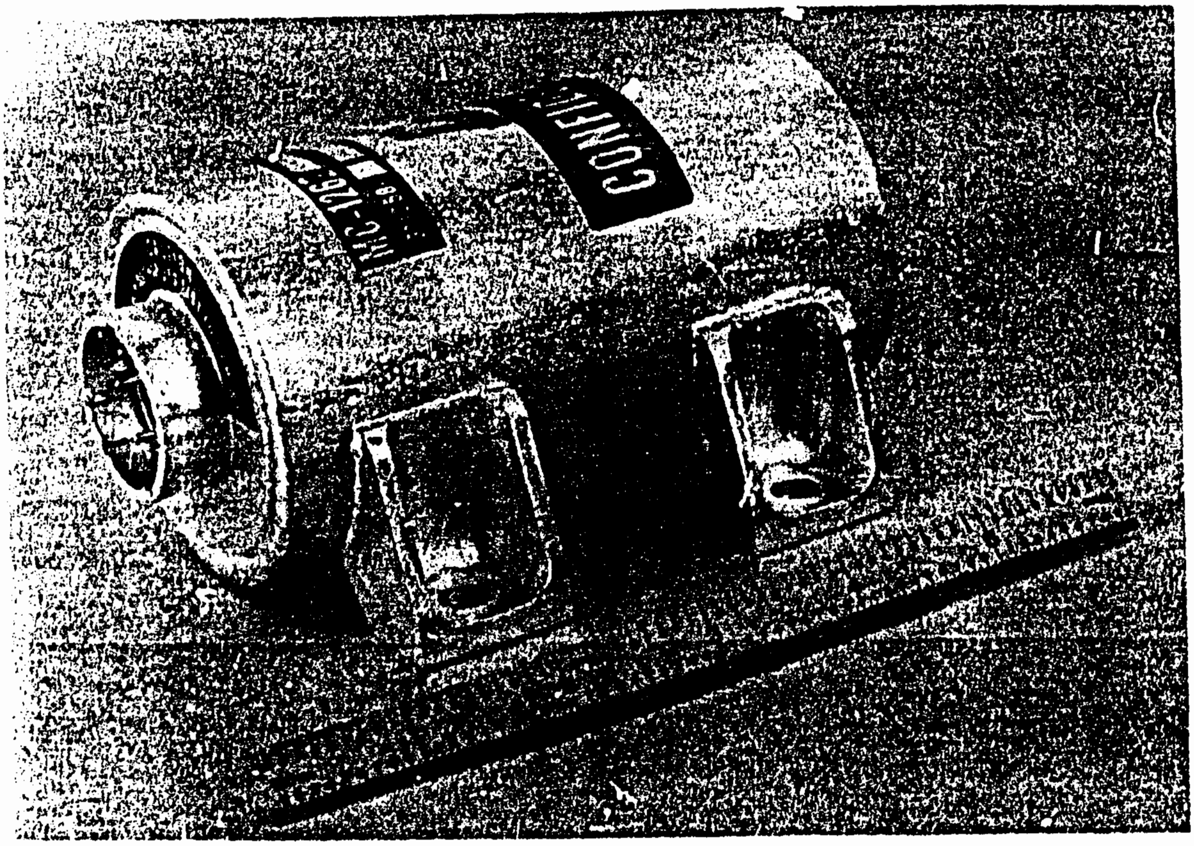

Figure 30. MC-1262 Fast Rise Thermal Battery

Figure 31. MC-1203 Interconnecting Box

Included in the MC-1203 is a 10-K resistor which provides a static ground for the parachute deployme systems, and a 40-ohm resistor which is used in the T-249 malfunction lamp circuit.

MC-1237 Interconnecting Box

The MC-1237 interconnecting box (see Figure 32) completes the circuits between the components in th main fuzing system. This interconnecting box is similar in construction to the MC-1203. It has 14 pigtails, and no resistors.

MC-1060 Detonator

[redacted]

MC-1282 Pressure Monitor

The MC-1282 pressure monditor (see Figure 33) is used to monitor case pressurisation in conjunction with the continuity check. The MC-1282 consists of the MC-1057 and MC-1272 temperature sensitive pres- sure switches and three electrical connectors. The MC-1057 and the MC-1272 are identical except for the pressure setting. [redacted]

System Operation

After the bomb has been loaded in the strike aircraft, the T-240 aircraft monitor and control system must be turned on and be in the safe position to allow operation of the MC-1100. The MC-1100 must be man- ually operated to the armed position (either retard or free-fall) prior to take-off. If the MC-1100 is left in the safe position, a dud will result in all burst options. Choice of AIR or GND option with the T-240 selects circuits in the MC-1200 to provide air burst or contact burst as desired. Laydown-delayed burst is selected automatically by the bomb if the bomb is delivered below a specified altitude and if the T-240 has been set to the AIR or GND position.

Laydown Delivery

At release of the weapon, the extraction of the pullout rods from the MC-1200 pullout device actuates the pulse generators (see Figure 34). The pulse generators initiate the MC-1262 fast rise thermal battery and the MC-1315 timer. The MC-1262 fast rise thermal battery provides power to the MC-1312 option baro- switch and the MC-1315 parachute timer and initiates the MC-1264 thermal battery. [redacted]

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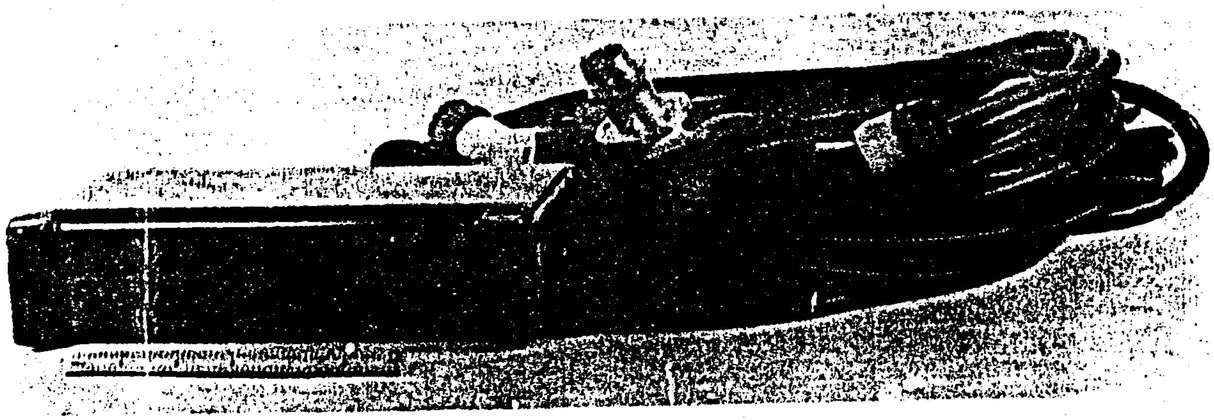

Figure 32. MC-1237 Interconnecting Box

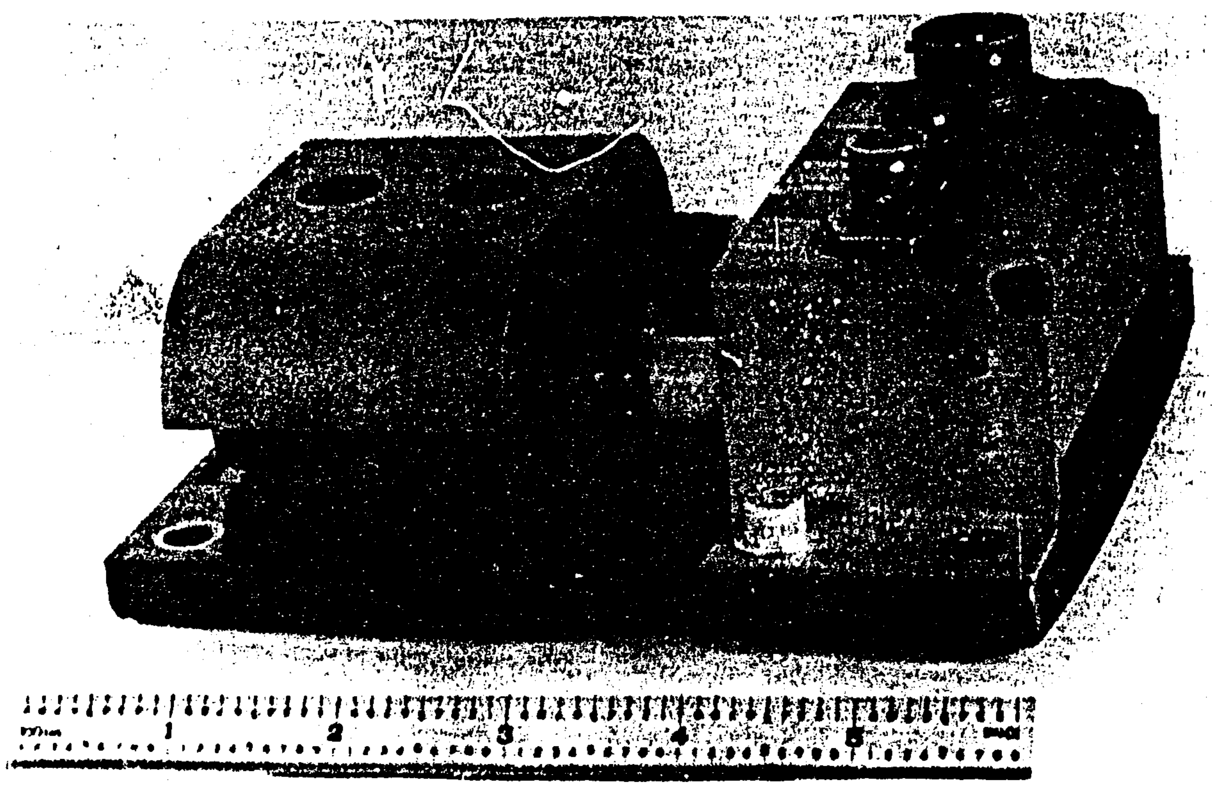

Figure 33. MC-1282 Pressure Monitor

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Figure 34. Operational Capability Diagram for TX-53

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release, the MC-1315 timer contacts close, completing the circuits between the MC-1262 fast rise thermal battery and the appropriate MC-1060 detonators in the automatic parachute deployment systems. At the same time, a signal is provided from the MC-1315 through the MC-1202 to cut the retardation parachute suspension lines, and the following parachute deployment sequence occurs (see Figure 35).

1. The automatic deployment cover is separated from the rear case section by the MDF system.
2. The automatic deployment cover deploys the pilot chute.
3. The pilot chute deploys the retardation chute.
4. The retardation chute, which has been cut loose from the retardation chute lugs, deploys the laydown parachute system.

The laydown parachute system is required to decelerate the weapon to a vertical terminal velocity of 55 fps maximum and limits the attitude angle of the longitudinal axis of the weapon to within 10 degrees of vertical at the time of impact. Upon impact, the kinetic energy is converted into work when the aluminum honeycomb in the energy-absorbing nose is crushed at a uniform load of approximately 70 g's. If a windy condition exists at the target, the weapon will have horizontal velocity as well as vertical velocity. At impact the weapon will topple, causing a secondary impact to occur. The aluminum honeycomb components (fins, rear case section, parachute stowage can, and outer case segments) deform to absorb the secondary impact energy and limit the loads to no more than 100 g's laterally within the basic assembly. All of the fuzing and firing components employed in the laydown option are housed within the basic case and are designed to withstand the 100-g impact shock load.

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[redacted]

High Altitude Delivery

If the weapon has been delivered from above 22,000 feet mean sea level, the MC-1312 option baroswitch contacts are closed, completing the circuit between the MC-1262 fast rise battery and the MC-1202 option switch.

The 22,000-foot minimum altitude was established by adding the sum of the deviations caused by baro-sensing errors and meteorological prediction errors to the upper operational limit of the MC-1312 option baro. Less than one second after release of the weapon the MC-1202 option switch operates to the high-level option. One second after release, the MC-1315 timer completes the circuits between the MC-1262 fast rise

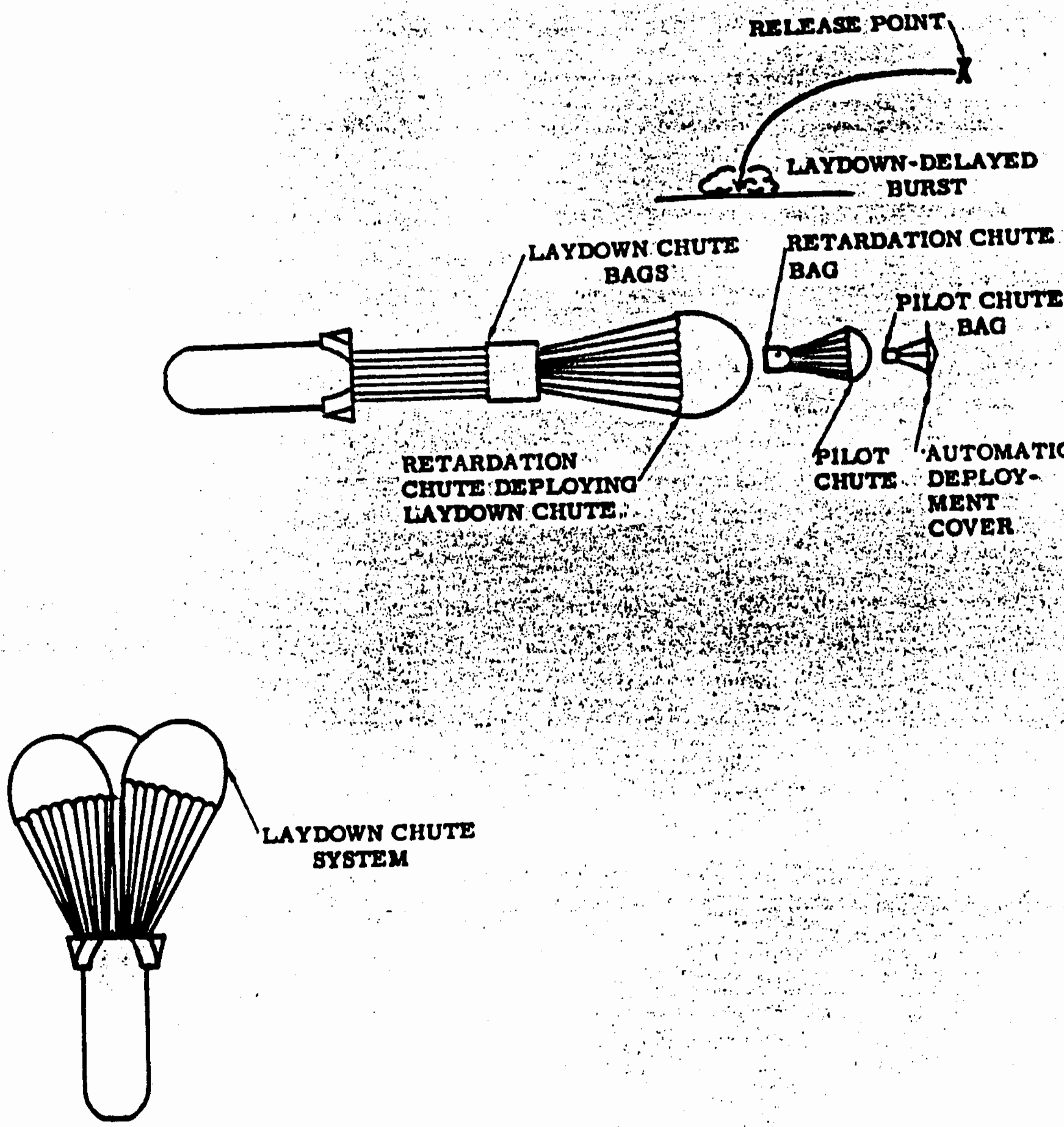

Figure 35. Laydown Option Deployment Sequence

thermal battery and the MC-1060 detonators in the automatic parachute deployment system. The high altitude delivery options are as follows:

Free-Fall -- If the free-fall option has been preflight selected by the MC-1199 ground safing and retard/free-fall switch, closure of the contacts in the MC-1315 parachute timer applies fast-rise battery power through the contacts in the MC-1199 to the parachute deployment system to sever the parachute system attachment. The deployment sequence is as follows (see Figure 36).

1. The automatic deployment cover is separated from the rear case section by the MDF system in the aft end of the rear case section.
2. The automatic deployment cover deploys the pilot chute.
3. The pilot chute deploys the retardation chute.
4. Since the parachute system attachment has been severed by the MDF system, the retardation chute extracts the parachute stowage can along with the remaining parachute system.

Since the parachute system with container weighs approximately 1050 pounds, expulsion of the system is necessary to effect a forward shift in center of gravity for free-fall aerodynamic stability.

Retarded-Fall Option -- The retarded-fall option sequence (see Figure 37) is similar to that outlined above with the exception that a parachute deployment circuit is interrupted in the MC-1199. This prevents severance of the parachute system attachment and causes the weapon to fall retarded.

Air-Burst Option -- Either air burst or contact burst can be selected at the T-249 in either the retarded or free-fall options.

DSWA b(3)

[redacted]

Contact-Burst Option -- The arming sequence of the contact-burst option is identical to the air-burst option. The firing sequence differs in that, by selecting ground burst on the T-249, the fire baro is bypassed by switching within the MC-1200, and the deformation switch is brought into the circuit. The firing circuit is completed by the deformation switch which closes upon contact with the target. The output from the pulse transformer is used to ionize the spark gap and results in the nuclear detonation.

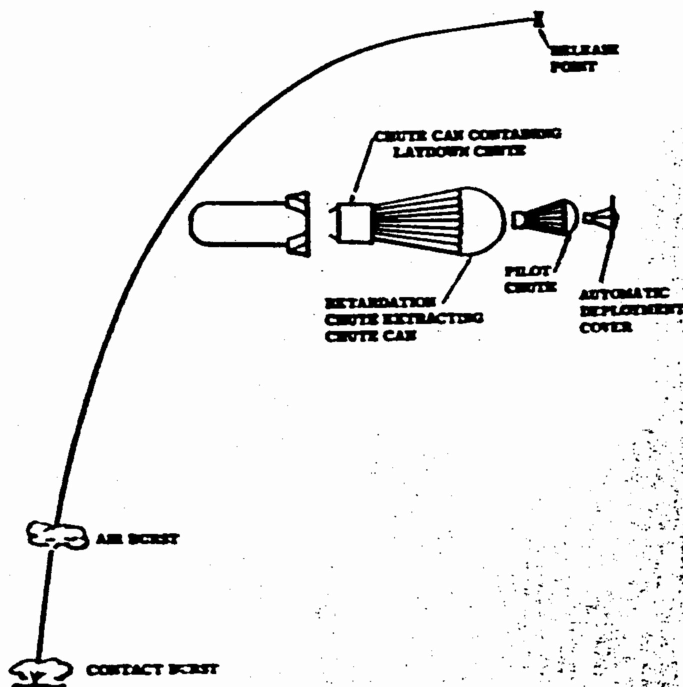

Figure 36. Free-Fall Option Deployment Sequence

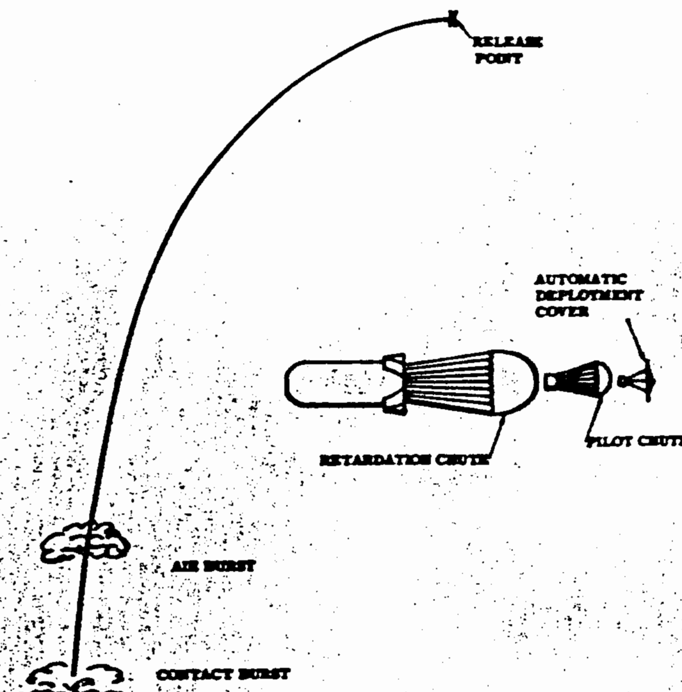

Figure 37. Retarded Fall Option Sequence

MHU-29/C Clip-In Subassembly

The aircraft presently designated as carriers for the TX-53 are the B-47 and B-52. At the time Phase 3 authorization was received, these airplanes were being fitted with clip-in suspension systems which consisted of a clip-in subassembly for the bomb and either the MAU-5/A aircraft adapter for the B-47 or the MAU-6/A aircraft adapter for the B-52.

A clip-in subassembly was being developed for an existing weapon which is 50 inches in diameter but which has a substantially different center of gravity and a hard outer case. The method used in the design of this clip-in subassembly to transmit longitudinal flight loads was friction between the bands of the clip-in subassembly and the hard case of the weapon. This approach requires substantial tightening of the bands around the weapon. Since the outer case segment system of the TX-53 is a thin sheet metal skin backed up by aluminum honeycomb (for laydown energy absorbtion), it was evident that a new clip-in subassembly was required. The MHU-29/C, clip-in subassembly was developed concurrently with the TX-53. A thrust pad on the bomb engages the clip-in subassembly for transmission of longitudinal flight loads. The MHU-29/C is shown attached to the TX-53 stowed in the H-794/H-795 hand truck in Figure 38.

Two fit tests have been conducted, the first resulted in several changes to the MHU-29/C and the TX-53. The last test revealed the lack of adequate clearance between the hand truck and the clip-in subassembly. Modification to the MHU-29/C has been requested to eliminate this interference. A prototype MHU-29/C was used in the test aircraft to accomplish eleven laydown and three high-altitude test drops as reported in Chapter III. A structural test of the MHU-29/C was conducted using a TX-53 basic assembly and an outer case segment system. At design ultimate load, structural compatibility was demonstrated.

In a later test in which a MHU-29/C was used with a TX-53 bomb, structural adequacy was demonstrated; however, excessive deflection of the clip-in subassembly necessitated a subsequent MHU-29/C–TX-53 flyaround test (not yet completed) to monitor bomb to bomb bay clearance.

Transportation and Hoisting

Figure 39 shows the weapon ready for loading into a B-52 bomb bay where the MHU-7/M trailer is employed. Clearance has been demonstrated with the minimum clearance encountered with low B-47 landing gear struts and irregular loading area surface (ice).

B-47 Aircraft

Figure 40 illustrates the TX-53 in the B-47 bomb bay. The TX-53 is compatible with the B-47 for both high and low altitude releases if the bomb bay spoiler doors on the aircraft are retracted to prevent adverse weapon pitch-down.

Compatibility of the TX-53 with the B-47 test aircraft has been demonstrated by 20 laydown and 9 high altitude drop test operations. A flyaround test is scheduled to investigate clearances between the bomb fins and the bomb bay with the bomb bay doors both open and closed.

B-52 Aircraft

Figure 41 illustrates the TX-53 (dual carriage) in the B-52 aircraft. The TX-53 is compatible with the B-52 for either a high altitude or a low altitude release. Single carriage in either bomb bay location or

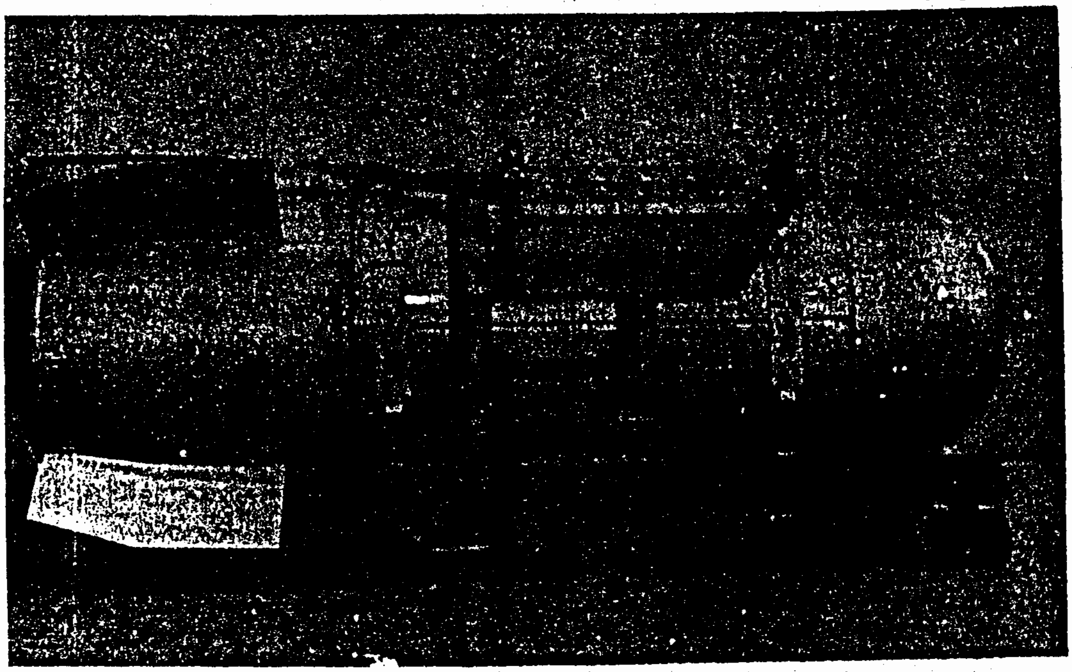

Figure 38. MHU-29C used with the H-794/H-795 Hand Truck

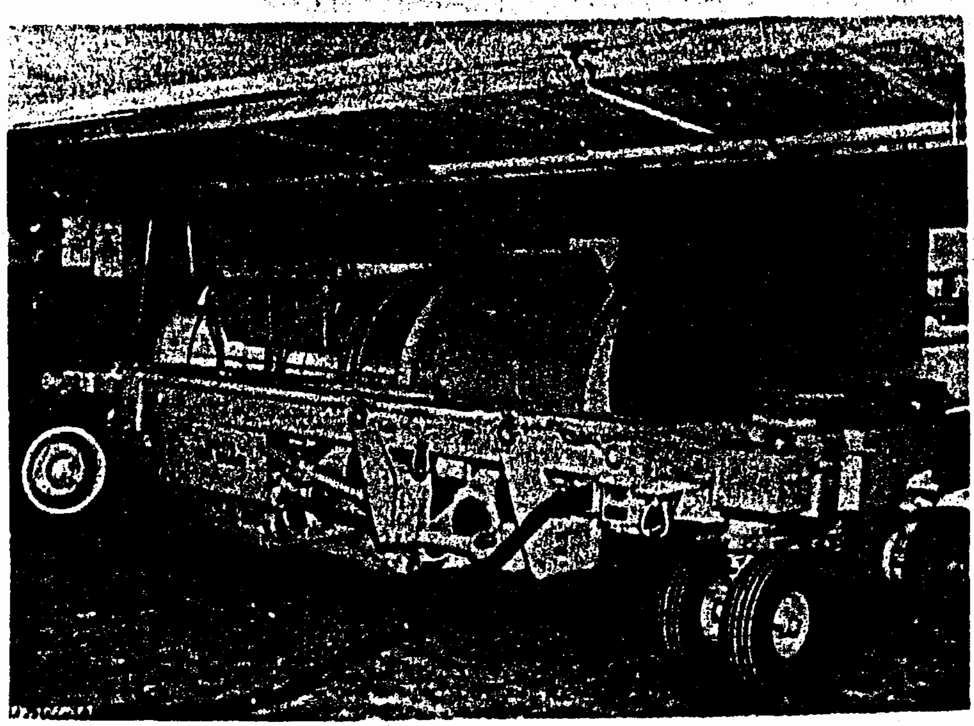

Figure 30. MHU-7/M Trailer

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Figure 40.

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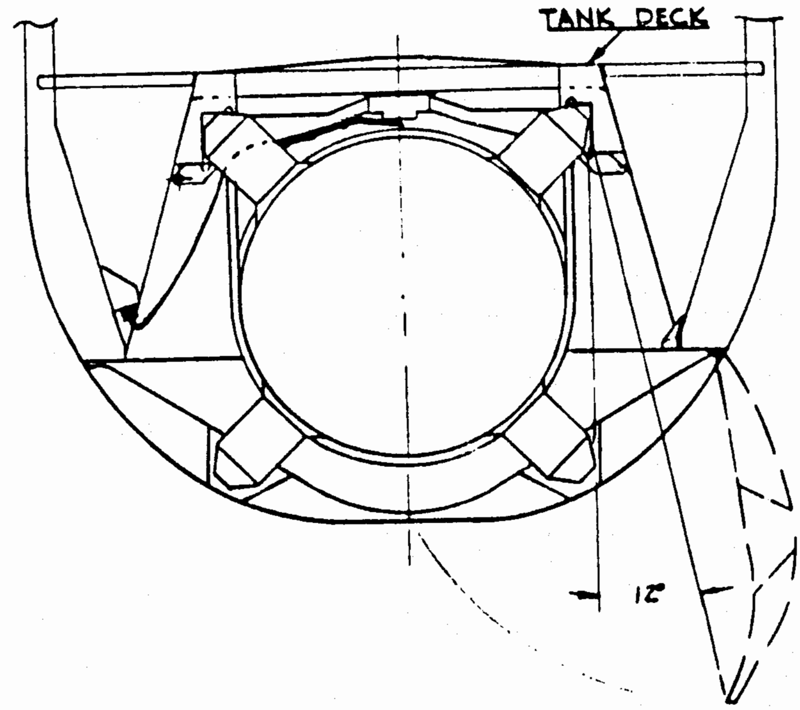

3 In B-47 Bomb Bay

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Figure 4

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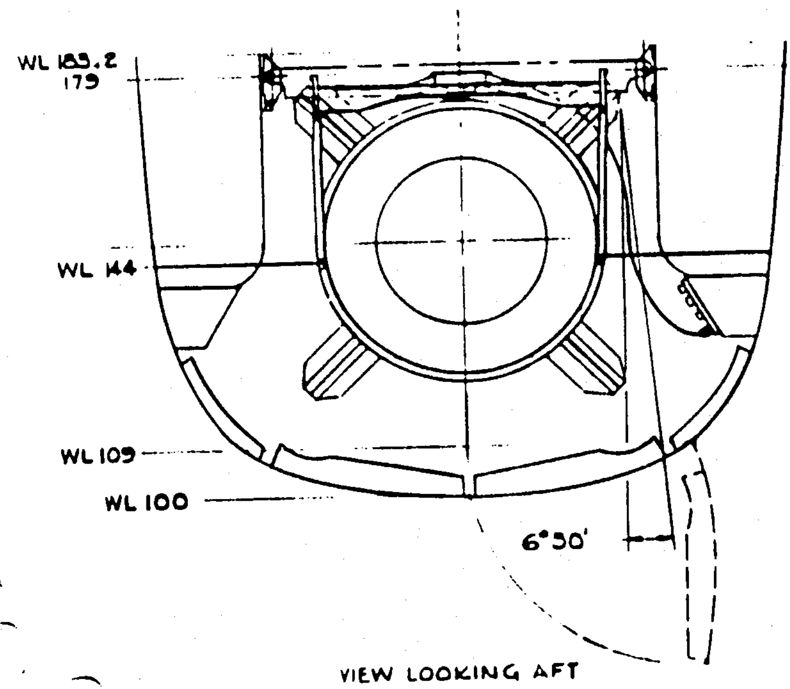

TX-53 in B-52 Bomb Bay

dual carriage is permissible. Either bomb may be released first. As illustrated in Figure 41, adequate fall clearances have been preserved and maximum parachute volume has been attained by the design of the tent-shaped automatic deployment cover. Dual carriage and fall clearance of the TX-53 from either B-52 bomb bay dictated the shape of the automatic deployment cover. Other weapon types have been dual-carried with the TX-53 in the B-52 during the development drop test program.

An extensive fly-around test is scheduled to demonstrate the compatibility of the TX-53 with the B-52H aircraft. Compatibility of the TX-53 with the B-52 test aircraft has been demonstrated by two laydown and sixteen high altitude drop test operations.

<u>Aircraft Monitor and Control System</u>

The TX-53 is compatible with the T-249 or T-249A aircraft monitor and control system and the T-380 peace/readiness switch used in the B-47 and B-52 aircraft. Compatibility has been demonstrated by the fuzing and firing drop tests reported in Chapter III conducted with T-249 or T-249A equipped aircraft.

Safety

Accidental detonation of the TX-53 is prevented by a series of safing devices which can be categorized as follows:

1. Manually set
2. Remotely set
3. Environment sensing

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The standard visual safety check to determine the condition of the TX-53 (safe or unsafe) consists of checking that the MC-1100 ground handling safety switch is in the safe position.

Reliability

[redacted]

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[redacted]

Two TX-53 configurations are contemplated: (1) the bomb for carriage in the B-47 and B-52 aircraft and (2) the basic assembly for installation in the B-58 pod. The TX-53 will have the capability for field conversion from bomb to basic assembly. The parts removed during conversion of bomb to basic assembl

1. Rear case section
2. Nose
3. Fairing
4. Deformation switch
5. Outer case segments
6. Wedge segments
7. Attaching strips
8. Automatic deployment cover
9. CF-1559 cable (deformation switch cable)
10. Switch position indicator
11. Fins
12. Parachute assembly with stowage can
13. Miscellaneous hardware

Three configurations have been designed and can be delivered to stockpile with the Mk/Mod identifica tions as follows:

1. BA53-0/BSC53-0 bomb packaged on the bolster
2. BA53-0 basic assembly packaged on the bolster
3. BSC53-0 bomb shape components, which consist of parts added to the basic assembly to make a bomb. (These components are identical to the above residue list from bomb to basic assembly conversion.)

Stockpile Life

[redacted]

Maintenance

[redacted]

Although the TX-53 bomb is easy to store, handle, and transport with the designated handling equipment, the energy-absorption system and rear case section, which completely surround the basic assembly, are susceptible to damage from sharp objects or concentrated loads. Honeycomb repair procedures are being provided to permit limited field repairs of these components in the event of accidental damage.

Testing

Safety Testing -- The TX-53 [redacted]

Baro Setting -- [redacted] It is unlikely that this setting will ever be changed; however, the T-389 has been developed so that fire-baro setting can be changed at depot level if war plans make a new air-burst altitude necessary.

Continuity Testing -- The Military Characteristics for the TX-53 require that the reliability of the TX-53 shall not be dependent upon continuity monitoring immediately prior to take-off. The TX-53 does not require a continuity test immediately prior to take-off; however, continuity testing is required after initial assembly and following any operation in which a cable (other than the pullout cable or a tester cable) has been disconnected or connected. This includes retrofits and field conversions. Since continuity testing and pressure testing are accomplished simultaneously with the same test equipment, continuity test intervals in the field are determined by pressure testing criteria (see the Pressure Testing for continuity test intervals and continuity test equipment).

Wherever practical, the continuity loops are designed to be incomplete electrically until the following conditions are satisfied:

1. All cables must be connected.
2. Each cable must be connected to the correct component.
3. All squib operated devices must be in the unfired condition.
4. All motor-driven devices must be in the reset position.

Following are the actions that should be followed if an open electrical continuity loop is discovered:

1. Since an open continuity loop may indicate some loss of safety, the ground handling safety switch must be in the safe position and the arming rods must be checked to assure that they have not been extracted before any movement of the weapon is attempted.
2. If the arming rods have been extracted or the ground handling safety switch cannot be safed, the weapon should be treated as dangerous. Disposition should be referred to IXOD procedures.
3. If an open continuity loop is detected and if the safety checks of (1) above have been successfully accomplished, the weapon will be rejected and its disposition determined jointly by the IXOD and AEC.

Pressure Testing -- The TX-53 basic assembly is designed to be sealed and pressurized at the time of assembly, and pressure monitoring will be required at intervals not exceeding 1 month. Considerable development testing is being done to prove the integrity of the weapon seal. Results of these tests and initi stockpile pressure monitor data will be analyzed in an effort to increase the stockpile pressure monitor interval.

Case pressurization is monitored by means of two pressure switches set to operate at different pressure levels. They are located inside the basic assembly. These pressure switches and the electrical continuity loops (see continuity test above) are monitored with the T-304B or T-304C continuity tester used in conjunction with the T-392 adapter cable kit. The adapter cables connect the T-304 to the continuity connector located on the outside of the basic assembly case. The T-304 has two indicating lamps (DS1 and DS2 and the T-392 has two cables (CT-1360 and CT-1361). The table below describes the meanings of the indica tion on the T-304 when using the different tester cables:

	DS 1 Lamp Lights	DS 2 Lamp Lights
Cable CT-1360	Pressure above 22 psi absolute	Pressure above 18 psi absolute and good continuity loops.
Cable CT-1361	Pressure above 18 psi absolute	Good continuity loops.

Possible pressurization and continuity indications (as obtained with the T-304 test) and the resulting actions are listed below:

1. If case pressure is above 22 psi absolute and the electrical continuity is complete, the unit is satisfactory.
2. If case pressure is between 22 psi absolute and 18 psi absolute and the electrical continuity loop is complete, the unit can be used but should be repressurized before further storage.
3. If case pressurization is lost and the electrical continuity loop is complete, the unit may or may not have to be rejected depending on its pressure history:
   (a) If the pressure history is unknown or indicates loss of pressure more than once in a 6-month period, rejection of the unit is mandatory. Disposition is determined jointly by the DOD and the AEC.
   (b) If the pressure history indicates that a previous loss of pressurization has not occurred within a 6-month period, the unit may be repressurized in the field.
4. If the electrical continuity loop is not complete, the unit must be rejected. Disposition is determined jointly by the DOD and the AEC.

Stockpile Sampling Program -- New materials system test (NMST) and quality evaluation system test (QEST) programs will be conducted. Stockpile sampling for the QEST program will continue through the stockpile life.

Capability to Meet MC's

The test program as of July 1, 1961 is approximately 75 percent complete. Test data received thus far indicate that, in general, the Military Characteristics have been complied with. Exceptions are as follows:

1. [redacted] Tests to demonstrate laydown delivery compatibility with minimum aircraft release speed have not been accomplished.

2. [redacted]

3. [redacted]

4. The Military Characteristics specify separate reliability requirements for the "warhead" and for the "fuze." Since both TX-53 configurations, one for the B-58 aircraft and one for the B-47 and B-52 aircraft, contain fuzing and warhead components, no clear-cut distinction exists between warhead and fuze. As a result, reliability estimates have been made only on the complete bomb. Analysis indicates that the TX-53 design can meet a functional reliability in each option (air burst, ground burst, and laydown delayed burst) of [redacted] In making the analysis it was assumed that the weapon would impact on a reasonably smooth surface. Laydown reliability has not been evaluated for targets such as railroad yards or cities.

5. The TX-53 is not compatible with the B-70 aircraft because of direction from the MLC through ALO to suspend development efforts on the B-70 application of the TX-53. The B-70 application problems requiring special weapon development efforts were (1) high temperature bomb bay environment, (2) bomb suspension system, (3) a major electrical power difference from that available in the B-47, B-52, and B-58 aircraft, and (4) high speed release conditions.

6. The requirement for maintaining the weapon in a completely assembled condition ready for immediate employment [redacted]

For complete information about compliance with the Military Characteristics and the Stockpile-to-Target Sequence, see Appendixes B and C, respectively.

CHAPTER III -- SUMMARY OF TEST PROGRAM

General

The test program for the TX-53 has been concentrated in the area of demonstrating ability to survive the impact conditions resulting from the laydown mode of delivery. More conventional aspects of the weapon design are being evaluated; however, maximum use has been made of experience from other weapon programs in order to allow concentration on the problems of laydown.

The laydown capability is being evaluated by means of air-drop tests and by drops from a 185-foot-high tower. Free-fall and retarded-fall capabilities are being evaluated by means of air-drop tests. Sled and 75-mm cannon tests are being used to evaluate the deformation switch used to provide the firing signal in the contact burst option of the free-fall and retarded-fall delivery modes.

Table II gives estimates of the status of each phase of the TX-53 test program as of May 1961. The estimated date of completion of the major part of the test program is September 1961. This date is determined largely by delays in the air-drop and tower-drop test programs caused by a series of changes to the three-cluster laydown parachute system being developed by the Air Force.

TABLE II

Status of TX-53 Test Program

May 1961

Type of test*	No. planned	No. complete	Percentage complete
Scaled-model tower-drop test			
1/2-scale solid nose	36	36	100
1/4-scale and 1/8-scale barrel-type nose	18	18	100
1/2-scale barrel-type nose	11	11	100
Full-scale tower-drop test			
To design conditions			
Trial run model (TRM) less fuzing and firing (F& F) parachute	10	10	100
TRM less parachute	2	2	100
To extreme conditions			
TRM	2	0	0
Other configurations	16	0	0
Special tests - barrel-type nose	6	4	67

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TABLE II (cont)

Type of test*	No. planned	No. complete	Percentage complete
High-altitude free-fall			
Air-drop tests			
Ballistic	8	8	100
Ballistic with F& F	5	3	60
High-altitude retarded			
Air-drop tests			
Ballistic	9	9	100
Ballistic with F& F	5	3	60
Low-altitude laydown			
Air-drop tests			
Ballistic	6	6	100
Ballistic with F& F	2	2	100
	12	4	33
TRM less F& F	6	3	50
Special tests			
Sled test (nose)	10	5	50
75-mm cannon tests (nose)	14	9	64
Preproduction tests	3	0	0
Fly around tests	3	1	33
Environmental tests			
Complete bomb	3	1	33

*The following definitions apply to vehicles used in the TX-53 test program. Exceptions are noted in the text.

	Case	Energy absorption system		Fuzing and firing
TRM (trial run model)	Cast, forged, or extruded aluminum	Complete		Complete
Ballistic	Steel or modified TX-46 aluminum case	Simulated		None

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Drop Tests

The tower-drop and air-drop test programs for the TX-53 are described in the following subdivisions.

Tower-Drop Tests

The tower-drop test program is divided into two phases: (1) scale-model tests, and (2) full-scale tower drop tests.

Scale-Model Tests -- The earliest test program for the TX-53 was a series of tower drops using half-scale models and the 300-foot-high tower facility at Sandia Corporation. Forty-seven tests were conducted during the period November 1958 to April 1960 with varying drop conditions and several types of energy absorbing systems. Thirty-six tests were conducted using either the right-cylindrical aluminum honeycomb or the toroidal aluminum honeycomb nose and eleven tests were conducted using the barrel-type nose. The barrel-type nose is being investigated as a backup design for the aluminum honeycomb nose. In addition to the tower-drop tests of half-scale models, nine 1/8-scale models and nine 1/4-scale models have been dropped from a hoist facility to verify scaling factors for the barrel-type nose.

The scale-model drop tower test program has satisfied the following objectives:

1. To confirm, by measurement and application of scaling factors, the predicted energy absorption properties of selected materials and configurations.
2. To obtain performance data for the energy absorption systems early in development by using the existing tower facility.

Full-Scale Tower-Drop Tests -- Because the existing 300-foot-tower facility at Sandia Corporation cannot handle the weight of the TX-53, a 185-foot-tower facility capable of 16,000 pounds maximum was constructed in Area 3 of the Sandia Corporation. This facility was completed in September 1960. Most of the testing of the energy absorbing system is being done with the 185-foot tower rather than with air-drop tests for the following reasons:

1. Target surfaces can be varied quickly and relatively cheaply.
2. Impact velocities can be varied, allowing the simulation of retardation and wind conditions.
3. Impact on the desired surface can be controlled accurately.

The full-scale tower-drop test program has the following objectives:

1. To demonstrate that the weapon will survive simulated laydown environments.
2. To demonstrate that the weapon will function as desired.
3. To determine variables performance data for fuzing and firing system evaluation.

Table III gives a summary of the results of the first phase, tests to design conditions, for the tower-drop test program. The design parameters involved were: vertical velocity - 55 fps, lateral velocity - 51 fps (simulating a 35 mph wind), impact angles of ±5 degrees from the vertical, and a flat concrete target surface. This program, completed in April 1961, has satisfied the objectives.

TABLE III

Summary of Results of Full-Scale Tower Drop-Test Program Tests to Design Conditions, for the TX-53

Test No.	Date	Description of Test Unit	Case	Fuzing & Firing System	Impact Velocity (ft/sec) Vertical	Impact Velocity (ft/sec) Lateral	Impact Acceleration (g's) Vertical Measured	Impact Acceleration (g's) Vertical Design Maximum	Impact Acceleration (g's) Lateral "Slapdown" (Design maximum is 100g's)	Impact Attitude (Degrees) From the Horizontal	Impact Attitude (Degrees) From the Vertical	Remarks
53-53L	9-23-60		Cast Al	None	54	19	65	50 (toroidal nose)	20	89.5	0	
53-54L	10-6-60		Cast Al	None	54	24	55	50 (toroidal nose)	15	95.4	0	
53-55L	11-19-60		Forged Al	None	53	30	53	50 (toroidal nose)	75	82.6	-7.0	
53-56L	12-3-60		Forged Al	None	55	36	90	85 (solid nose)	80	89.4	0	
53-57L	12-23-60		Forged Al	None	51	43	87	85 (solid nose)	51	86.0	-1.8	
53-63L	2-4-61		Forged Al	Complete	65	54	93	85 (solid nose)	27	95.0	0	
53-61L	2-16-61		Forged Al	Complete	26	63	83	85 (solid nose)	>125g's, off-scale	89.7	Did not release	
53-67L	3-29-61		Forged Al	Complete	52	0	3.2	85 (solid nose)	No slapdown	89.9	0	
53-59L	3-4-61		Forged Al	None	55	49	72	70 (solid nose)	28	89.0	0	
53-60L	3-11-61		Extruded Al	None	55	45	86	70 (solid nose)	68	102.0	-3.1	
53-65L	4-26-61		Cast Al	None	55	40	64	70 (solid nose)	36	Data unavailable	Data unavailable	
53-58L	4-10-61		Forged Al	None	55	45	74	70 (solid nose)	22	Data unavailable	Data unavailable	

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NOTES:

Tests are grouped by type of nose used.
All target surfaces are flat concrete, 24 inches thick, unless noted otherwise.
Accelerations listed are faired values of instruments giving highest reading. See SC-4452 for definition of faired value.
Lateral accelerations are vector sums of horizontal and vertical accelerations at slapdown.

The second phase of the tower-drop test program involves testing to extreme conditions. The objectives are to determine the margins of safety between design conditions and conditions of either ultimate failure, limits of test equipment, or conditions of reasonable judgment, by varying impact velocities, impact attitudes, unit temperature, and target surfaces. These data are to be used as source data for estimating weapon reliability with regard to assumptions of winds over the target and the nature of target complexes, and for adjusting environmental test specifications for weapon components. An outline of the proposed program is given as Table IV.

The third phase of the tower-drop test program involves the testing of full-scale models of the TX-53 using the barrel-type nose. The objective is to determine the energy-absorbing properties of several types of aluminum materials in barrel-type configurations. Four of the six scheduled tests have been completed. Table V gives a summary of the results. The data indicate that the barrel-type nose is comparable to the aluminum-honeycomb, right-cylinder nose in energy absorption and, therefore, the barrel-type nose provides an alternate design.

Air-Drop Tests

The air-drop test program is divided into three categories: (1) high-altitude free-fall summarized in Table VI; (2) high-altitude retarded-fall summarized in Table VII and (3) low-altitude laydown summarized in Table VIII. High-altitude tests have been conducted at Tonopah Test Range, while laydown tests have been conducted at both Dalhart Test Range and Tonopah Test Range. Both of these ranges are equipped with concrete targets. The air-drop test program has the following primary objectives:

1. To demonstrate the compatibility of the weapon with the assigned carriers and support equipment.
2. To demonstrate that the weapon will survive the system environment.
3. To demonstrate that the weapon will function as desired.

In addition to the primary objectives the following secondary objectives apply:

1. To define certain system environments by test and data analysis.
2. To determine variables performance data for the evaluation of the fusing and firing system.
3. To obtain variables data for evaluation of the mechanical system.
4. To obtain ballistics data for use as source data for bombing tables.

Two high-altitude free-fall, two high-altitude retard, and eleven laydown drop tests have been delayed pending verification by the Air Force that the three-cluster parachute will satisfy the TX-53 requirements. Generally, the special objectives of the high-altitude drops (both free-fall and retard) have been satisfied. However, final verification of design depends on the remaining four drops. The remaining high-altitude drop tests are required to test at worst conditions (1) pneumatic system sensing, (2) pitch down at release, and (3) any other condition that may occur at a previously untested combination of speed, altitude, carrier (B-47 or B-52) or bomb bay location (front or rear).

Little can be concluded from the laydown air drop that has not been already concluded in the tower-drop test program, since none of these units tested used the final design parachute.

TABLE IV

Outline of Proposed Full-Scale Tower Drop Test Program
Tests to Extreme Conditions

Parameter to be investigated	No. of tests	Range of parameters	Remarks
Impact velocity, flat concrete target	3	Vertical velocity: 65 to 75 fps	Unit to be restrained to prevent slapdown. Range of vertical velocity intended to cover events of one and two parachute failures.
Concrete curb target at design impact velocity	2	Vertical velocity: 55 fps Curb height: 8", 20" Nose Area on curb: 50%, 90%	
Impact angle, flat concrete target	2	Vertical velocity: 55 fps Lateral velocity: 51 fps Impact angle: 70°, 105°	
Slapdown, flat concrete target	6	Vertical velocity: 0 Lateral velocity: 30 fps to failure	Four tests to use weight equivalents of nose and rear case section. Proof tests at 40 fps and below failure limit.
Impact on rear case section, reverse acceleration	5	Vertical velocity: 20 fps to failure Lateral velocity: 0	Nose assembly to be simulated by weight equivalent.

TABLE V

Summary of Results of Full-Scale Tower Drop-Test Program
Tests of the Barrel-Type Nose

Test No.	Energy Absorption Method	Date	Impact Velocity (ft/sec) Vertical	Impact Velocity (ft/sec) Lateral	Impact Acceleration Vertical (g's) Measured	Impact Acceleration Vertical (g's) Design Maximum	Lateral or "Slapdown" (Design Maximum 100g's)	Impact Attitude (degrees) From the Horizontal	Impact Attitude (degrees) From the Vertical	Remarks
BB-1	Energy absorbed by metal forming.	11-9-60	55.5	49.1	139	60	See "Remarks"	81.6	0	
BB-2		11-26-60	63.7	50	119	60	250g's	79.1	0	
BB-3	Energy absorbed by metal forming and crushing of honeycomb in outer case segments restrained by flange.	1-26-61	40	38	62	60	See "Remarks"	90	0	
BB-4		3-14-61	62	51.3	84.5	60	See "Remarks"	96	0	
BB-5	Energy absorbed by nose and unrestrained outer case segments.	7-61	55	51.3	-	60	-	-	0	
BB-6		8-61	55	51.3	-	60	-	-	0	

NOTES:

BB-2 and BB-4 vertical impact velocities represent the impact conditions if one parachute in the cluster were to fail.
All target surfaces are flat concrete, 24 inches thick.
Accelerations listed are faired values of the instrument giving the highest reading. See SC-4452 for definition of faired value.
Lateral accelerations are vector sums of horizontal and vertical accelerations at slapdown.

TABLE VI

Summary of Results of High-Altitude, Free-Fall Air-Drop Tests of the TX-53

Test No.	Date	Delivery Information: A/C	Delivery Information: Bomb Bay (unit location)	Delivery Information: Suspension System	Description of Test Unit		Description of Parachute System	Option Selected	Release Conditions: Altitude (ft above terrain)	Release Conditions: True Air Speed (knots)	Release Conditions: Dynamic Pressure "Q" (lbs/ft²)	Stability During Fall	Impact Velocity (fps)	Remarks
53-3	8-26-59	B-52	Rear (front empty)	MHU-23C (TX-41)	Ballistic		None used		39,788	459		Severe pitch at release; unit tumbled	763	
53-5	9-3-59	B-47		AFSWC interim design	Ballistic		None used		37,740	457		Severe pitch at release; unit stable before impact	1011	
53-8	3-31-60	B-52	Front (rear empty)	AFSWC interim design	Ballistic		None used		40,479	534		Unstable trajectory	971	
53-10	4-1-60	B-52	Rear (TX-53 shape in front)	AFSWC interim design	Ballistic		None used		40,586	510		Some pitch at release; stable trajectory	972	
53-18	10-12-60	B-52	Rear (front empty)	AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	16-1/2' reefed to 12'		44,451	412		Stable	990	
53-23	10-28-60	B-52	Rear (front empty)	AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	16-1/2' reefed to 12'		45,153	467		Stable	988	
53-25	10-28-60	B-47		AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	16-1/2' reefed to 12'		38,626	414		Stable; first time bomb-bay spoilers disabled	997	
53-26	12-8-60	B-47		AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	16-1/2' reefed to 12'		17,101	517		Stable	932	
53-29	12-9-60	B-52	Rear (front empty)	AFSWC interim design	Ballistic w/F&F		16-1/2' reefed to 12'	Contact	44,570	466		Somewhat unstable because parachute container not extracted	99	
53-32	2-14-61	B-52	Rear (TX-28-X2 in front)	AFSWC interim design	Ballistic w/F&F		16-1/2' reefed to 12'	Air	44,813	TAS Unavailable; Ground speed 386 knots		Stable	98	
53-36	2-28-61	B-52	Rear (SAMOS in front)	MHU-29C	Ballistic w/F&F		16-1/2' reefed to 12'	Air	13,992	521		Stable	421	
53-45					Ballistic w/F&F		16-1/2' reefed to 12'	Contact						
53-46					Ballistic w/F&F		16-1/2' reefed to 12'	Contact						

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Summary of Results of High-Altitu

Test No.	Date	A/C (Delivery Information)	Bomb Bay (unit location) (Delivery Information)	Suspension System (Delivery Information)	Description of Test Unit		Dia (ft) (Description of Retard Parachute System)	Line Length (ft) (Description of Retard Parachute System)	Option Selected
53-1R	7-28-59	B-47	--	AFSWC interim design	Ballistic	Static line deployed	12	40	--
53-4R	8-20-59	B-52	Rear, front empty	MHU-23C (TX-41)	Ballistic	--	12	40	--
53-7R	11-5-59	B-47	--	AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	12	40	--
53-2R	12-11-59	B-52	Rear, front empty	MHU-23C (TX-41)	Ballistic	Simulated X-unit for deformation-switch study	11 (apex line)	16	--
53-9R	1-13-60	B-52		AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	12	40	--
53-13R	4-13-60	B-52	Rear, front empty	AFSWC interim design	Ballistic	--	12	20	--
53-10R	5-25-60	B-52	Rear, front empty	AFSWC interim design	Ballistic	--	16.5 reefed to 12	20	--
53-21R	10-12-60	B-47	--	AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	16.5 reefed to 12	21	--
53-24R	11-10-60	B-47	--	AFSWC interim design	Ballistic	Simulated X-unit for deformation-switch study	16.5 reefed to 12	20	--
53-27R	12-13-60	B-47	--	AFSWC interim design	Ballistic w/F&F	Simulated X-unit for deformation-switch study	16.5 reefed to 12	20	Air
53-28R	1-26-61	B-52	Front, rear empty	MHU-20C	Ballistic w/F&F	Simulated X-unit for deformation-switch study	16.5 reefed to 12	20	Air
53-37R	4-8-61	B-47	--	MHU-20C	Ballistic w/F&F	Simulated X-unit for deformation-switch study	16.5 reefed to 12	20	Ground
53-33R					Ballistic w/F&F	Simulated X-unit for deformation-switch study			
53-39R					Ballistic w/F&F	Simulated X-unit for deformation-switch study			

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TABLE VII

itude, Retarded Air-Drop Tests of the TX-53

Release Conditions			Trajectory Information				
Altitude (ft above terrain)	True Air Speed (knots)	Dynamic Pressure "Q" (lbs/ft²)	Time of Fall (sec)	Time of fall corrected 40,000 ft, to 4,000 ft (sec)	Stability	Impact Velocity (fps)	Remarks
37,806	419	141.0	94.4	94	Unstable	367	
39,508	447	146.5	58.3	Not applicable	Unstable in a free-fall trajectory	1014	
36,436	445	164.0	60.60	Not applicable	Stable	790	
40,029	445	137.4	91.4	81	Stable	387	
39,955	486	152.1	71.36	Not applicable	Unstable, unit rolled	875	
40,441	480	161.0	96.48	84	Unstable	351	
45,297	412	90.4	93.0	84	Slightly unstable	421	
13,061	523	518.1	41	64	Unstable	408	
38,521	303	112.3	85.5	70.5	Unstable	411	
13,002	528	530.0	34.3	Not applicable	Stable	623	
45,202	455	112.3	87.4	Not applicable	Unstable for 30 seconds	415	
10,291	553	493.0	56.78	99	Stable	390	

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TABLE VIII

Summary of Results of Low-Altitude, Laydown ...

Test No.	Date	A/C	Delivery Information: Bomb Bay (unit location)	Delivery Information: Suspension System	Description of Test Unit: Bomb	Laydown Parachute: Type	Laydown Parachute: Reef Length (ft)	Laydown Parachute: Reef Time (sec)	Release Conditions: Altitude (ft above Terrain)	Release Conditions: True Air Speed (knots)	Dynamic Pressure "Q" (lbs/ft²): Actual	Dynamic Pressure "Q" (lbs/ft²): % Design Maximum	Performance: Fall Distance to Required Vertical Velocity (fps): Distance (ft)	Required Vertical Velocity (fps): Design Max. Vel.	Tra... A...
53-6L	9-12-59	B-47		AFSWC interim design	Ballistic	3-44'	16	4	1185	325 (indicated air speed)	No test		No test	70	No
53-11L	10-10-59	B-47		AFSWC interim design	Ballistic	3-44'	16	2	1283	393	435	71	No test	70	No
53-15L	11-6-59	B-47		AFSWC interim design	Ballistic	3-44'	16	2	1247	431	538	87	800	70	
53-20L	12-9-59	B-47		AFSWC interim design	Ballistic	3-44'	16	2	~1200	46?	635	103	Not attained	70	Not a
53-10L	1-8-60	B-52	Rear (front empty)	AFSWC interim design	Ballistic	3-44'	16	2	1134	317	384	46	988	70	
53-48L	4-27-60	B-52	Rear (B39-1 in front)	AFSWC interim design	TRM less F&F	3-44'	None	None	987	340	337	54	460	70	
53-14L	6-2-60	B-47		AFSWC interim design	Ballistic with F&F	3-44'	None	None	1012	356	351	57	490	70	
53-40L	6-3-60	B-47		AFSWC interim design	TRM less F&F	3-44'	None	None	1119	399	419	68	870	70	
53-17L	8-17-60	B-47		AFSWC interim design	Ballistic with F&F	3-44'	None	None	982	356	336	55	834	42	
53-50L	8-10-60	B-47		AFSWC interim design	TRM less F&F	3-44'	None	None	~1000	~235	310	51	No test	42	No
63-22L	10-26-60	B-47		MHU-20C	Ballistic	3-48'	None	None	1002	475	605	96	Not attained	62	
53-34L	2-6-60	B-47		AFSWC interim design		1-76' (Sandia design)	30	1	1072	459	582	95	500	55	
53-31L	3-2-61	B-47		MHU-20C		3-48'	22.5	1	1587	381	No test		No test	55	No
53-30L	3-10-61	B-47		MHU-20C		3-48'	22.5	1	2024	368	365	59	No data	55	No
53-35L	4-21-61	B-47		MHU-20C		3-48'	25.0	1	966	470 (B-47 Max.)	632	103	Not attained	55	Not r
53-36L														55	
53-43L														55	
53-40L														55	
53-41L														55	
53-42L														55	
53-71L														55	
53-44L														55	
53-72L														55	
53-52L														55	
53-47L														55	
53-73L														55	

NOTE: 1. Tests 53-6L to 53-17L, inclusive, were conducted at Dalhart Test Range, Texas. All other tests at Tonopah Test Range, Nevada.

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·Drop Tests of the TX-53

ance of Parachute System
each:

Required Attitude, 90+5° tory e	By Attitude Angle	Impact Velocity (fps)	Load (lbs) Actual	Load (lbs) Design Maximum	Performance of Energy-Absorption Material Vertical Acceleration at Impact (g's) Actual	Design	Aerodynamic Performance Pitch Angle at release (down from horizontal, °)	Remarks
st	Not requested	239	No data	100,000	No test (concrete)	50	70	
st	Not requested	527	108,000	100,000	No test (concrete)	50	No test	
)	Not requested	55	78,500	100,000	50 (concrete)	50	110	
ined	Not requested	No data	38,000	100,000	Nose tore loose in fall	50	80	
)	Not requested	58	43,000	100,000	50 (concrete)	50	30	
)	Not requested	59	68,000	150,000	45 (concrete)	50	Not applicable	
)	Not requested	59	128,500	150,000	45 (concrete)	54	30	
)	Not requested	78	90,000	150,000	50 (concrete)	80	80	
)	Not requested	59	99,000	150,000	44 (dirt)	50	No data obtained	
est	Not requested	No test	No test	150,000	No test (dirt)	80	8	
0	Not requested	93	92,000	150,000	No test (dirt)	50	30	
5	850	55	73,300	150,000	51 (dirt)	80	18	
est		607	Deployed free-fall	150,000	No test (dirt)		No data obtained	
ata	Not attained	54	84,500	150,000	80 (dirt)	85	30	
ained	Not attained	77	72,000	150,000	105 (concrete)	85	33	
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.
				150,000				Test not completed.

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It is believed that the remaining 11 units will satisfy the TX-53 design objectives if the Air Force laydown parachute system will meet the TX-53 requirements associated with impact condition and weapon structure.

Environmental Tests

General

The criteria for environmental tests of the TX-53 have been determined by study of environmental standards as outlined in the Stockpile-to-Target Sequence; applicable parts of MIL-E-5272B, MIL-A-8591B (ASG), Joint Environmental Task Group Report SC-2943A(TR), SC-4451(M), the document which supersedes SCS-5 and SCS-7; and by review of data obtained from other weapon drop tests. These tests are designed to demonstrate that the TX-53 is capable of surviving the expected storage, handling, transportation, and delivery environments and is capable of operating over the target as intended.

Component Environmental Tests

Table IX gives a summary of the environmental tests conducted and planned for TX-53 components. Environmental test parameters shown, in general, represent the minimum values applicable and do not necessarily indicate the capability of the component or the actual conditions for particular components. Components have satisfactorily passed the indicated test, or, where failures have been experienced, remedial design action has been taken. There appear to be no significant problems in the area of environmental capability of TX-53 components.

In addition to the test program described in Table IX, certain components will be subjected to a separate test program whereby the ultimate capability of the component in the environment of concern will be ascertained by testing to component failure, to test equipment limitations, or to levels of reason. This program supplements the tower-drop test program previously described.

Weapon Environmental Tests

Three complete bombs are scheduled to be subjected to the environmental tests shown in Table X. These tests, in general, supplement the component tests previously described in that the prime interest is in detecting the more subtle types of interactions among components which cannot easily be detected when testing components individually. In addition, testing of the complete weapon is necessary in order to determine the degrees of environmental protection afforded by the energy absorption material and the aluminum case. Test results to date indicate satisfactory environmental resistance; however, further testing is required before a high degree of confidence can be achieved.

Other Environmental Considerations

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TABLE IX

Component Environmental Test Summary

Storage, Handling, and Transportation

Key:
1. Total tests planned
2. Tests completed
3. Tests successfully passed
4. Lot size
5. Sample size
6. Allowable failures

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TABLE IX (cont)

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TABLE IX (cont)

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TABLE IX (cont)

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TABLE IX (cont)

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TABLE IX (cont)

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TABLE X

Summary of Environmental Test Program for TX-53 Weapons

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[redacted]

Acoustic Noise -- Acoustic noise environments of the B-47 and B-52 are considered to have a negligible effect on the TX-53 and no special tests are planned. The B-58 is reported to have an environment of about 140 decibels in the area of the two-component pod. A special test of the TX-53 basic assembly using the B-58 as a noise generator is planned for late 1961.

Nuclear Radiation -- [redacted]

Fly-Around Tests

Three types of weapon fly-around tests are planned: B-47 pressure survey, B-52H vibration survey, and B-47 bomb bay clearance survey.

The B-47 pressure survey was conducted in order to obtain data relative to the bomb pitchdown problem at release which had been encountered in the air-drop test program. A TX-53 was instrumented with 56 pressure transducers for the 35 port locations on the bomb. Camera coverage was provided for the fabric tufts fastened to the outside of the bomb. This test confirmed the indication that air flow phenomenon in the B-47 bomb bay caused severe pitchdown problems. A series of wind tunnel tests were conducted by Sandia Corporation and a series of fly-around tests were conducted by the Air Force to investigate bomb shapes, restraining fixtures, ejection systems, and baffles. The severe pitchdown is eliminated by retraction of the spoilers forward of the B-47 bomb bay and these doors will be retracted for all B-47/TX-53 operations.

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The B-52H vibration survey is scheduled for completion by February 1962. The objective of the test program as set forth by the Air Force is to verify physical compatibility and weapon loading technical orders for weapons programmed for use with the B-52H. The program includes fit tests, instrumented flight tests, noninstrumented flight tests, and drop tests. Sandia Corporation is providing an airborne instrumentation system which will monitor vibration at selected locations on the clip-in suspension system and within the weapon. It is anticipated that about 400 hours of flight at low altitude and high speed will be accumulated and that data will be gathered during selected intervals amounting to about 10 percent of the total time. The TX-53 test unit is to be as realistic as practicable, having a complete F&F system, [redacted]

b(3)

The B-47 bomb bay clearance survey was scheduled for July 1961. Airborne instrumentation capable of monitoring the clearances between the weapon fins and the bomb bay will be provided.

Preproduction Tests

Three TX-53 units are to be drop tested as a part of the Sandia Corporation preproduction test program. The units, [redacted] are to be fabricated by AEC production agencies using WR-quality components wherever possible. The units are to be delivered to the project development organization for tests in accordance with the delivery conditions given in Table XI prior to FPU-WR.

Structural Tests

Fins

Four fins have been successfully load tested to design ultimate simulating the maximum airloads expected during functional use. Two of the fins were tested on a test fixture, while the other two were tested in conjunction with the rear case section. Since the fins are bonded honeycomb panel structures, two units were subjected to temperature shock and salt spray environments prior to structural testing. No additional testing is believed necessary.

Rear Case Section

One rear case section has been tested with the parachute stowage can and fins. The objective of this test was to evaluate the ability of the rear case section to withstand the aerodynamic load input from the fins. The test results were satisfactory. A second rear case section was tested to evaluate the ability of the rear case section to withstand the ultimate load from the laydown parachute at the maximum tolerable pitch condition of the bomb. The structure failed at the bond joints adjacent to the access door openings. Additional tests will be performed on a rear case section incorporating improved assembly techniques and bonding materials.

The rear case section mounting ring of the final design has been structurally tested as follows: (1) to determine its ability to withstand the laydown parachute loads, and (2) to determine the ability of the MDF to sever it for the free-fall option. Three rings have been loaded to failure. These rings tested from [illegible] to 16 percent above design ultimate. Fourteen rings were severed satisfactorily by the MDF system.

TABLE XI

Summary of Planning for the TX-53
Preproduction Test Program

			Delivery conditions			
				Option		
Unit No.	Aircraft	Mode	T-249	MC-1199	Estimated test date
1. - Type 6	B-52	High-altitude	Contact	Retard	November 1961
2. - Type 6A	B-47	Laydown	Contact	Free-fall	November 1961
3. - Type 6	B-52	High-altitude	Air burst	Free-fall	December 1961

NOTE: Instrumentation being considered is a recoverable data package to be located

DOE b(3)

Twenty tests were conducted to determine the ability of the MDF to separate the automatic deployment cover from the rear case section. Structural failure of the aft ring of the rear case section was not experienced and the automatic deployment cover was separated successfully on all tests. Further testing is considered unnecessary.

Thirty tests were conducted to verify the ability of the flexible linear shaped charge to cut the retardation chute shroud lines. The test results were all successful. Additional tests will be performed using the MC-1581 flexible linear shaped charge.

Parachute Stowage Can

Two tests have been performed to verify the ability of the parachute stowage can to withstand theoretical ultimate loads from the retardation chute. Both tests resulted in structural failures. The parachute stowage can design has been modified to increase strength, and, also, calculations of loads based on drop test results have justified a reduction in the loads imposed by the previous calculations. An additional parachute stowage can is scheduled for test.

Basic Assembly Nose Cap

One test was conducted to demonstrate the ability of the nose cap to support the Squash during laydown. At the time of this test, the longitudinal laydown load was 50 g. The nose cap satisfactorily withstood a Squash load equivalent to 87 g when a test fixture breakdown occurred. At this load, strain gage readings indicated that the maximum stresses in the nose were approximately 55 percent of the allowable yield strength, consequently, the test was terminated. Subsequently the longitudinal laydown load factors have been increased to 70 g. A verification test is planned.

Paper Honeycomb Cylinder

In addition to air- and tower-drop tests, cylindrical sections from the paper honeycomb Squash support have been tested successfully by using simulated lateral loads equivalent to 100 g. A structural test of the basic assembly is planned to evaluate the Squash support system.

Outer Case Segment System

A dynamic test of the outer case segment system was conducted to verify its structural ability to limit the lateral loads on the basic assembly to 100 g during laydown. Satisfactory results were obtained from the test.

Nose

The air-drop, tower-drop, and static test results have proved the structural ability of the nose to limit the longitudinal loads in the basic assembly to 70 g during laydown.

Basic Case

The air- and tower-drop tests of the TX-53 have proved the structural ability of the basic case to withstand the 70 g longitudinal and 100 g lateral loads during laydown.

Closing Plate

In addition to air- and tower-drop tests, the closing plate has successfully passed an internal pressure test to design ultimate load.

Automatic Deployment Cover

Twenty separation tests, with the rear case section, supplement the air-drop tests to prove the structural integrity of the automatic deployment cover.

Other Special Tests

Sled and 75-mm Cannon Tests

Although air-drop tests yield the indications that the deformation switch used to provide the contact firing signal operated and that the time interval between deformation switch operation and weapon deformation is acceptable, instrumentation available for air-drop tests is incapable of defining the quality of deformation switch closure. To overcome this limitation in evaluation, a series of sled tests and 75-mm cannon tests for the TX-53 is being conducted. Table XII gives a summary of this test series.

Five of the ten sled tests planned have been conducted. The first three tests are considered to be invalid because of the method of test used. The tests were conducted with a steel target mounted on the sled and the nose section of the bomb fastened to a concrete slab at the end of the sled track, in order to locate instrumentation on the stationary rather than the moving element. The column of air in front of the moving target caused the deformation switch to operate prematurely because the breathing openings in the deformation switch were too small to allow equilization of pressure. This condition is unrealistic for an air-drop situation. The remaining tests have the nose section mounted to the sled and the target stationary. Although data recovery has not been completely satisfactory, the results of the latter two tests indicate satisfactory performance at speeds less than and greater than expected values.

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TABLE XII

Summary of Results of the Sled Test and 75-mm Cannon Test Programs for the Deformation Switch used in the TX-53

Test No.	Type test	Impact velocity (fps)	Type target	Electrical closure	Timing	Remarks
1E	Sled	1252	25° steel		8' premature	Test not valid*
2E	Sled	300	40° steel		Satisfactory	Test not valid*
3E	Sled	1200	6° steel		8' premature	Test not valid*
4E	Sled	310	Flat concrete	Satisfactory	Satisfactory	Successful
5E	Sled	1200	Flat concrete	Satisfactory	Probably satisfactory	Part of data lost
6E	Sled		Water			Test not completed
7E	Sled		Angled concrete			Test not completed
8E	Sled		Angled concrete			Test not completed
9E	Sled		Not determined			Test not completed
10E	Sled		Not determined			Test not completed
1	75 mm	980	Not applicable	Satisfactory	Not applicable	Successful
2	75 mm	370	Not applicable	Probably satisfactory	Not applicable	Part of data lost
3	75 mm	370	Not applicable		Not applicable	All of data lost
4	75 mm	370	Not applicable	Probably satisfactory	Not applicable	Part of data lost
5	75 mm	370	Not applicable	Satisfactory	Not applicable	Successful
6	75 mm	388	Not applicable	Satisfactory	Not applicable	Successful
7	75 mm	946	Not applicable		Not applicable	All of data lost
8	75 mm	940	Not applicable	Satisfactory	Not applicable	Successful
9	75 mm	940	Not applicable	Satisfactory	Not applicable	Successful
10	75 mm					Test not completed
11	75 mm					Test not completed
12	75 mm					Test not completed
13	75 mm					Test not completed
14	75 mm					Test not completed

*See text for explanation.

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Nine of the fourteen 75-mm cannon tests have been conducted, four at velocities less than that anticipated in weapon applications and five at velocities greater than that anticipated. Five tests indicated acceptable closure based on complete data, two tests indicated acceptable closure based on partial data, and two tests yielded no data. The program is temporarily suspended pending the development of more reliable instrumentation.

Wind Tunnel Tests

Three basic series of wind tunnel tests were conducted during the TX-53 development. The tests were as follows:

1. Original series to check aerodynamic characteristics of the bomb and to determine the suitability of various extendable fins for stability at a 55 percent CG location.

2. Because of a design change which allowed a 45 percent CG position, a second series of tests to determine the new aerodynamic characteristics was conducted with fixed fins of a 6- to 26-degree double wedge design.

3. Additional tests to seek a solution to the unique high angle "pitch-down" encountered with high "q" releases from the B-47.

All these tests were successful.

DOE b(3)

As a result of these wind tunnel tests and the full-scale drop tests, the TX-53 is determined to have a predictable and repeatable trajectory when delivered in the free-fall option. In addition, the ballistic dispersion is [redacted] when delivered from an altitude of 10,000 feet or more.

Static force tests show that the TX-53 with a 45-percent CG has a static margin of approximately 6 percent. The free-fall version has aerodynamic drag properties consistent with the required degree of stability to assure repeatable trajectories.

The third series of wind tunnel tests indicated, and full-scale tests have proven, that the "pitch-down" of the TX-53 upon separation from the B-47 bomb bay under high "q" conditions will not exceed 25 degrees if the aircraft spoiler doors are retracted.

Ancillary Equipment Tests

Because of the nature of the equipment and its similarity to previously tested equipment, environmental testing was considered unnecessary. The emphasis of this program was on mechanical strength and functional tests. Unless otherwise noted, one item was tested.

The status and description of testing is as follows:

Item	Functional test completed	Structural test
H-794 hand truck	1. Use with the TX-53 bomb and H-795.	Complete cargo aircraft tiedown test. Rail bump test at 11 mph.
	2. Use with the TX-53 basic assembly and H-796.	

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Item	Functional test completed	Structural test
H-794 hand truck (cont)	3. Use with straddle carrier and fork lift. 4. Use for bomber aircraft (B-47 and B-52) loading with MHU/7M trailer 5. Use with clip-in subassembly (MHU/29C) 6. Use with ATMX 600 Series railcar with appropriate shock absorbing support.	The following items of the H-794 have been static tested to six times the working load: 1. Overhead hoistings attaching points. 2. Outrigger bars 3. Outrigger tubes
H-795 hand truck adapter kit	Use with H-794 and TX-53, and clip-in subassembly.	Static test with H-794.
H-796 hand truck adapter kit	Use with H-794 and TX-53 basic assembly	Static test with H-794
H-797 security cover frame	Use with bomb, H-794 and clip-in assembly.	Tested with H-794 during rail humping.
H-798 security cover	Use with bomb, H-794 and clip-in subassembly.	Not applicable.
H-799 bomb sling	Use with bomb on H-794 and H-806.	Has been static tested to six times the working load.
H-800 parachute shipping and storage container	Use with MC-1387, H-801, and H-811.	Ramp test to simulate 11 mph railroad hump; 12-inch drop test; cargo aircraft tiedown tests; and vibration test. Static test to four times working load on hoisting fittings.
H-801 parachute protective cover	Use with MC-1387, H-800, and H-309.	Static test to six times working load. Vibration and drop test with the H-800.
H-802 bomb sub-assembly sling	Use with H-804, H-813, and H-946.	Static test to six times working load.
H-804 parachute hoisting adapter	Use with the MC-1387 and rear case section.	Static test to six times the working load in horizontal and vertical operating positions.

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Item	Functional test completed	Structural test
H-805 shipping and storage container	Use with the rear case subassembly	Ramp test to simulate 11 mph railroad hump; 12-inch drop test; cargo aircraft tiedown; and vibration test. Static test of the hoisting fittings to six times the working load.
H-806 bomb stand	Use with the bomb, outer case segment and H-796.	Not applicable.
H-807 closing plate handle	Use with the closing plate with or without the rear case section installed on the bomb.	Not applicable.
H-808 locating fixture	Use with the outer case segment, basic assembly, and H-806.	Not applicable.
H-809 shipping and storage container	Use with the nose, nose fairing, and slip ring.	Ramp test to simulate 11 mph railroad hump; 12-inch drop test; cargo aircraft tiedown test; vibration test; and static tests of the hoisting fitting to six times working load.
H-810 shipping and storage container	Use with the outer case segment, wedge segment and attaching strips.	Ramp test to simulate 11 mph railroad hump; 12-inch drop test; cargo aircraft tiedown test; vibration test; and static tests of the hoisting fitting to six times the working load.
H-811 parachute protector	Use with the MC-1387 and H-800.	Vibration tests and drop tests with the H-800.
H-813 adapter nose hoisting	Use with the nose fairing, H-902 and H-971.	Tested to six times working load.
H-825 security cover frame	Use with the basic assembly, H-794 and H-796.	Not applicable.
H-826 security cover	Use with the basic assembly, H-825, H-794, and H-796.	Not applicable.
H-836 beam sling	Use with basic assembly, H-962 and H-993.	Static tested to six times the working load
H-900 MDF protector ring	Use with the rear case section.	Not applicable
H-946 rear bomb subassembly hoisting adapter	Use with the rear case section and H-802.	Static tested to six times the working load

Item	Functional tests completed	Structural test
H-962 hoisting adapter	Use with the basic assembly with nose attached and with the H-836.	Static tested to six times the working load.
H-971 nose hoisting adapter	Use with the nose, H-802, and H-813.	Static tested to six times the working load.
H-993 hoisting adapter	Use with the outer case segment, the nose, and the H-810 and H-836.	Static tested to six times the working load.
H-995 protective ring	Use with the basic assembly when the closing plate is removed.	Not applicable.
H-989 removal and installing tool	Use with electrical component assembly and TX-53 basic assembly.	Tests not completed.
	Tests on Carry-Over Items used on this Program	
H-309 sling, warhead and container	Use with H-801.	Static tested to six times the working load.
H-563 bomb hand truck sling	Use with the H-800.	Static tested to six times the working load.
H-639 bomb hand truck sling	Use with the bomb, H-794, H-797, H-798, a commercial hook, and the ATMX 600 Series railcar. Use with the basic assembly, H-794, H-825, and H-826.	Static tested to six times the working load.
H-690 and H-691 spanner wrench	Test not required.	Not applicable.
H-762 caster tool	Use with H-794.	Not applicable.
H-772 hoisting beam	Use with bomb and clip-in subassembly.	Static tested to six times the working load.
H-876 socket wrench	Use for removing and replacing torque of the gland nut.	Not applicable.
H-935 screw thread cleaning tool	Use for cleaning the gland nut.	Not applicable.
836856-00 swivel hook	Use with the bomb, H-794, H-797, and H-798.	Static tested to six times the working load.

CHAPTER IV-- ANCILLARY EQUIPMENT

Packaging and Handling Equipment

The design of the TX-53 packaging and handling equipment is based on the requirements of AEC, the Military Characteristics, and the Stockpile-to-Target Sequence. The handling equipment will be used for shipment (via cargo aircraft, truck, or rail) and also for storage of the bomb, the basic assembly, and the bomb shape components. The handling equipment will also be used for bomb-to-basic, or basic-to-bomb conversion, and for maintenance of the bomb or basic assembly.

The following block diagram (Figure 42) shows the field equipment necessary for maintenance of the bomb, the items used for bomb-to-basic or basic-to-bomb conversion, and the handling items furnished on one-to-one basis with the bomb or basic assembly.

The following is a description of the packaging and handling equipment for the bomb and basic assembly.

H-794 Hand Truck

The H-794 (Figure 43) is a caster-mounted aluminum hand truck used for shipping, storage, positioning, and maneuvering of the bomb or basic assembly. It consists of a welded aluminum frame mounted on four dual-wheel rubber casters. It has attaching points for the H-795 and H-796 (adapter kits), which restrain the bomb or basic assembly on the H-794. The H-794 hand truck remains with the bomb or basic assembly during shipping or storage operation. Shipment can be made by cargo aircraft, truck, or rail. Shipment by rail must be in ATMX 600 series rail cars or equivalent transportation. The hand truck has four sliding outrigger bars for attachment to the MHU-7/M trailer and four sliding outrigger tubes for use with the straddle carrier. The outrigger bars and tubes are locked to the hand truck frame by spring-loaded cam-acting pins.

There are four pear-shaped links fixed to the hand truck frame by which the H-630 sling is attached for overhead hoisting of the hand truck with bomb or basic assembly. These links are also used for tiedowns in cargo aircraft. Stored on the frame of the hand truck is a two-piece tow bar, which can be attached on the forward end or on either side of the frame for maneuvering the hand truck with bomb or basic assembly. A 2.00-inch-diameter access hole is provided on one side of the frame for an extension wrench which is used to attach the clip-in subassembly to the bomb.

H-795 Hand Truck Adapter Kit

The H-795 (Figure 44) is composed of one steel telescoping shear pin and two aluminum bands. Each of the two bands is composed of three segments which are joined by quick-release pins. The two bands are attached to the H-794 by quick-release pins. The telescoping shear pin bolts to the frame of the H-794 (Figure 45). The two bands resist the vertical loads, and the shear pin resists the horizontal loads, which are encountered during transportation of the bomb. The clip-in subassembly can be attached to the bomb while the bomb rests on the H-794/795.

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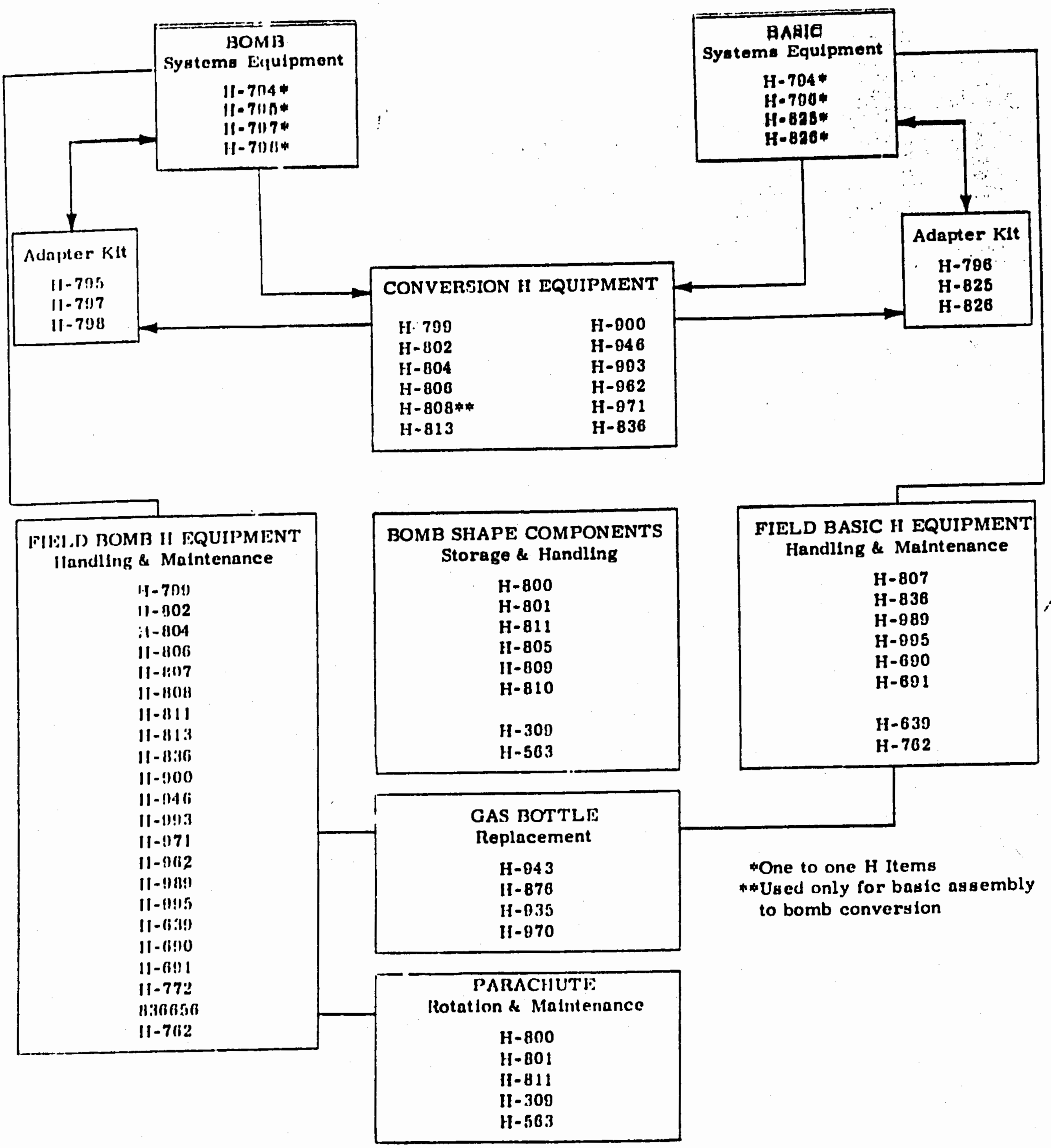

Figure 42. F'eld Equipment Block Diagram

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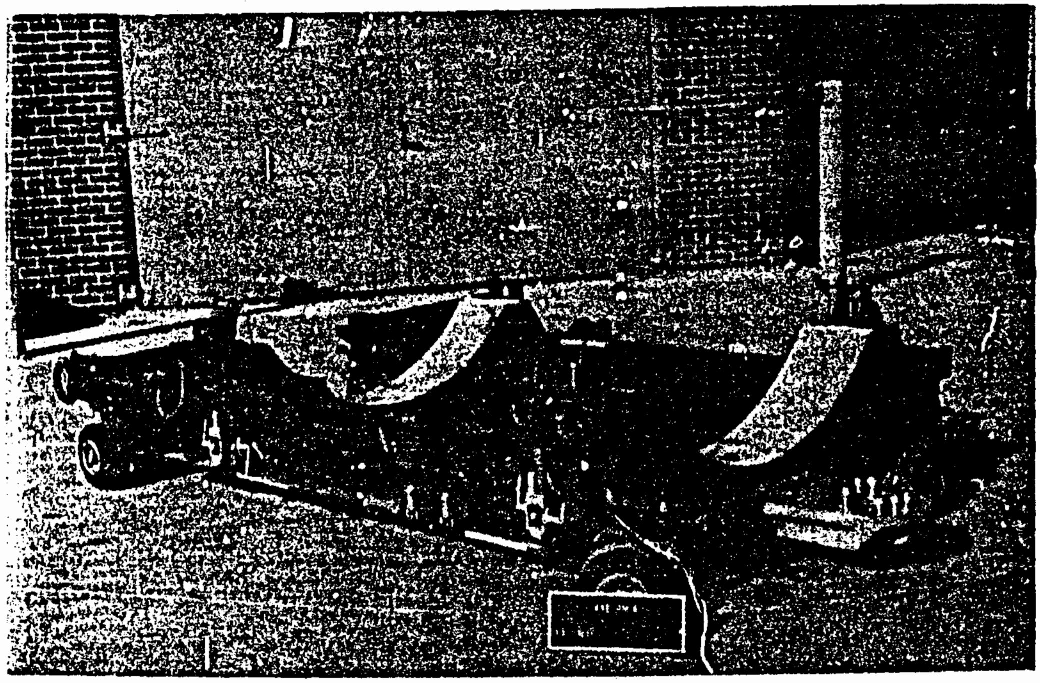

Figure 43. H-794 Caster-Mounted Hand Truck

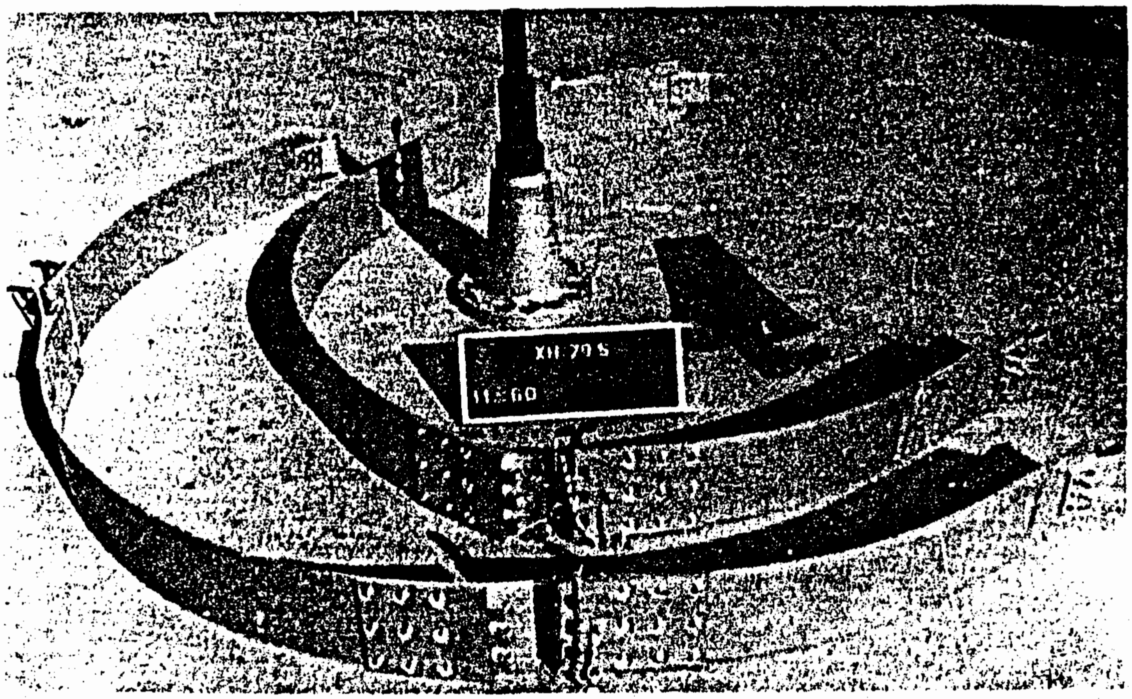

Figure 44. H-795 Hand Truck Adapter Kit

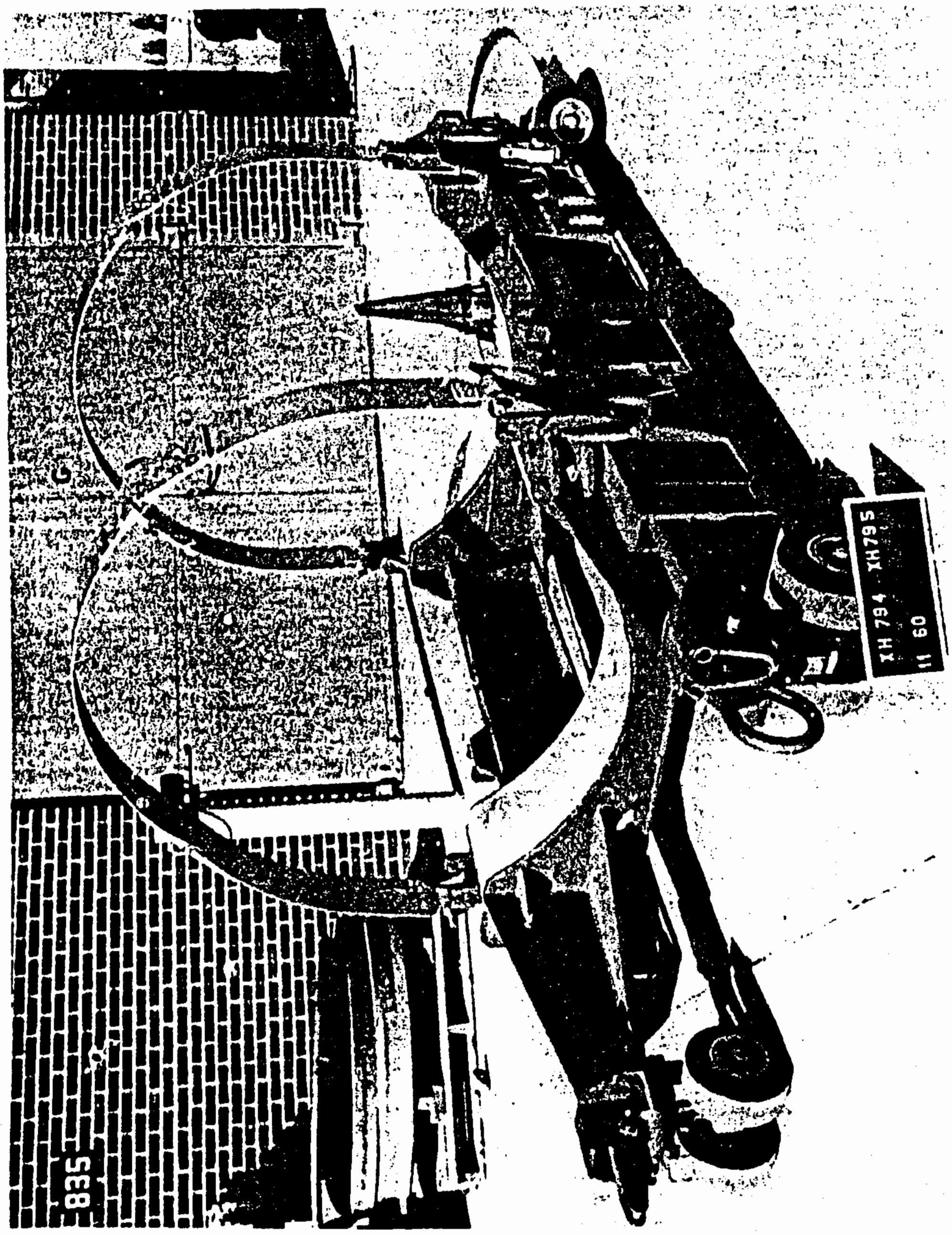

Figure 45. H-794 with H-795

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H-796 Hand Truck Adapter Kit

The H-796 (Figure 46) is composed of two steel bands, one steel shear pin, and two aluminum chocks. The two bands attach to the H-794 hand truck with quick-release pins. The two chocks adapt the H-794 hand truck to the smaller diameter of the basic assembly (Figure 47). Also the chocks are used to adapt the H-806 bomb stand to the diameter of the basic assembly for use during conversion or maintenance. The bands and shear pin with the two aluminum chocks hold the basic assembly on the H-794 during transportation.

H-797 Security Cover Frame

The H-797 which supports the H-798 security cover for the bomb is a one-piece welded structure of round steel tubing. The frame mounts on top of the bomb with clearance for the clip-in subassembly and is held in place by four nylon straps which attach to the frame of the H-794 (Figure 48).

H-798 Security Cover

The H-798 (Figure 49) provides visual security during shipping or storage of the bomb. The H-798 is fabricated from 16-ounce waterproof nylon fabric, in one-piece construction. The cover is held in place by nylon straps which attach it to the frame of the H-794. The part of the H-798 which covers the lower two fins can be folded up to reveal the fins. This should facilitate loading of the bomb into the MHU-7/M trailer and prevent fin damage during this operation. The cover fits with or without the clip-in subassembly installed on the bomb.

H-799 Bomb Sling

The H-799 (Figure 50) is a short aluminum strongback with two aluminum bands at each end and is used to adapt the bomb to overhead hoisting. Each band is composed of three segments which are joined and fastened to the turnbuckles on the strongback by quick-release pins. The H-799 is employed by placing the strongback longitudinally on the top of the bomb at approximately the weapon's center of gravity. The bands are then placed around the bomb and are drawn tight by the four turnbuckles.

H-800 Parachute Shipping and Storage Container

The H-800 (Figure 51) is a round steel container used for storage and shipment of the following items:

1. MC-1388 (bomb parachute stowage can) with H-801 and H-611 assembled.

2. MC-1387 (parachute assembly) with H-801 and H-811 assembled.

Shipment may be made by rail, cargo aircraft, and truck provided the following modes of restraining the H-800 are used:

Cargo aircraft - four large pear-shaped links

Rail - shoring only

Truck - shoring or four large pear-shaped links.

Local handling can be accomplished by fork lift or with overhead hoisting equipment. If overhead equipment is used the H-563 sling is also used with the four links on the H-800 cover. The H-800 may be stacked during storage, but stacking is not permitted during shipment.

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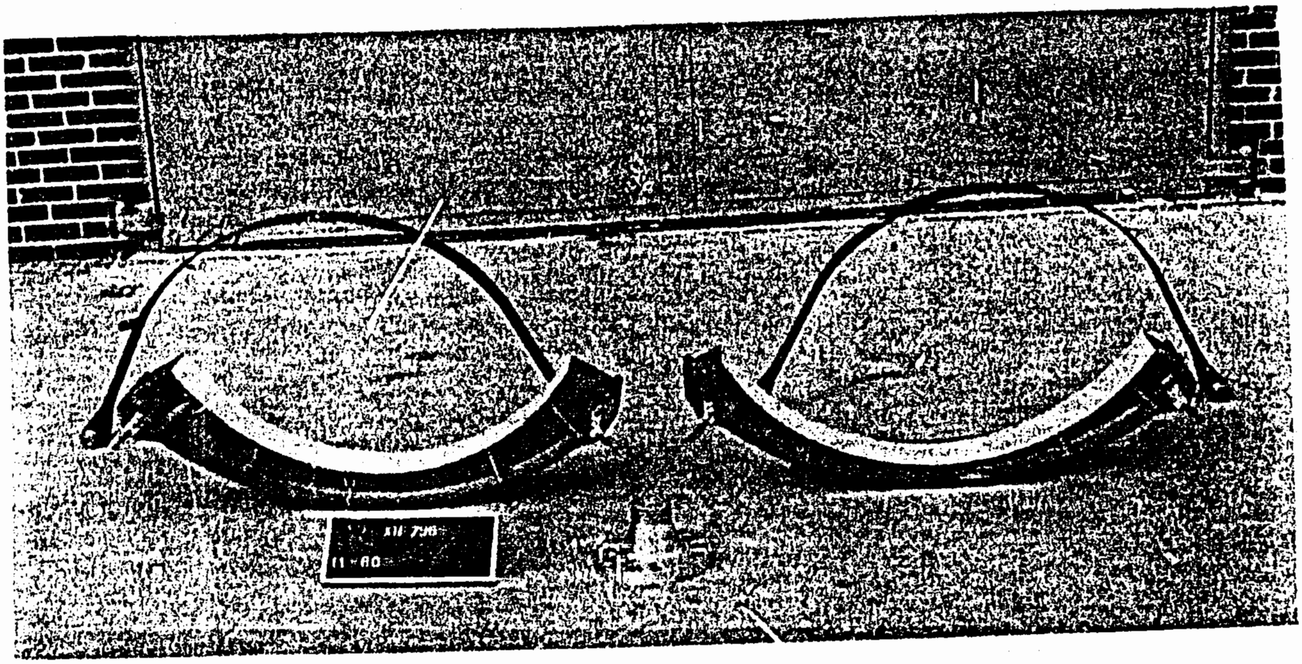

Figure 46. H-796 Hand Truck Adapter Kit

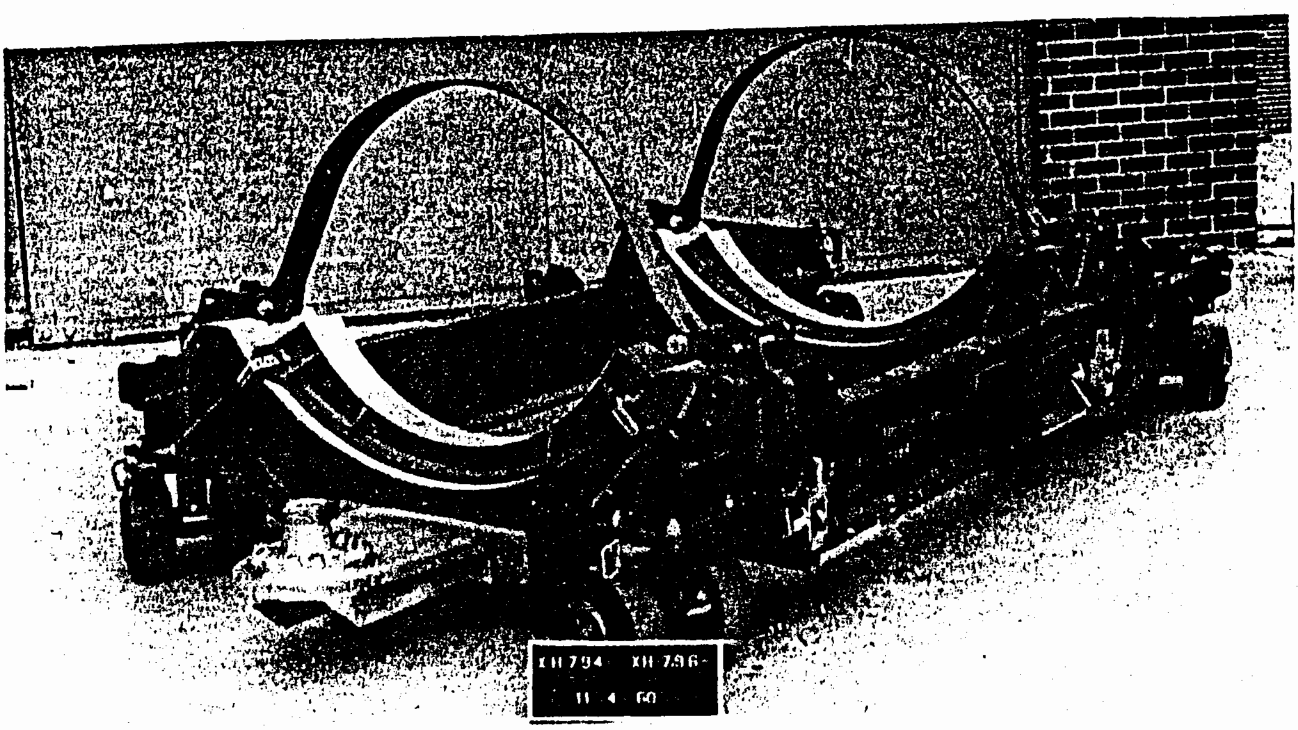

Figure 47. H-794 with H-796

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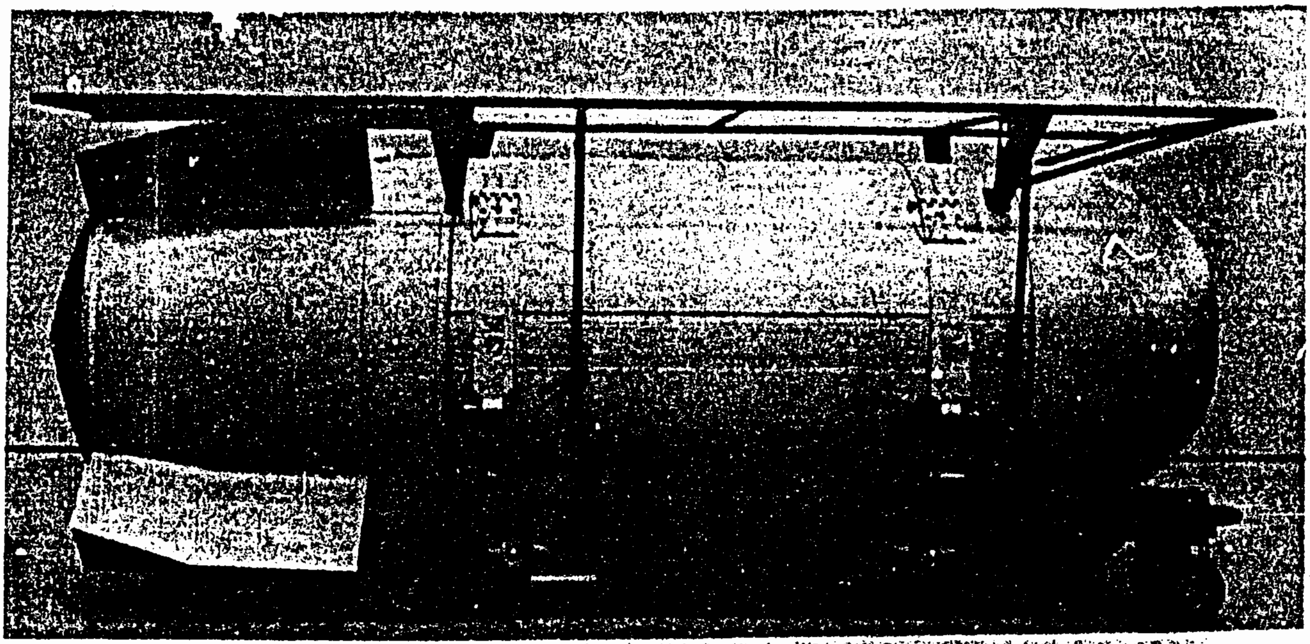

Figure 48. H-707 Security Cover Frame (Installed)

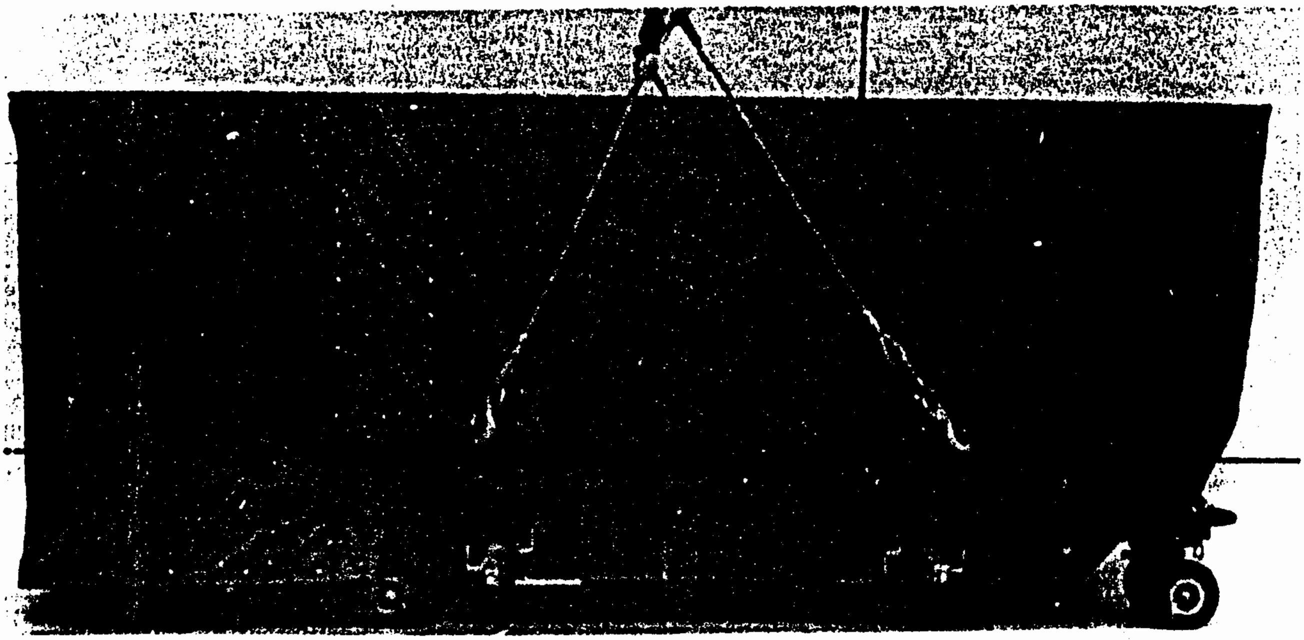

Figure 49. H-708 Security Cover (Installed)

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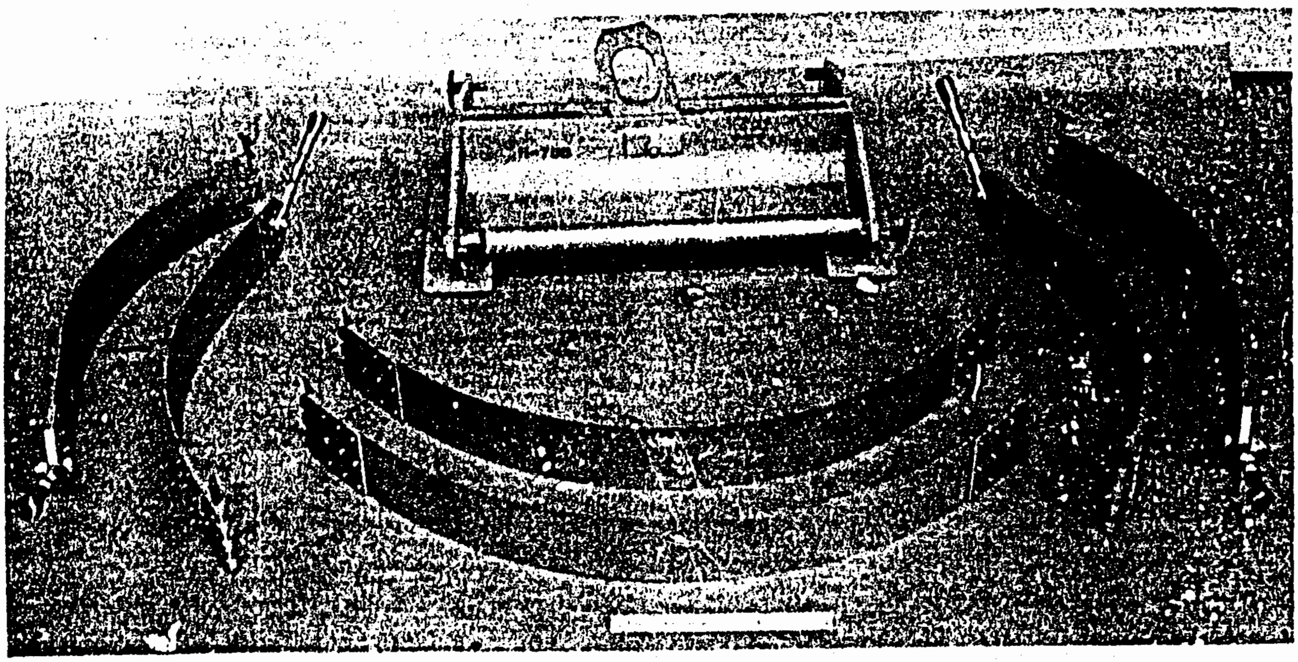

Figure 50. H-799 Bomb Sling

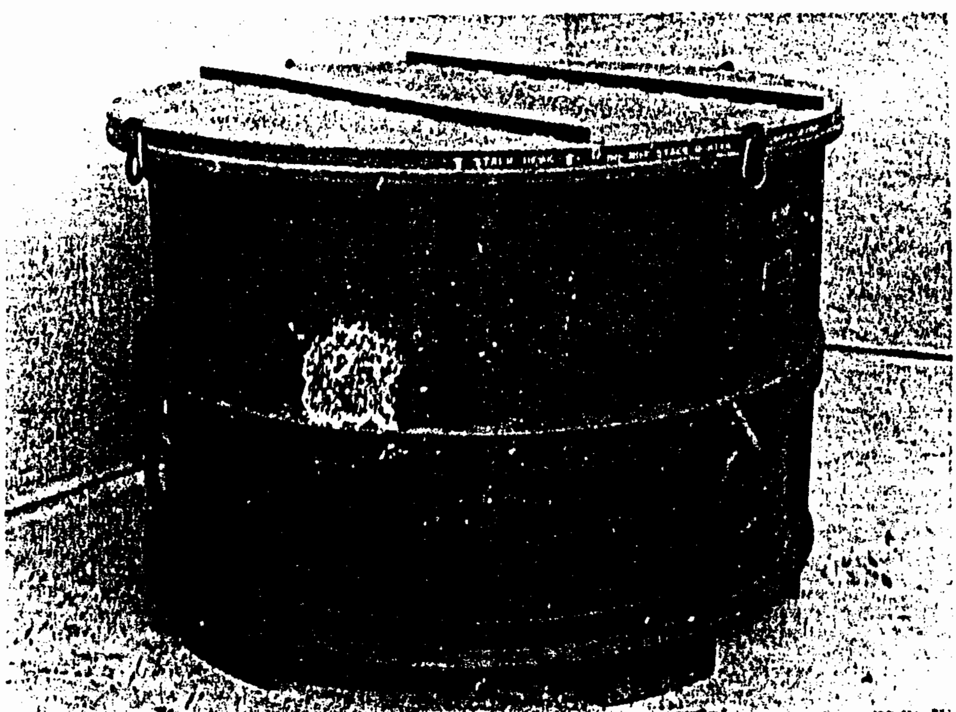

Figure 51. H-800 Parachute Shipping and Storage Container

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H-801 Parachute Protective Cover

The H-801 (Figure 52) is a cast-aluminum cover used to prevent the parachute stowage can (MC-1388) or stowage can with parachute (MC-1387) from becoming out of round during handling and transportation. The H-801 attaches to the stowage can by four clamps. The H-801 cover has four handles for manual handling or hoisting with the H-309 sling.

H-802 Bomb Subassembly Sling

The H-802 is a strongback composed of a steel beam with a hook attachment point at its center. Hinged to the ends of the beam are legs which provide for attachment to the H-804, H-813, and H-048 trunnion adapters for handling the MC-1387 parachute assembly, nose, fairing, and the rear case section of the bomb respectively. The H-802 in conjunction with the H-813 is shown in Figure 62. For storage, the hinged legs fold under the beam of the H-802 (Figure 53) and are pinned in this position.

H-804 Parachute Hoisting Adapter

The H-804 (Figure 54) provides a means for hoisting and rotating the MC-1387 parachute assembly. It is composed of two main parts: a ring 50 inches in diameter by 4 inches deep, by 3/4 inch thick, and a welded tubular steel framework. Four attaching lugs and eight truing fixtures are spaced around the inside circumference of the ring. The attaching lugs are used for attaching the H-804 to the MC-1387. The truing fixtures are used to force the MC-1387 parachute assembly into a round configuration so that it can be installed or removed from the rear case section. The steel frame is bolted to the ring and provides the pick-up and trunnion points for attachment of the H-802 sling (see Figure 54).

H-805 Shipping and Storage Container

The H-805 (Figure 55) is a sheet-metal container designed to facilitate handling and to provide physical protection for the bomb rear case section, fins, closing plate, and switch position indicator during shipment and storage. The H-805 consists of a base and cover. The base is a steel weldment constructed of square and rectangular tubing to which a rolled angle is attached in order to provide a mounting surface for the store. Two guards made of round steel tubing are fastened to the base with quick-release pins. These guide the cover so it will not strike the fins as it is lowered on the base. Square tubing is added to the base in order to facilitate handling by fork lifts. The cover is also a steel weldment, consisting of a frame of square tubing covered with sheet metal. A pear-shaped link is provided on the top of the cover for single-point pickup of the cover or the loaded container. Angles are welded to the top of the cover to orient and locate the second unit during stacking. Pear-shaped links are attached to the corners of the cover to provide for cargo aircraft tiedown.

H-806 Bomb Stand

The H-806 (Figure 56) is a welded steel stand used to support the bomb or basic assembly during conversion or maintenance operations. The chocks of the H-706 are used to adapt the stand to the smaller diameter of the basic assembly. The stand has four spring-loaded casters which permit moving of the empty stand. A positioning rod locates and centers the outer case segment in the stand for conversion or maintenance.

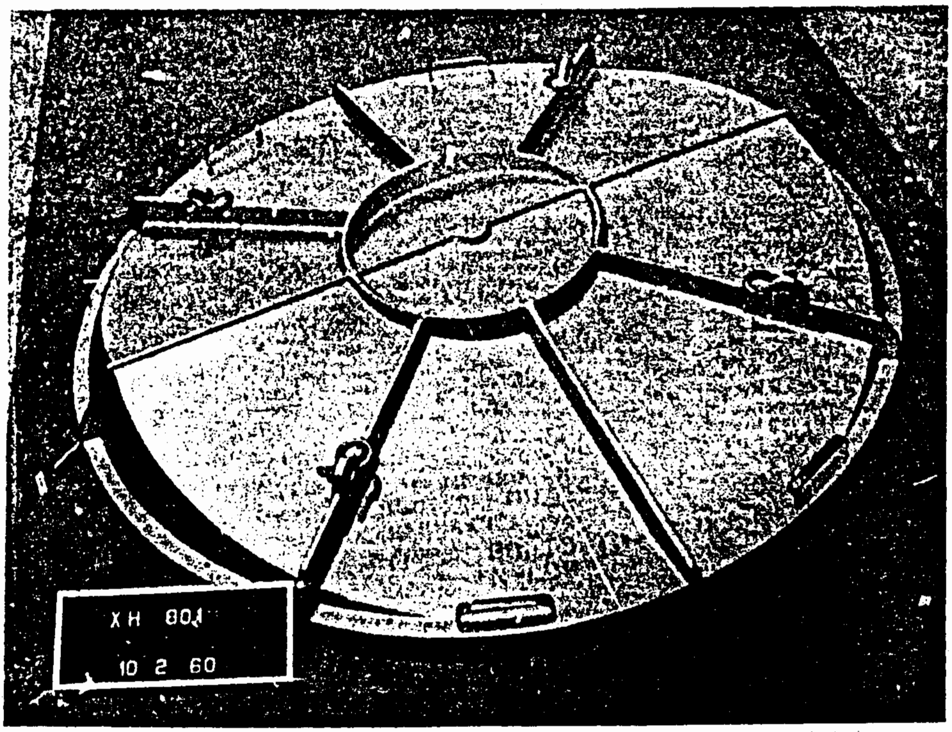

Figure 52. H-801 Parachute Protective Cover

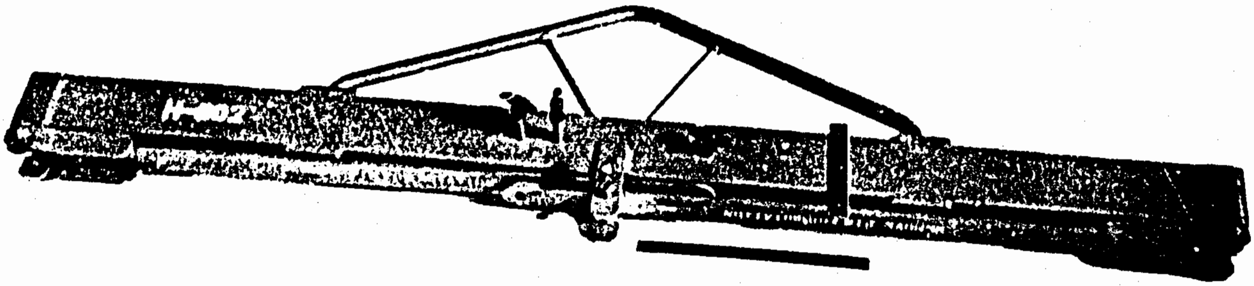

Figure 53. H-802 Bomb Subassembly Sling

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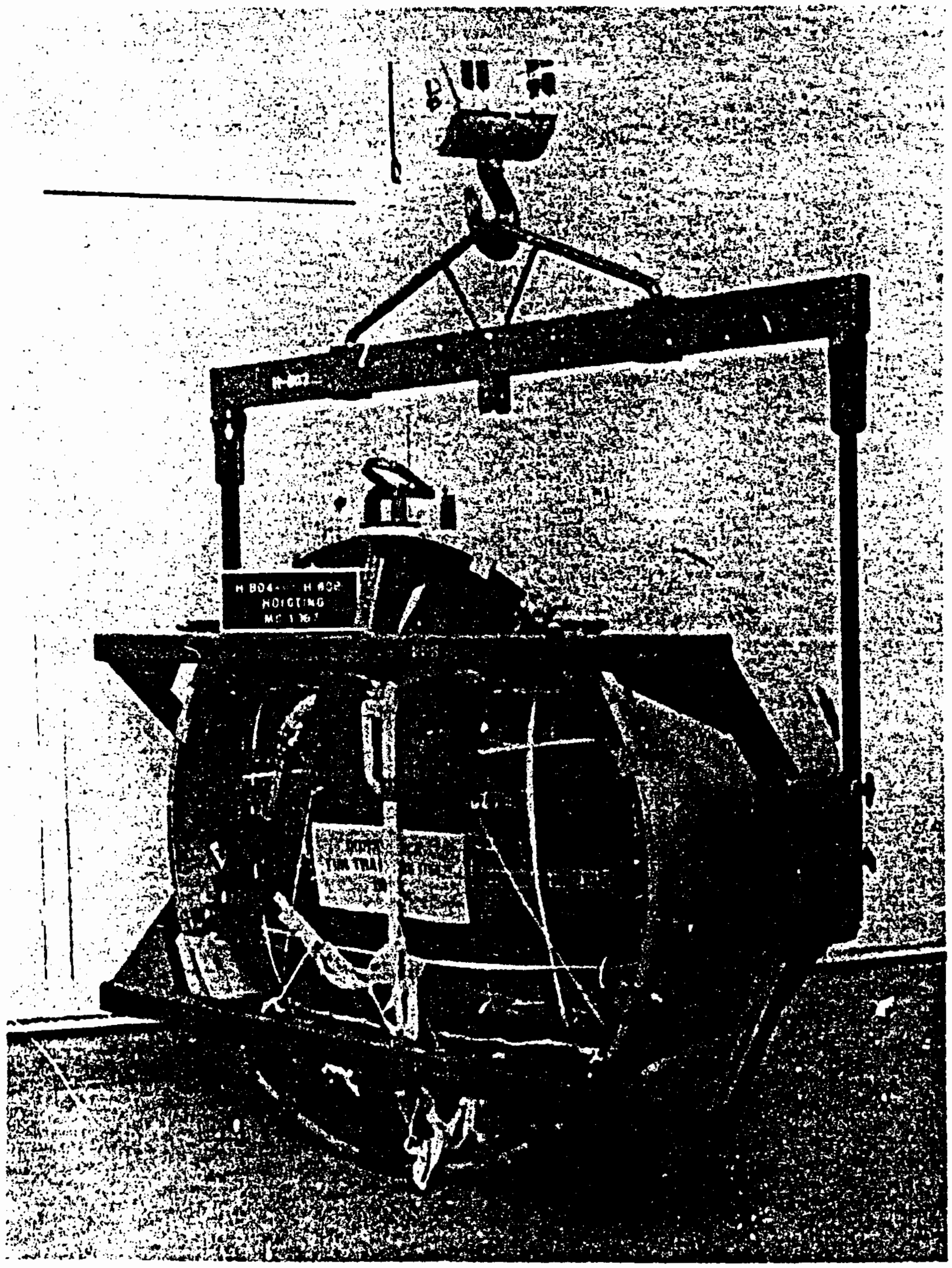

Figure 54. H-804 Parachute Hoisting Adapter

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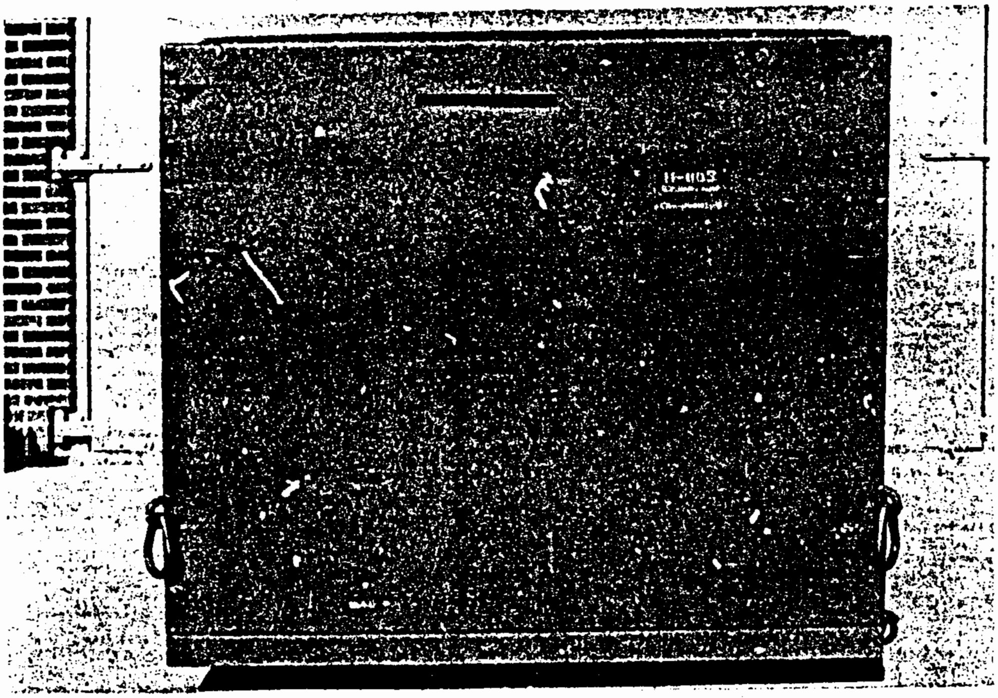

Figure 55. H-805 Shipping and Storage Container

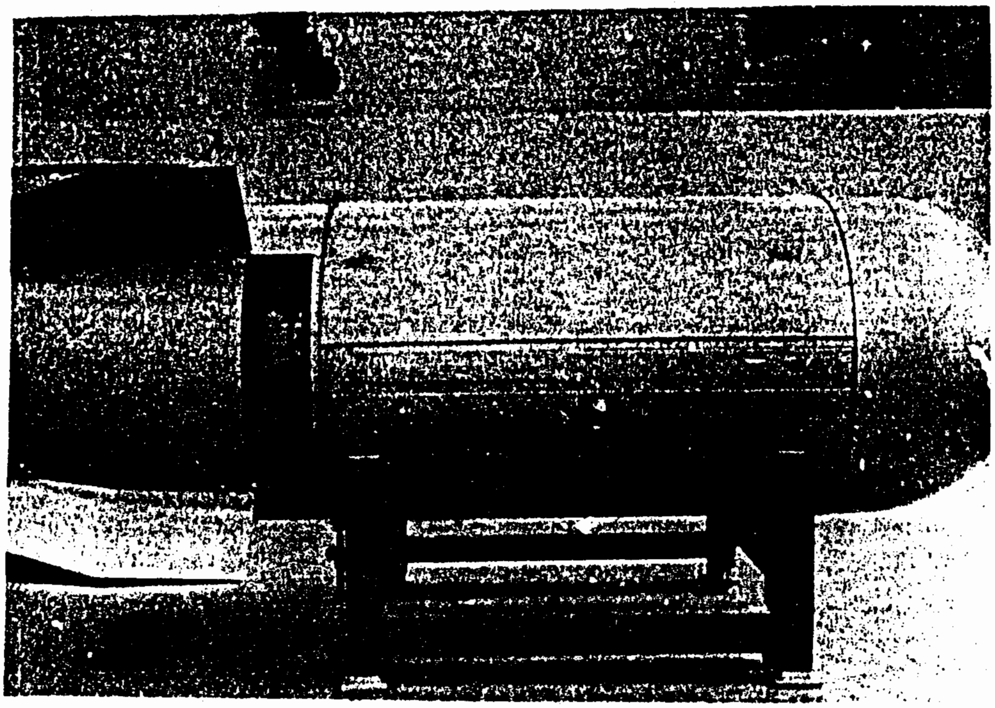

Figure 56. H-806 Bomb Stand

H-807 Closing Plate Handle

The H-807 (Figure 57) consists of one handle, one knurled nut, and one guide pin. The handle screws into a 5/16-thread insert in the basic assembly closing plate. The guide pin screws into the 5/16-threaded holes in the basic case. Two H-807's are required. The handles are used to lift and control the closing plate. Two guide pins position the closing plate and thus prevent damage to the sealing surfaces.

H-808 Locating Fixture

The H-808 (Figure 58) is a Z-shaped aluminum casting with two machined flanges. One flange has a four-hole pattern for attachment to the basic assembly case flange. The H-808 is used to position and alig the outer case segment. The H-808 is bolted to the underside of the flange on the basic assembly case. Th basic assembly is then lowered by the H-836 sling into the outer case segment so that the outer flange of th H-808 bears against the end of the outer case segment. When the holes in the H-808 flange match the holes in the outer case segment, the basic assembly and outer case segment are in the proper position for the next assembly operation. The outer case segment is supported on the H-806 during this operation.

H-809 Shipping and Storage Container

The H-809 (Figure 59) is a sheet metal container designed to facilitate handling and to provide physic protection for the bomb nose assembly (nose, fairing, slip ring, and deformation switch) during shipment and storage. The H-809 consists of a cover and a steel weldment base. A mounting surface for the nose is provided. The deformation switch is mounted within the nose in the same manner as it is mounted in the bomb. The slip ring is mounted over the nose and fastened to four brackets welded to the base. Four spri are used to fasten the slip ring to the base and insure that excessive loads will not be applied. The fairing is then mounted over the nose and slip ring. The fairing is fastened to the nose in the H-809 in the same manner as on the TX-53. Rectangular tubes are provided for the base of the H-809 to facilitate handling by fork lift. A pear-shaped link is provided on the top of the cover for single-point pickup of the cover or the loaded container. Angles are welded to the top of the cover to orient and locate the second unit during stacking. Stacking of empty or loaded containers is permissible. Pear-shaped links are attached to the cover to provide for cargo aircraft tiedown.

H-810 Shipping and Storage Container

The H-810 (Figure 60) is a sheet-metal container designed to facilitate handling and to provide physic protection for the bomb outer case segment, wedge segment, and attaching strips during shipment and stor age. Two H-810's are required to ship these items for one bomb. The H-810 consists of a base and cover. The base is a steel weldment constructed from square and rectangular tubing to which brackets are welded to provide the mounting surface for the store. Two guards made of square tubing are bolted to brackets welded to each end of the base in order to protect the store while the cover is lowered on the base. The cover, a steel weldment, consists of an angle frame covered with sheet metal. A structure of square tubin was added to provide for stacking (loaded or empty). A pear-shaped link located on the top of the cover provides a single-point pickup for the cover or the loaded container. Pear-shaped links are attached to the corners of the cover to provide for cargo aircraft tiedown.

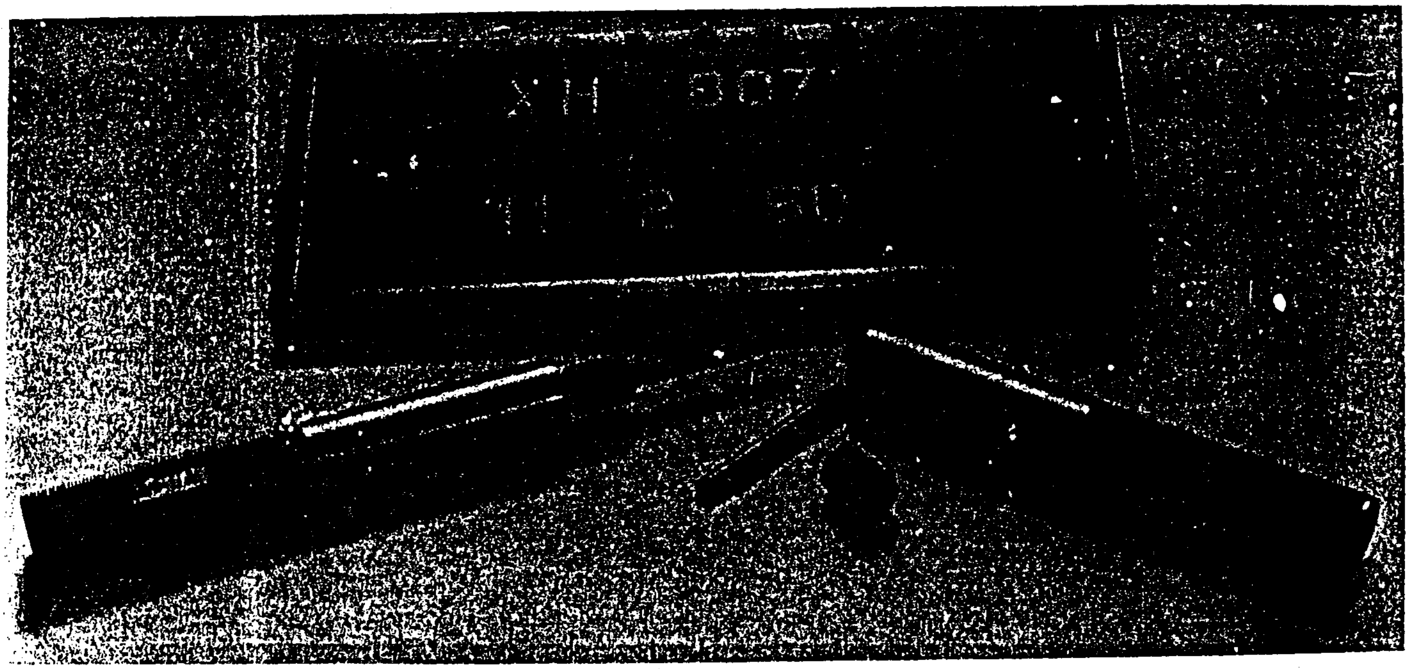

Figure 57. H-807 Closing Plate Handles

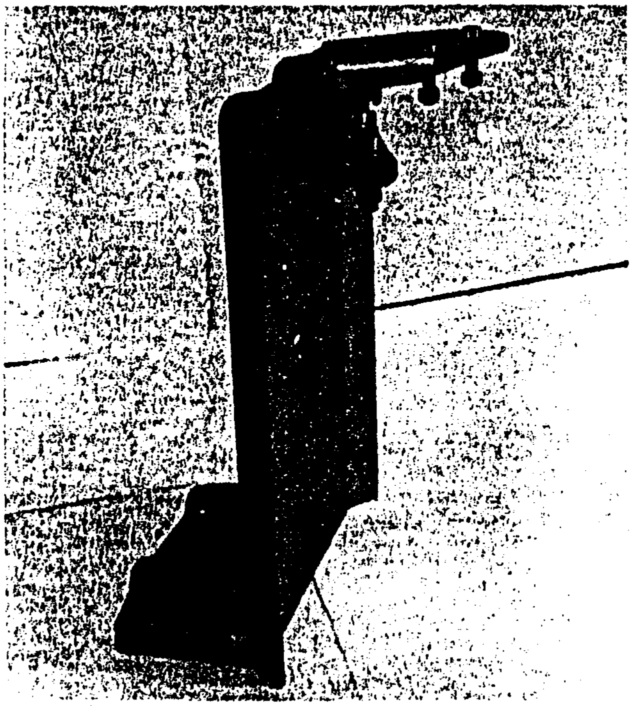

Figure 58. H-808 Locating Fixture

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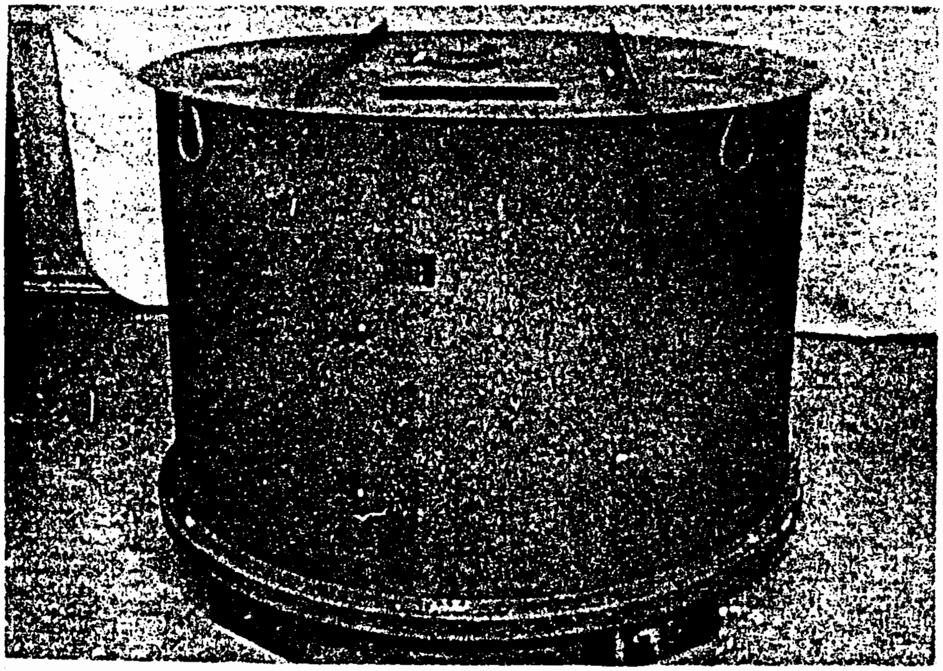

Figure 59. H-800 Shipping and Storage Container

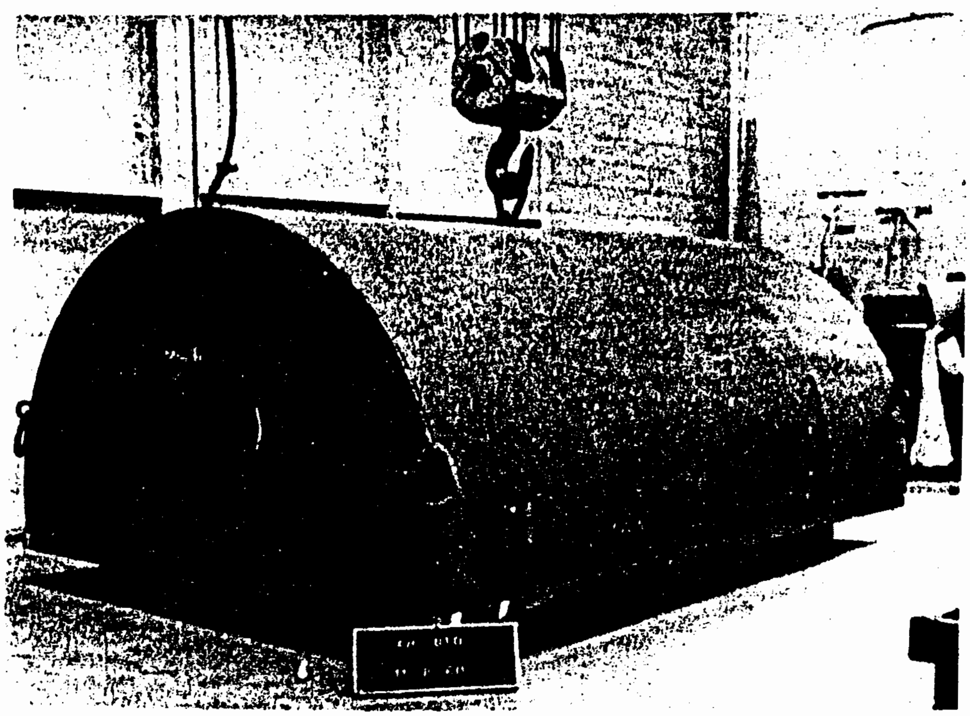

Figure 60. H-810 Shipping and Storage Container

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H-811 Parachute Protector

The H-811 (Figure 61) is composed of one aluminum ring casting and eight spring clips. The ring casting attaches to the closed end of the stowage can (MC-1388) by six bolts. The spring clips slip between the stowage can and the shroud lines and lock to the ring casting. The ring casting prevents damage to the shroud lines and supports the recessed center part of the stowage can during handling and transportation. The spring clips prevent the shroud lines from becoming soiled and damaged.

H-813 Hoisting Adapter

The H-813 is fabricated of 2-inch-square steel tubing by welded construction. The hoisting adapter attaches to the forward face of the bomb fairing by four bolts. The adapter is used to remove or replace the fairing in its container (H-809) and to handle the fairing during installation on or removal from the bomb. The fairing, when attached to the H-813, can be rotated from the horizontal to the vertical position and vice versa. The H-813 adapter is used with the H-802 strongback (Figure 62) for all handling operations.

H-825 Security Cover Frame

The H-825 (Figure 63), which supports the H-826 security cover for the basic assembly, is a one-piece welded structure of round tubing. The frame is mounted on top of the basic assembly and is held in place by two nylon straps which are attached to the frame of the H-794.

H-826 Security Cover

The H-826 (Figure 64) provides visual security during shipping or storage of the basic assembly. The H-826 is fabricated from 16-ounce waterproof nylon fabric and is of one-piece construction. The cover is held in place by nylon straps which are attached to the frame of the H-794.

H-836 Beam Sling

The H-836 (Figure 65) is used for: (1) hoisting the basic assembly, (2) hoisting the outer case segments when used with the H-993, and (3) hoisting the basic assembly with nose installed when used with the H-962.

The H-836 is composed of a steel beam with a hoisting attachment point near its center. At one end of the beam is an adapter which is attached to the nose of the basic assembly by two 3/4-inch-diameter bolts. At the other end of the beam is an adapter which is connected to the basic assembly by two 3/8-inch-diameter quick-release pins. Points for attaching the H-962 and H-993 are marked at other points near the ends of the beam. During the time when the H-962 and H-993 are being used, the forward adapter of the H-836 can be removed and stored on the main beam of the H-836.

H-900 Mild Detonating Fuse Protective Ring

The H-900, shown installed in Figure 66, is an aluminum ring assembly which protects the mild detonating fuse (MDF) whenever the parachute assembly is removed from the rear case section. During any maintenance which requires removal of the parachute from the rear case section, the MDF must be protected to keep it from being accidentally struck by tools or other objects which are being used by maintenance personnel.

The H-900 is attached to the inner subassembly of the rear case section. A rubber pad approximately 38.5 inches long, 26 inches wide, and 1 inch thick is used with the H-900. This pad provides protection to the inner skin of the rear case section when maintenance personnel are working inside the rear case section.

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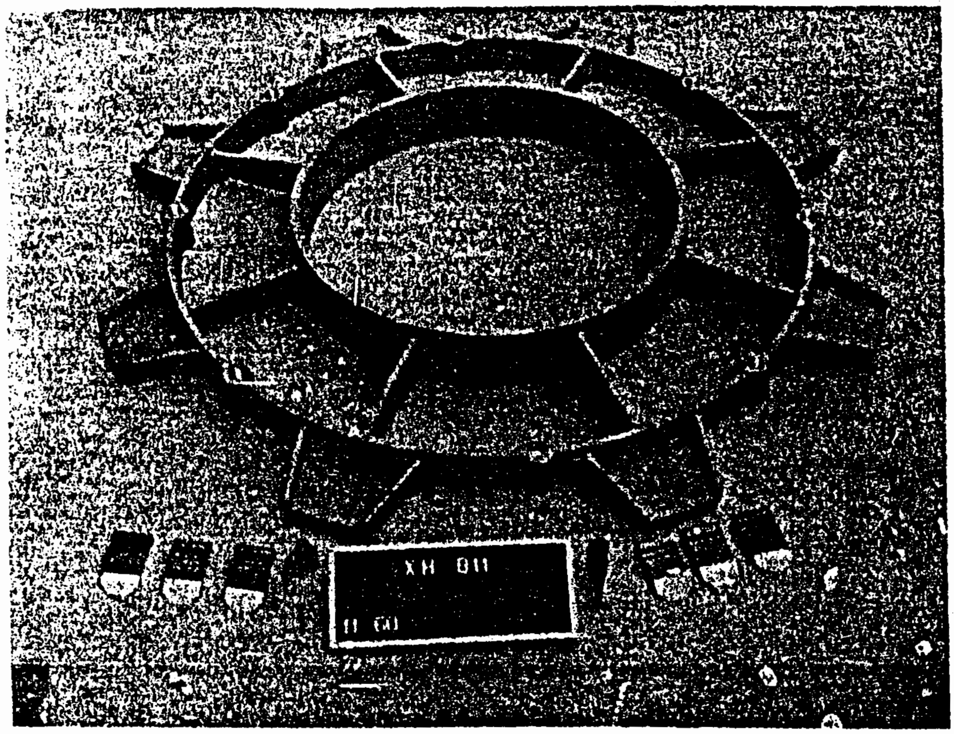

Figure 61. H-811 Parachute Protector

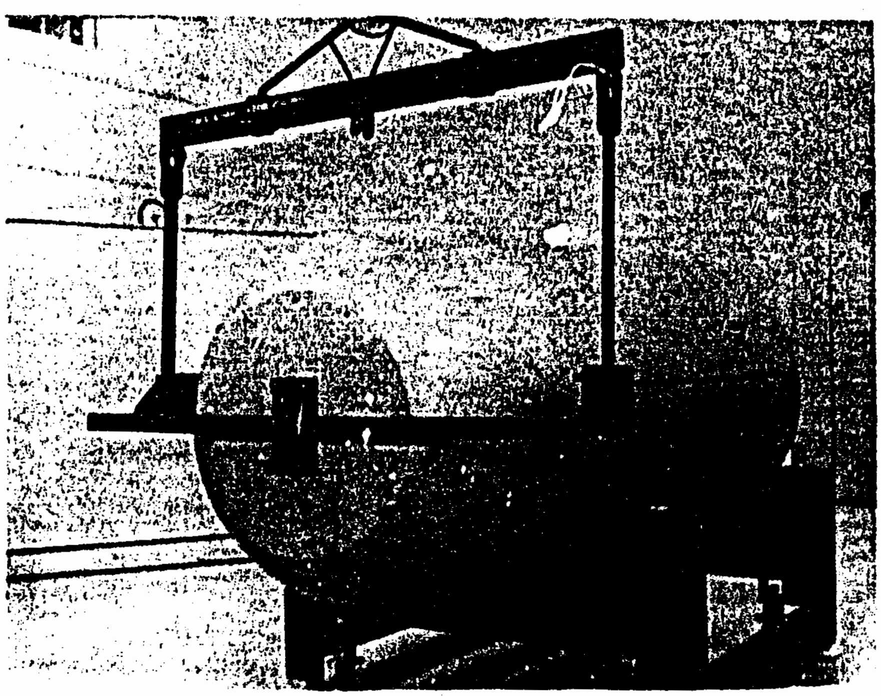

Figure 62. H-813 Hoisting Adapter

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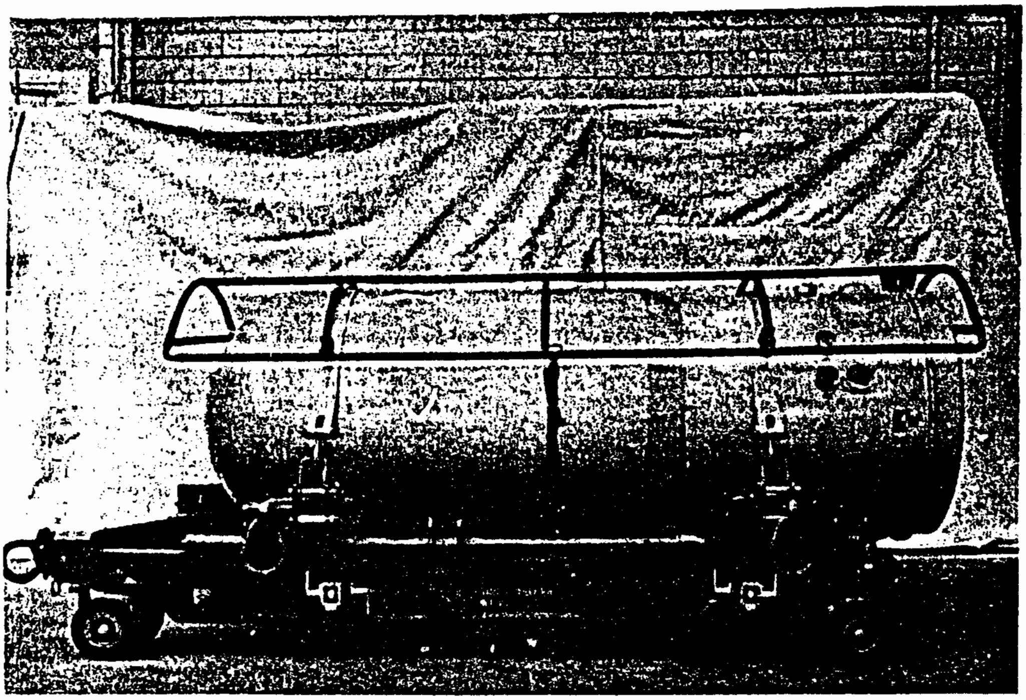

Figure 63. H-825 Security Cover Frame (Installed)

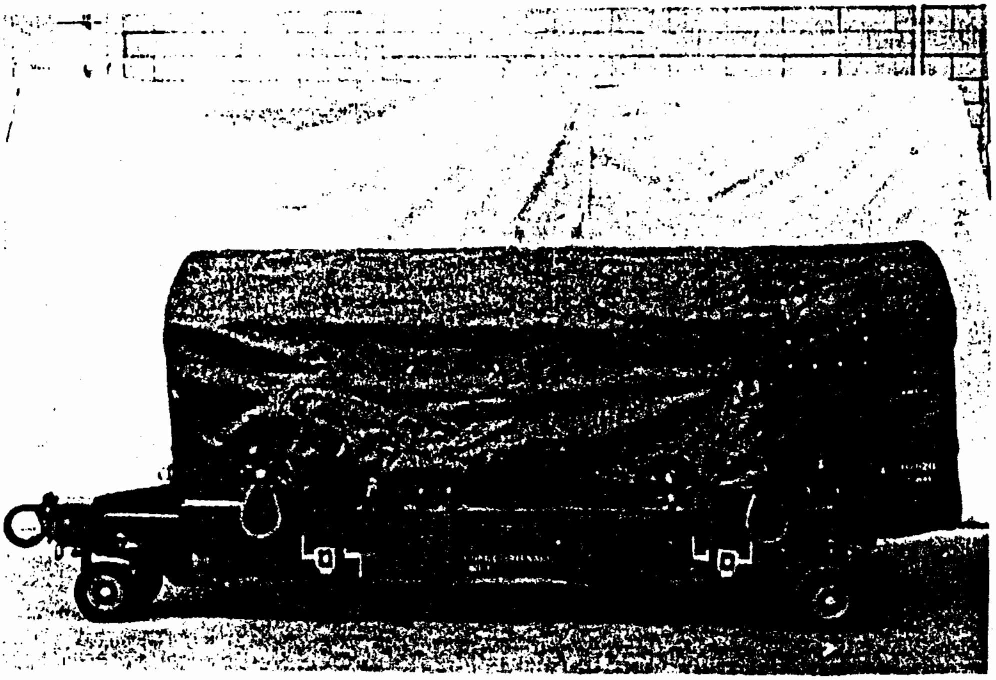

Figure 64. H-826 Security Cover (Installed)

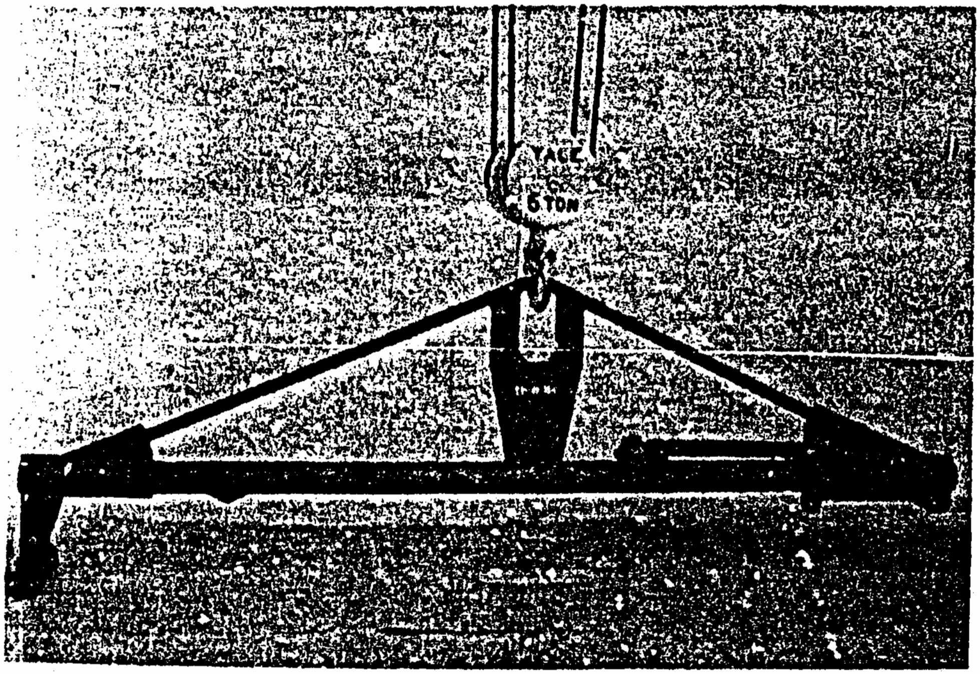

Figure 65. H-836 Beam Sling

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Figure 66. H-900 Mild Detonating Fuse Protective Ring

H-946 Rear Case Section Hoisting Adapter

The H-946 is used with the H-802 (Figure 67) for hoisting and rotating the rear case section. The H-946 is of welded steel construction. It attaches to the aft end of the rear case section by four bolts.

H-962 Hoisting Adapter

The H-962 (Figure 68) is an aluminum hoisting adapter for hoisting the basic assembly when the rose is installed. It is composed of two parts. The first part is a plate that is attached by six bolts to the basic assembly at the same radial hole pattern where the nose is attached. This part is rectangular in cross section and is curved to match the radius of the weapon in the area where it is attached. The second part of the H-962 is a clevis which links the first part to the H-836 hoisting beam.

H-971 Nose Hoisting Adapter

The H-971 (Figure 69) consists of a welded structure fabricated from 1.75-inch steel square tubing. It is used with the H-813 hoisting adapter and is attached to the H-813 by four bolts. The H-802 sling with the H-813/H-971 is used for hoisting the nose from the container and for rotating the nose from a horizontal to a vertical position or vice versa during conversion or maintenance operations.

H-993 Hoisting Adapter

The H-993 (Figure 70) is composed of two semicircular rings, two spreader beams, and two hoisting brackets. The H-993 is used for hoisting and rotating the bomb outer case segments and is used during bomb maintenance or conversion. When the semicircular rings are attached to the ends of the outer case segment, the outer case segment can be rotated by rolling it over on the floor. When the spreader beams and hoisting brackets are attached to the semicircular rings, the case segment can be hoisted with the H-836 sling.

H-995 Protective Ring

The H-995 (Figure 71) is a quarter segment of a circular ring 3/4 x 3/8 inch in cross section. A 1/16-inch thick rubber strip is bonded to one surface of the segment. When the closing plate is removed, the H-995 is bolted to the aft end of the basic assembly to protect the O-ring sealing surface.

H-989 Removal and Installing Tool

The H-989 (Figure 72) is used for removing and installing the component ring assembly. It is a welded aluminum construction.

Existing Equipment or Carryover H-Items

H-309 Warhead and Container Sling

The H-309 (Figure 73) is a four-legged cable sling which can be attached to the H-801 parachute protective cover to hoist the MC-1387 parachute assembly. The H-309 will be used to place the parachute assembly into or remove it from the H-800 parachute shipping and storage container.

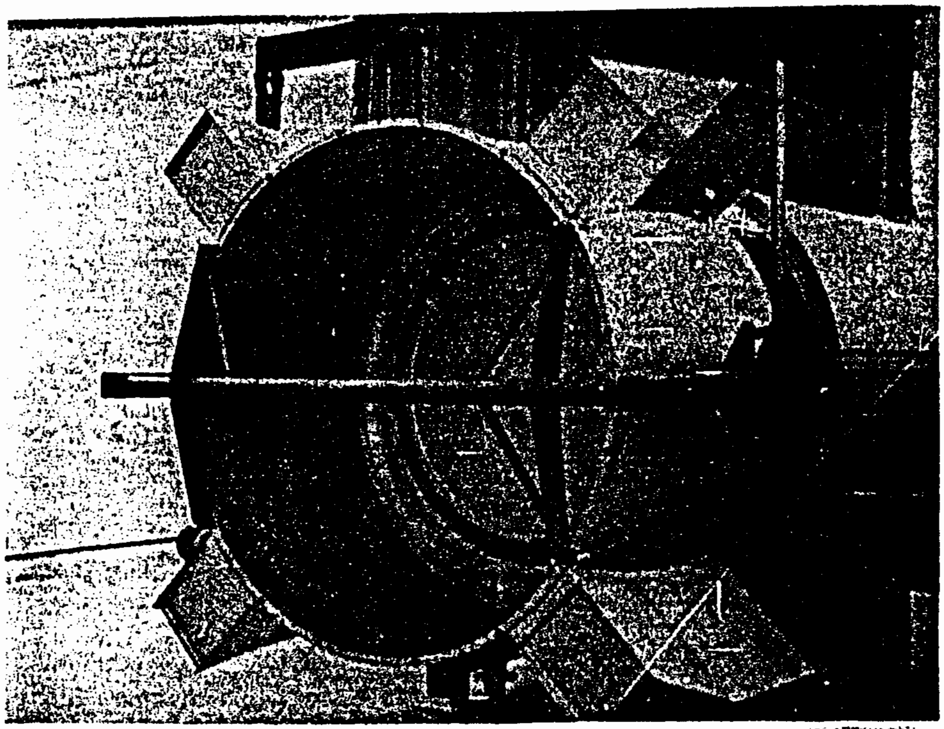

Figure 67. H-946 Rear Case Section Hoisting Adapter

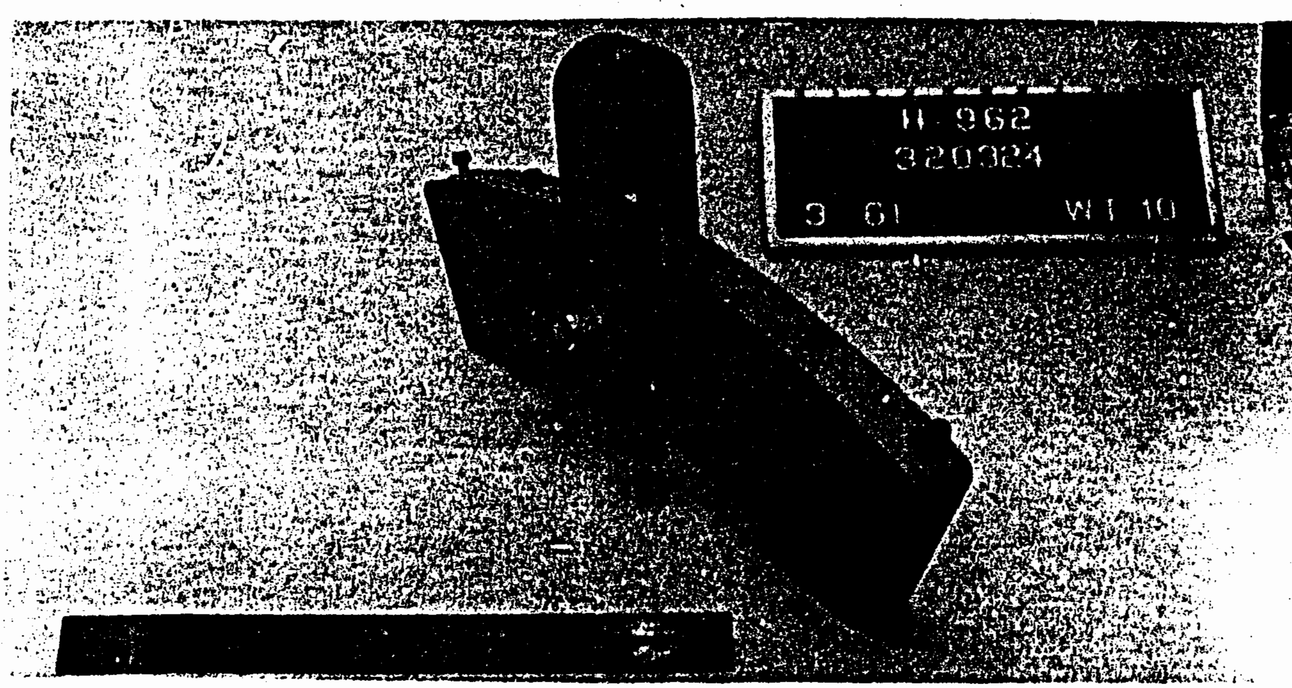

Figure 68. H-962 Hoisting Adapter

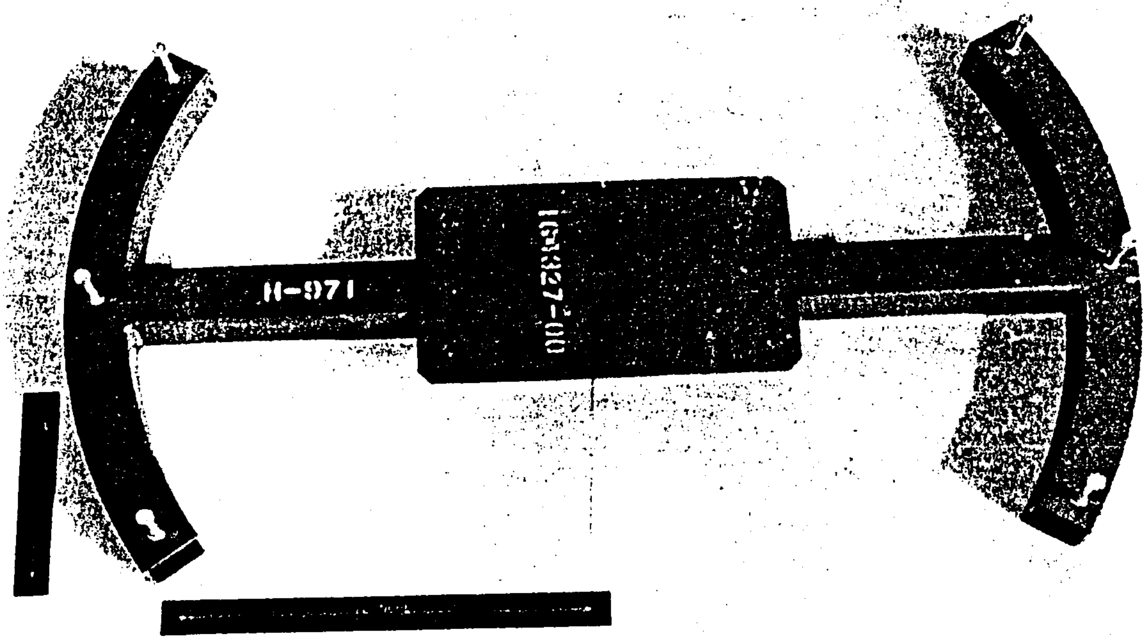

Figure 69. H-971 Nose Hoisting Adapter

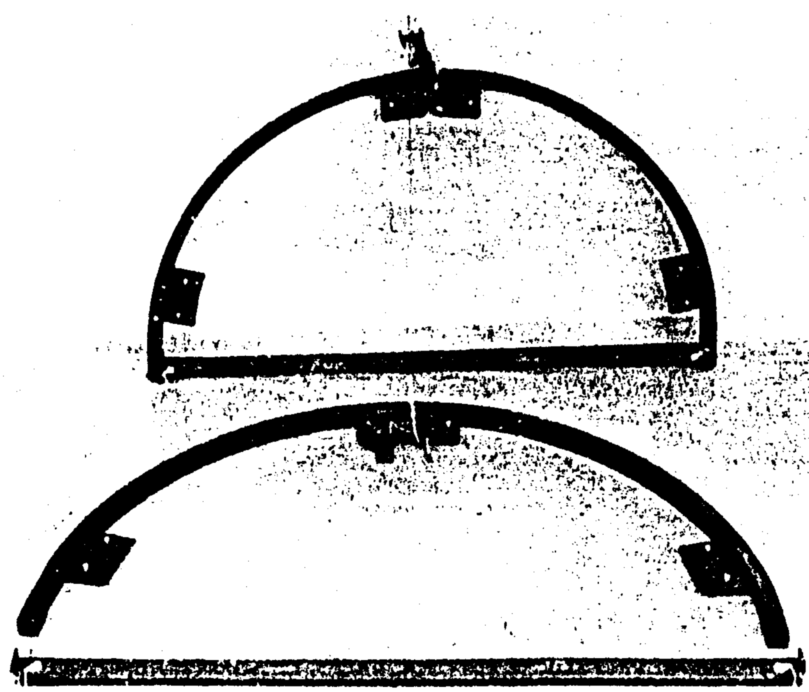

Figure 70. H-993 Hoisting Adapter

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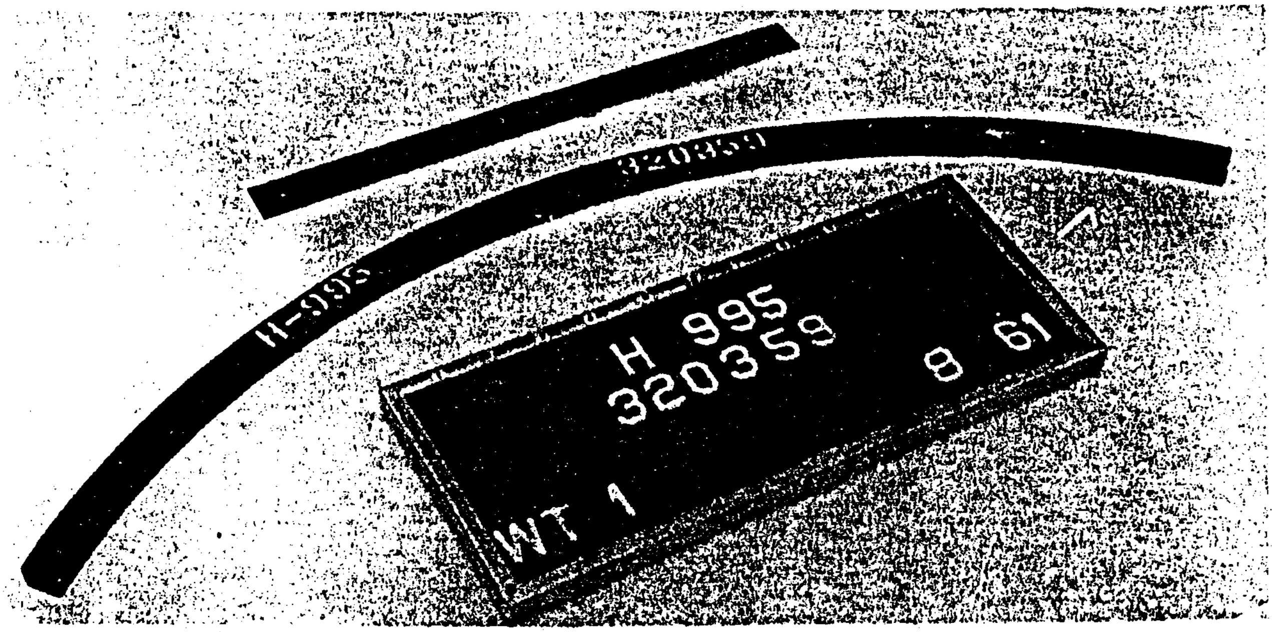

Figure 71. H-995 Protective Ring

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Figure 72. H-989 Removal and Installing Tool

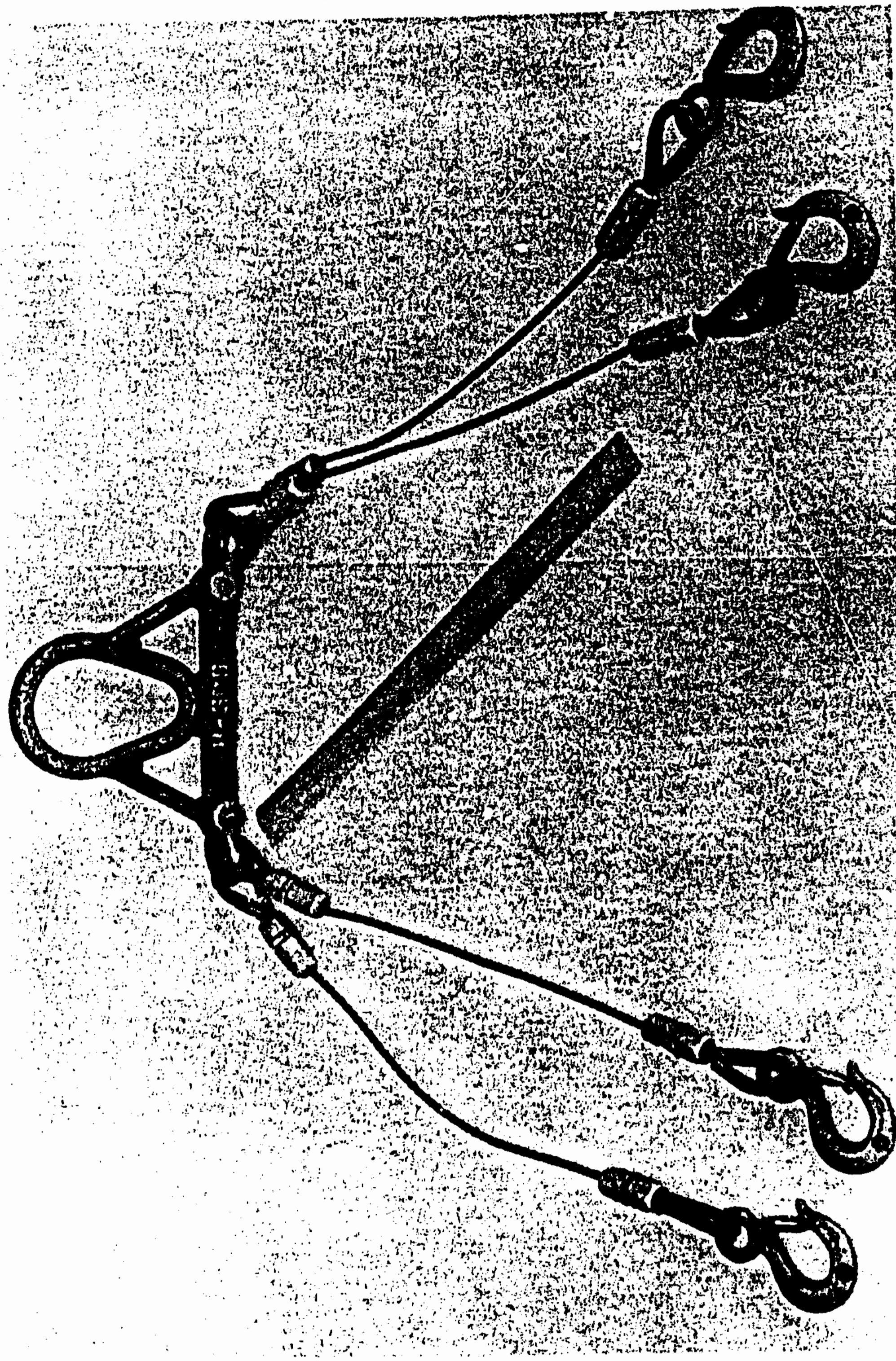

Figure 73. H-309 Warhead and Container Sling

H-563 Bomb Hand Truck Sling

The H-563 (Figure 74) is a beam used to either hoist the H-800 parachute shipping and storage container or to remove the lid from the H-800. The H-563 has two cable and hook assemblies at each of the beam ends which are attached to the cover of the H-800. It may be used to handle the container during parachute replacement and conversion.

H-639 Bomb Hand Truck Sling

The H-639 (Figure 75) is a four-legged sling which is attached to the H-794 hand truck and is used to hoist the H-794 and bomb with the H-798 security cover in place or to hoist the H-794 and basic assembly with the H-826 security cover in place. It is to be used both during shipment and maintenance.

836656 Swivel Hook

The swivel hook is a commercial hook used with the H-639 hand truck sling for hoisting the H-794 hand truck and bomb.

H-690 Spanner Wrench

The H-690 is required to remove and reinstall the humidity indicator assemblies on special design test set cases and packaging units.

H-691 Spanner Wrench

The H-691 is required to replace the humidity indicator card in the humidity indicator assembly.

H-762 Caster Tool

The H-762 is used for turning the dual-wheel caster on the H-794 hand truck. It can be used on all four casters when the basic assembly is installed on the H-794, but only on the forward casters when the bomb is installed.

H-772 Hoisting Beam

The H-772 (Figure 76) is an aluminum hoisting beam for lifting the bomb with overhead equipment when the clip-in suspension subassembly is installed. The attachment lugs on the clip-in are used for pickup points so hoisting can be done with the bomb either on or off the H-794 hand truck.

H-876 Socket Wrench

[redacted]

H-935 Screw Thread Cleaning Tool

[redacted]

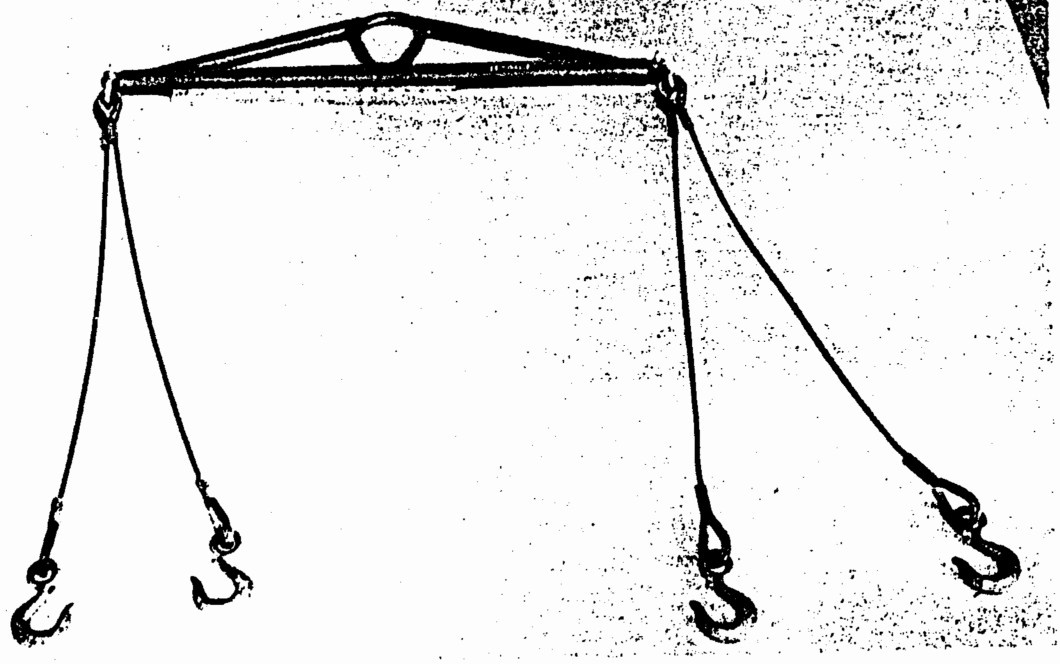

Figure 74. H-563 Bomb Hand Truck Sling

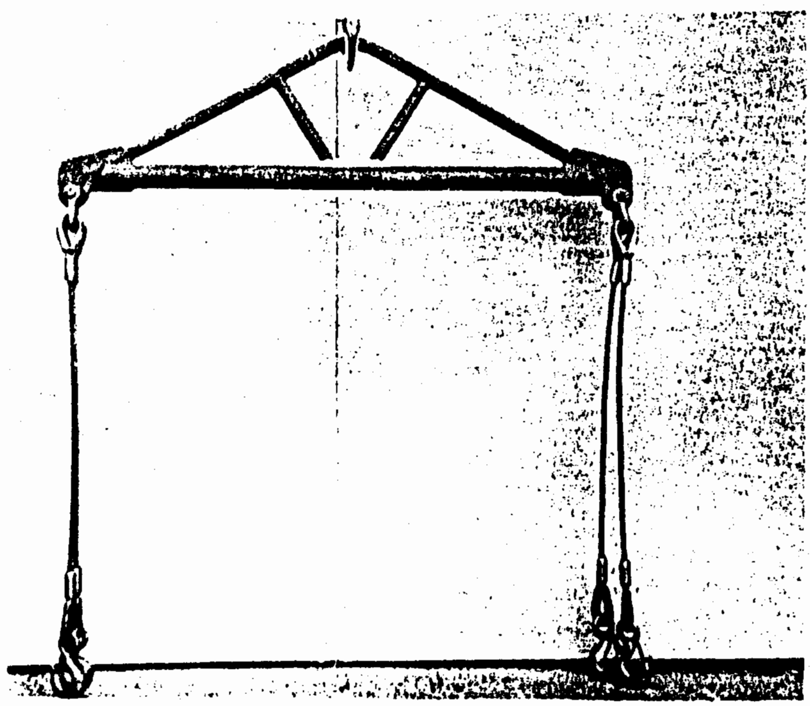

Figure 75. H-639 Bomb Hand Truck Sling

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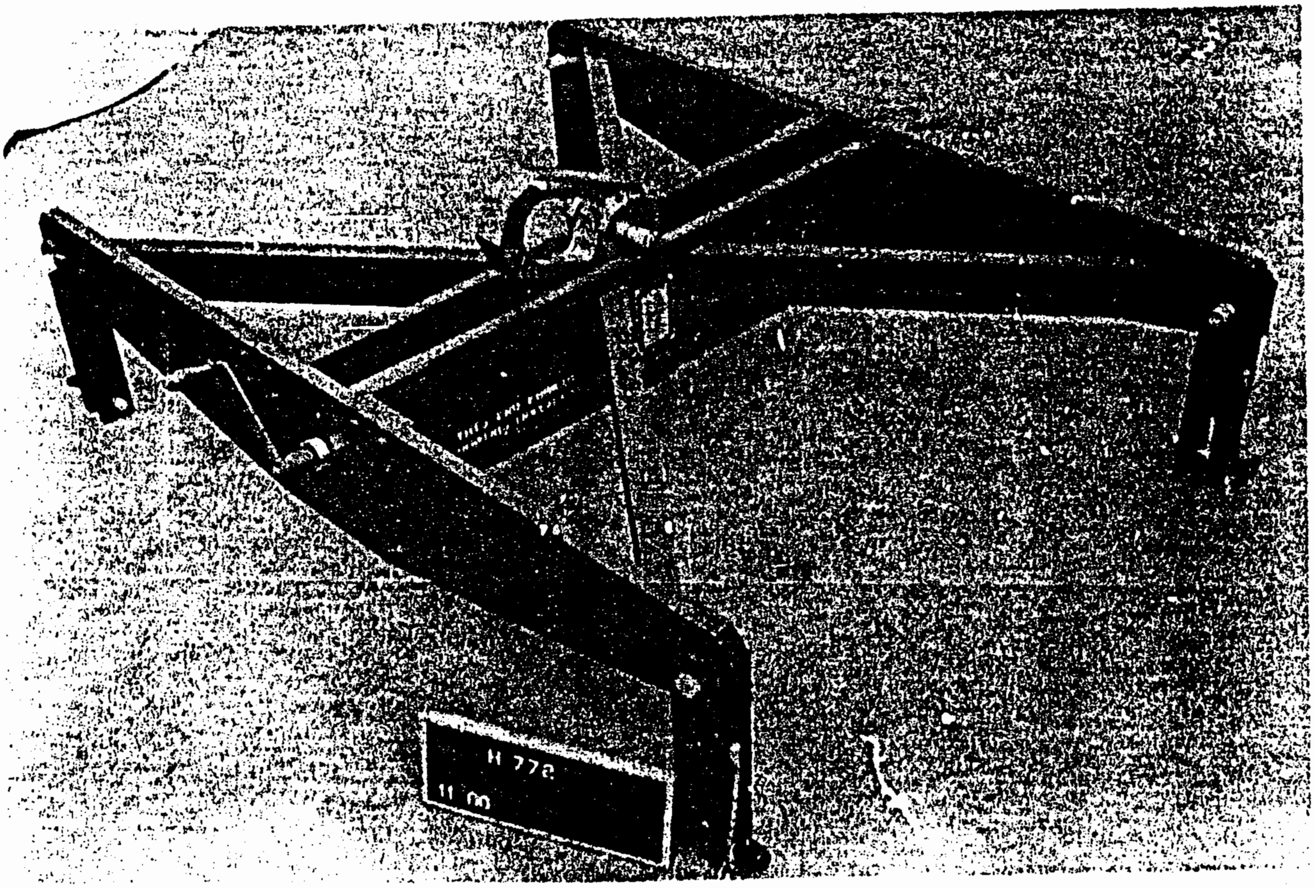

Figure 76. H-772 Hoisting Beam

Figure 77. H-876 Socket Wrench and H-035 Screw Thread Cleaning Tool

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T-283 Pressure Seal Test Set

The T-283 is a dial indicating pressure gage which is required after repressurizing the basic assembly, and can be used to verify the indication of the MC-1282 pressure monitoring switch which is monitored by the T-304B multiple purpose continuity test set. The T-283 can be used when the unit is in either the bomb or basic assembly configuration.

T-289A Air Monitoring Sampler

The T-289A is used to detect the presence of tritium gas. It is designed for use in inhabited structures, weapon assembly buildings, and other similar locations. The T-289A is composed of two units, one of which may be installed in an adjacent room, but not more than 50 feet from the first unit. This separation is desirable so that access to the T-289A controls, located on the second unit, will be possible in case of a tritium leak. The T-336 and T-329A may be used as needed with the T-289A. The T-336 over-radiation alarm is designed to provide information from the T-289A to a remote location. The T-329A radiological urinalysis kit is used in conjunction with the T-289A to check body fluid radioactivity.

T-290/T-290A Air Sampler

The T-290 is a portable instrument used to detect the presence of tritium gas. Tritium monitoring is required whenever there is a possible tritium hazard to personnel. Although the T-290 is not required where the T-289A air sampler is in use, the T-290 should be available in case of T-289A failure, or, in case the T-289A detects the presence of tritium gas, the T-290 can be used to isolate the source of the tritium gas. As the T-290 is a portable device with a self-contained power supply, it is suitable for monitoring weapons containing tritium at locations where permanent monitoring facilities are not available. The T-290 is an alternate for the T-290A.

T-298 Hose to Valve Adapter

The T-298 is used to adapt the pressurizing system to the air valve in the basic assembly. Repressurizing the basic assembly will be necessary when appropriate indication is given by the T-283 pressure seal test set, and after gas reservoir and valve replacement. The T-298 can be used when the unit is in either the bomb or basic assembly configuration.

T-304B Multiple Purpose Continuity Test Set

The T-304B is used with the T-302 cable adaption kit to monitor continuity and pressure in the bomb or basic assembly.

T-329A Radiological Urinalysis Monitoring Kit

The T-329A is used in conjunction with the T-289A air sampler to check body fluid for radioactivity. Personnel working with or around weapons containing tritium are exposed to a radiation health hazard in the event of a tritium leak. In case of known, or suspected, exposure of personnel to tritium, a positive determination of the extent of exposure can be obtained through the use of the T-329A and T-289A.

T-336 Over Radiation Alarm

The T-336 is used with, but remote from, the T-289A air sampler to provide optional auxiliary audible and visual indications of information from the T-289A. The T-289A is used to detect leakage of tritium and was designed for use in inhabited structures, weapon assembly buildings, and other similar locations. The T-336 provides information from the T-289A to a remote location. In addition, as the T-336 is weatherproof, it can be located outside of the building and provide a readily apparent indication of conditions inside the building.

T-389 Baroswitch Test Set

The T-389 offers the capability for changing the factory-set air burst firing altitude of the MC-1266 baroswitch.

T-392 Cable Adaption Kit

The T-392 is used with the T-304B multiple purpose continuity test set to monitor continuity and pressure in the bomb or basic assembly.

CHAPTER V -- PROGRAMMING

The TX-53 Phase 3 development authorization was received at Sandia Corporation on December 23, 1958, with a scheduled FPU (WR) date of August 1961. The development program proceeded upon the schedules shown in the bar-chart (Figure 78). The principal new and complex problems faced in the TX-53 design and development were:

1. Development of a high strength case capable of withstanding laydown loads and, at the same time, retaining the same nuclear physics properties of [redacted]
2. [redacted]
3. [redacted]
4. Parachute system provisions for low-altitude high-speed release.
5. Development of an energy-absorbing cocoon surrounding the basic assembly for protection against a reasonable variety of target configurations.

The primary energy absorbing system includes the energy-absorbing nose and the outer case segment system. The secondary energy-absorbing system includes the rear case section, parachute stowage can and fins, all of which are of aluminum honeycomb sandwich construction.

[redacted]

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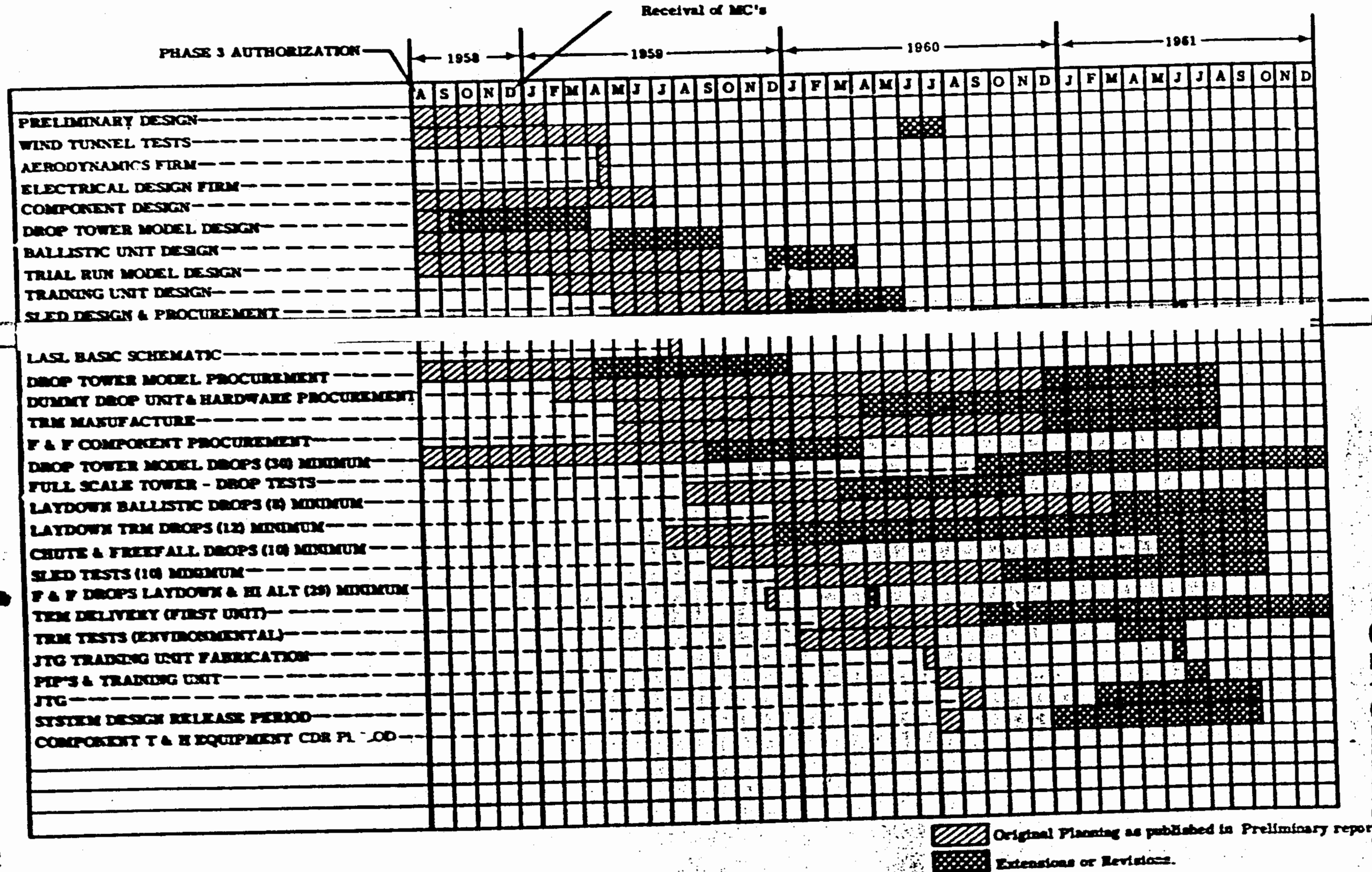

Figure 78. Development Schedule

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b(1), 1.5(a)

Problems encountered in the development of the parachute system have delayed the TX-53 drop test program which resulted in delays in the weapon development to the extent that the weapon First Production Unit (FPU) date is in jeopardy. Every effort is being exerted by Sandia Corporation and the other agencies concerned to maintain the established schedules.

Weapon development problems were centered around the Military Characteristics requirements for a 500-foot release above terrain in the laydown option, and are as follows:

1. Parachute system volume limitations resulting from the size of the B-47 (single carriage) and B-52 (dual carriage) bomb bays.
2. Structural system and center of gravity features which dictated the maximum load (drag) that could be imposed by the parachute system.
3. Structural limitations of the nuclear and fuzing and firing system that dictated performance characteristics of the parachute system such as terminal velocity prior to impact, attitude of the weapon at impact and stability of the weapon/parachute system in winds up to 35 miles per hour.

The tests as noted by the schedules shown in Chapter III are planned for completion in September 1961. Further tower testing will be conducted after September 1961 to establish the ultimate structural capability of the TX-53 and to estimate weapon reliability with regard to assumption of winds over the target and the nature of target complexes. In addition, these test data will be used to confirm or adjust test specifications for weapon components.

APPENDIX A

REFERENCES

COPY SECRET UNCLASSIFIED COPY

TO: N. E. Bradbury, Director, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.
J. W. McRae, President, Sandia Corporation

Date: Sep 11 1958

FROM: K. F. Hertford, Manager
Albuquerque Operations, AEC

SUBJECT: CLASS C LAYDOWN WEAPON (FuFo)

ALP:RRL

Reference: DMA/ALO Memorandum of 9-2-58, with enclosure, above subject. (cc: LASL, SC)

In accordance with the reference, please proceed with preliminary arrangements for the Phase 3 development of subject weapon, joining with the Air Force as appropriate. Phase 3 authorization will be given immediately upon receipt of the approved Military Characteristics from the DoD.

Direct correspondence and liaison with the DoD participants are authorized, subject to the stipulations of AEC Manual Chapter 2318.

DISTRIBUTION:
1A - N. E. Bradbury, Director, LASL
2A - J. W. McRae, President, SC
3A - H. A. Fidler, Manager, SAN
4A - E. Teller, Director, UCRL
5, 6A - L. T. Heath, Maj Gen, USA, Commander, FC/AFSWP
7A - W. M. Canterbury, Maj Gen, USAF, Commander, AFSWC
8A - A. D. Starbird, Brig Gen, USA, Director, DMA
9A - R. P. Johnson, Ass't Mgr for Mfg, ALO
10A - C. C. Campbell, Area Mgr, SAO
11A - A. B. White, Advance Planning, ALO
12A - Advance Planning Files
13, 14A - ALO Classified Files

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TO: N. E. Bradbury, Director, Los Alamos Scientific Laboratory, Los Alamos, New Mexico
James W. McRae, President, Sandia Corporation
Attn: R. W. Henderson

Date: Sep 23 1958

FROM: Ralph P. Johnson, Assistant Manager for Manufacturing, ALOO

SUBJECT: CLASS C LAYDOWN WEAPON (FUFO)

SYMBOL: MPP:AOM

DOE b(3)

By SRD memorandum, Starbird/Hertford, subject: [redacted] Laydown Weapon", symbol: MAR:MRR, dated September 2, 1958, copies to Sandia Corporation and LASL, ALO is requested to advise DMA scheduling possibilities and the estimated OAD for a Class C Laydown Weapon.

An estimated timetable, based on the time that will be required to complete design, development, testing and first production for this program is requested.

This information is desired by October 15, 1958. If this date cannot be met ALO should be advised as to when a response can be expected.

Distribution:

1A - N. E. Bradbury, Dir., LASL, Los Alamos, New Mexico
2A & 3A - James W. McRae, Pres., SC, Attn: R. W. Henderson
4A - J. V. Durant, Br. Ch., Ofc. of Mfg., #2
5A - Manufacturing Files
6A & 7A - Central Files

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DOE b(3)

[redacted]

Mr. K. F. Hertford, Manager
Albuquerque Operations Office
P. O. Box 5400
Albuquerque, New Mexico

Attn: Mr. R. P. Johnson, Assistant Manager
Office of Manufacturing

Re: [redacted] DOE b(3)

Reference: SRD Ltr., Johnson, ALO, to McRae, Sandia Corp. and Bradbury, LASL, [redacted]
Ref. Sym: [redacted] DOE b(3)

The reference letter requested that a tentative development schedule be submitted by Sandia Corporation and Los Alamos Scientific Laboratory for the [redacted] weapon which will have full fuzing option. DOE b(3)

The following dates are the best current estimates which can be made and are based on informal information concerning the desired military characteristics for this weapon:

Complete Engineering Release - August, 1960
First Production Unit (WR) - August, 1961

As little or no data exist which are applicable to the design of the shock-mitigating features of a weapon in this weight class, it may be necessary to adjust the development schedule after significant drop-test data are available. Some testing may be done after CER. DOE b(3)

The above information is presented assuming use of the [redacted] with little modification. Should major changes be needed, a complete new evaluation of time scales will be essential.

J. P. Molnar - President
Sandia Corporation

N. E. Bradbury - Director
Los Alamos Scientific Laboratory

CLC:1217:jb

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COPY

TO: N. E. Bradbury, Director, Los Alamos Scientific Laboratory, Los Alamos, N. M.
J. P. Molnar, President, Sandia Corporation, Sandia Base, N. M.

DOE b(3)

FROM: K. F. Hertford, Manager
Albuquerque Operations

DOE b(3)

SUBJECT: PHASE 3 AUTHORIZATION [redacted]

Reference: [redacted] re Military Characteristics f
[redacted] (CC: LASL, SC)

DOE b(3)

In accordance with the reference, please join with the Air Force and AFSWP (FC) in the development throu
Phase 3 [redacted]

DOE b(3)

In implementation of the program, direct correspondence and liaison with the DOD participants are author
subject to the stipulations of AEC Manual Chapter 2318.

<u>To comply with DMA's request, will you please advise this office, at the earliest possible time, if it beco apparent that any portion of the Military Characteristics cannot be met.</u>

<u>Distribution:</u>

1A - N. E. Bradbury, Director, LASL
2A - J. P. Molnar, President, Sandia Corporation
3A - E. C. Shute, Manager, San Francisco Operations, AEC, Oakland
4A - E. Teller, Director, UCLRL, Livermore, Calif.
5, 6A - Maj. Gen. L. T. Heath, Commander, FC, AFSWP, Sandia Base
7A - Maj. Gen. W. M. Canterbury, Commander, AFSWC, Kirtland AFB
8A - Brig. Gen. A. D. Starbird, DMA, AEC, Washington
9A - R. E. Poole, Vice President, Sandia Corporation, Livermore
10A - Marvin Martin, UCLRL, Livermore, Calif.
11A - R. P. Johnson, Asst. Mgr. for Mfg., ALOO
12A - C. C. Campbell, Area Mgr., Sandia Area Ofc
13A - A. B. White, AP, ALOO
14A - AP Files
15, 16A - ALOO Classified Files

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Mar 13 1959

SWVWT 941

President, Sandia Corporation
Sandia Base, New Mexico
ATTN: Division 1200

THRU: Commander
Field Command, AFSWP
ATTN: FCDDI
Sandia Base, New Mexico

DOE b(

SUBJECT: (U) Target Height

1. For your information and guidance, it is the desire of SAC that a maximum target heigh[redacted] be used for weapon design purposes. This figure should be used for TX-41, TX-53 and all future strategic weapon designs. We do not intend to request a change to the TX-41 Military Characteristics because of the late stage of weapon development. Since no reference is made to target height in the TX-53 Military Characteristics, no change will be necessary. (SECRET RD)

2. This letter is classified SECRET RD because it reveals thermonuclear weapon operational design parameters. (UNCLAS)

FOR THE COMMANDER:

M. E. SORTE
Colonel, USAF
Deputy Director
Development Directorate

CY furn
AEC/ALOO, Albuq. NMex

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TO: J. P. Molnar, Pres., Sandia Corporation
Attn: R. W. Henderson, Vice-Pres., Dev.
N. E. Bradbury, Dir., Los Alamos Scientific Laboratory, Los Alamos, New Mexico

FROM: Ralph P. Johnson, Assistant Manager for Manufacturing, Albuquerque Operations

SUBJECT: TX-53/B-70 COMPATIBILITY

DOE b(3)

SRD memorandum.

copies of which were forwarded to you, requests additional information on TX-53/B-70 compatibility.

You are requested to develop the information requested in paragraph 3. of referenced memo and forward a coordinated reply direct to DMA at the earliest practicable date.

Distribution:
1,2A - J. P. Molnar, Pres., SC, Attn: R. W. Henderson, 1000
3A - N. E. Bradbury, Dir., LASL, Los Alamos, New Mexico
4A - Brig. Gen. A. D. Starbird, USA, Dir., DMA, Washington, D. C.
5A - J. V. Durant, Br. Ch., Br. #2, Off. of Mfg., ALOO
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K. F. Hertford, Manager
Albuquerque Operations

Brig. General Alfred D. Starbird, USA
Director of Military Application

MILITARY CHARACTERISTICS FOR TX-53

1. Forwarded herewith is a copy of Amendment 1 to subject military characteristics for your information and compliance.

2. The Military Liaison Committee provides additional guidance as follows:

a. B-58 Compatibility. The course of action being pursued by the development agencies appears acceptable to the Department of Defense; namely, that a basic bomb without retardation or shock mitigation is to be installed in the B-58 two component pod in the manner of a "warhead." Definite AEC/DoD interface problems which are not always clear early in the development program should under existing ground rules and agreements be resolved within the joint working groups. Such problems which cannot be resolved should be referred to the principals for resolution.

NOTE: A Memorandum of Agreement on Division of Weapon Responsibilities for the B-58/Class B, C and D Weapons Systems was recently signed by the Director, DMA and the Director of Research and Development, Headquarters USAF. This agreement is presently being formalized through the Military Liaison Committee and the Atomic Energy Commission. This agreement states that the Atomic Energy Commission will provide arming and fuzing components in the case of the B-58/TX-53 combination.

b. In regard to paragraph 3.2.5 of the Subject Military Characteristics, the Department of Defense advises that the United States Air Force is designing a parachute system to meet the Military Characteristics in the required time period.

3. The Military Liaison Committee has asked for additional information concerning the TX-53 bomb being developed to be compatible with the B-70. This information is necessary in order to assist the Department of Defense to determine whether a waiver of requirements, and amendment to the Military Characteristics or new Phase 3 development authorizations are required. Specific information requested is as follows:

a. Will the TX-53/B-70 bomb exceed the physical parameters as now stated in the MC's?

b. Please advise as to the extent and nature of such deviations, if any required, the extra order of development effort, if any involved, and the degree of reversibility of interchangeability provided in the peculiar B-70 weapon.

4. Upon receipt of the information specified in paragraph 3 above, the MLC will be requested to verify the present Phase 3 development authorization or to delete the B-70 as a carrier. Until this is done, your design and development effort on the B-70 compatible bomb should be limited to that required to answer the questions above.

Attachment:
Amend. #1 to TX-53 MC's, Cy 2A

CC: SAN w/cy 3A of encl.
LRL w/cy 4A of encl.
LASL w/cy 5A of encl.
SC-Alb. w/cy 6A of encl.
SC-Liv. w/cy 7A of encl.

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Oct 29 1959

Ref. Sym: 1000 (3434)
R&D File: TX-53, 2-1

Brig. General A. D. Starbird, Director
Division of Military Application
U. S. Atomic Energy Commission
Washington 25, D. C.

Re: TX-53/B-70 Compatibility

References:
1. SRD Memo, R. P. Johnson to J. P. Molnar, SC, and N. E. Bradbury, LASL, dtd 9/24/59, Q-86085, Ref. Sym: MPP:AOM, same subject
2.
3. SRD Memo, J. P. Molnar to Brig. Gen. A. D. Starbird, dtd 4/14/59, Ref. Sym: 1 (1200), subject, Study of our Capability to Improve our Atomic Weapon to Withstand the Environment of the Air Force New Weapon Systems

The third paragraph of Reference 2 requested information relative to the TX-53/B-70 compatibility, and Reference 1 requested that this information be sent directly to DMA. As the answers to the specific questions are so interrelated, the information herein is not presented in the order asked.

Since the objective of our effort has been to achieve B-70 compatibility for special weapons with the minimum penalty to the over-all delivery capability as outlined in Reference 3, we have assumed in our study that any thermal protection must be part of the weapon. If aircraft bomb bay cooling or insulation is provided that will maintain weapon temperature below 165°F, the present TX-53 is compatible with the B-70 pending verification of aerodynamic and parachute system performance.

Several materials and components of the TX-53 require that there be no sustained exposure to temperatures higher than 165°F or brief exposure higher than 200°F. If it is necessary (as we have assumed) to provide this protection, it is anticipated that the version of the TX-53 for B-70 carriage can be made field convertible by replacing the shock mitigation system, afterbody, and parachute system with parts designed to withstand the higher temperatures. The resultant converted TX-53 would exceed the present physical parameters in that a length of 164 inches, a diameter of 52 inches, and weight of 9300 pounds could be expected. The present TX-53 is within the Military Characteristics parameters of 148 inches in length, 50 inches in diameter, and 8500 pounds, except for a local extension to provide increased parachute storage volume. This extension has been coordinated with and approved by Field Command, Defense Atomic Support Agency, as it does not affect aircraft bomb bay clearance. The B-70/TX-53 would be reversible to the original configuration for the B-47, B-52 (multiple carriage), or to that required for the B-58 applications. It is estimated that about 15 months of additional development, with FPU about February 1963, will be required to produce this version. This effort has already been reflected in our budget forecast.

No further authorization for development of a version of the TX-53 for the B-70 is considered necessary, since the Military Characteristics for the bomb clearly state this requirement.

R. W. Henderson

CLC:1217:nt

Distribution:
1/5A Brig. Gen. A. D. Starbird, DMA
2/5A K. F. Hertford, Mgr., ALO, Attn: J. V. Durant
3/5A N. E. Bradbury, Dir., LASL, Attn: E. H. Eyster
4/5A R. K. Smeltzer, Central Record File, 3421-3
5/5A R. W. Henderson, 1000, Attn: S. A. Moore

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TO: J. P. Molnar, President
Sandia Corporation

Date: May 2 1960

FROM: Paul W. Ager, Assistant Manager for
Advance Planning, ALO

SUBJECT: WEAPON DEVELOPMENT EFFORT IN SUPPORT OF THE B-70 AIRCRAFT

SYMBOL: PW:ABW

Ref: (a) DMA/ALOO Memo of 4/25/60, subject as above
(b) DMA/ALOO Memo of 1/18/60, subject as above
(c) ALOO/SC Memo of 1/26/60, subject as above

Being supplemental to References (b) and (c), the entire text of Reference (a) is quoted below for your information and guidance:

"I refer to my memorandum of January 18, 1960, subject as above.

"Until further notice, continue the current suspension of weapons developmental effort in support of the B-70 aircraft. Efforts should continue, however, on upgrading weapons components of the TX-53 and TX-41 to withstand the extreme environments of other advanced systems.

"For your information, the Air Force may, in the future, request the AEC to resume full weapon development effort in support of the B-70 program."

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1A - Addressee
2A - E. C. Shute, Mgr., SAN
3A - N. E. Bradbury, Dir., LASL
4A - E. Teller, Dir., LRL
5A - Marvin Martin, LRL
6A - R. E. Poole, Vice Pres., Sandia Corp, Livermore
7A - Brig. Gen. A. D. Starbird, Dir., DMA, USA, WashDC
8A - Maj. Gen. C. M. McCorkle, Commander, AFSWC-KAFB
9-10A - Commander, FC/DASA, Attn: Col. Charles E. Carson, FCDV
11A - C. C. Campbell, Area Mgr., SAO
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Jan 27 1960

JAMES L. MC CRAW
ASSISTANT MANAGER FOR MANUFACTURING
USAEC, ALBUQUERQUE OPERATIONS

UNCLASSIFIED

USAEC, WASHINGTON, D. C.
ATTN: BRIG. GEN. A. D. STARBIRD

AS WAS DISCUSSED WITH YOUR MR. COOK ON JAN 22, SANDIA CORP. HAS FORMALLY RECOMMENDED THAT THE TX 53 PROGRAM BE SLIPPED BY SIX MONTHS, FPU/WR, FROM AUG 1961 TO FEB 1962. THE CONTROLLING CAUSE FOR DELAYS IN THE PROGRAM IS THE UNAVAILABILITY OF BASIC CASE STRUCTURES NECESSARY TO EVALUATE STRUCTURAL INTEGRITY OF THE CASE DESIGN AND PRACTICABILITY OF PROPOSED METHODS OF FABRICATION. PAR THE RECOMMENDED SIX MONTHS DELAY IN THIS PROGRAM REPRESENTS A MINIMUM OF ADDITIONAL TIME NECESSARY TO COMPLETE THE DEVELOPMENT BASED ON PRESENT COMMITMENTS FOR AVAILABILITY OF MATERIAL AND TEST FACILITIES. PAR THIS PROPOSED PROGRAM SLIP MAY CREATE A HARDSHIP IN ACHIEVING A B 58/TX 53 CAPABILITY COINCIDENT WITH THE AVAILABILITY OF THE B 58 TWO COMPONENT POD (TCP). INFORMALLY, SANDIA CORP. HAS ADVISED SAC REPRESENTATIVES THAT AN EC OR IOC PROGRAM MAY BE POSSIBLE ON THE ORIGINAL TIMESCALES, HOWEVER, SUCH AN INTERIM CAPABILITY PROGRAM MAY CAUSE A FURTHER SLIP IN FPU/WR. SAC REPRESENTATIVES ARE TAKING THIS INFO TO SAC HQRTS AND ON FEB 8, AT THE NEXT B58 JOINT WORKING GROUP MEETING AT S.C. WILL PRESENT THE SAC DESIRES WITH REGARD TO AN EC OR IOC PROGRAM. PAR WITH THIS PROPOSED SLIP [redacted] ALO PROPOSES TO CHANGE THE 53 PROGRAM DATES AS RECOMMENDED BY SANDIA CORP. AND REVISE THE ALO PROGRAMMING DOCUMENTS ACCORDINGLY. PAR YOUR COMMENTS AND/OR CONCURRENCE IS REQUESTED. END REF MPP:JVD

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Headquarters
Air Force Special Weapons Center
Air Research and Development Command
United States Air Force
Kirtland Air Force Base, New Mexico

REPLY TO ATTN OF: SWVCS/Capt Crespy/2345

SUBJECT: B-47/MK-53 Compatibility (U)

TO: President
Sandia Corporation
ATTN: Divisions 7117 & 7183
Sandia Base
Albuquerque, New Mexico

1. In a letter early this year, AFSWC advised SAC of joint Sandia Corporation/AFSWC tests which were undertaken [redacted] The letter outlined results of drop tests utilizing the "Swiss Cheese" panels and results of tests in which the spoiler doors were deactivated. It was pointed out that either the "Swiss Cheese" panel installation or spoiler door deactivation would provide equally satisfactory results. (CONF)

2. We have recently received notification from SAC that the "Swiss Cheese" panel modification is not an acceptable method [redacted] However, SAC approves of spoiler door deactivation as the means to alleviate this problem. (CONF)

3. Accordingly, we are taking action to change the B-47 loading manual to reflect spoiler door deactivation procedures when the MK-53 is carried. We will keep you advised on this matter as significant progress or changes take place. (CONF)

FOR THE COMMANDER

REGNALD H. MASON
Colonel, USAF
Chf, Aerospace Systems Div
Development Directorate

DOWNGRADED AT 3 YEAR INTERVALS;
DECLASSIFIED AFTER 12 YEARS.
DOD DIR 5200.10

SWVCS-1-01.3 c. /

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Routine TWX

From: AFSWC Kirtland AFB New Mexico

May 25 1961

TO: AFSC Andrews Air Force Base, Md.

INFO: USAF Washington D C
SAC Offutt AFB NEBR
ASD Wright Patterson AFB Ohio
DMA Germantown, Md.
Sandia Corporation, Sandia Base, N. M.
ALO, Sandia Base New Mexico

SECRET RD FROM SWVWT- -5-296

For SCRAS at AFSC, AFDRT-GW/1 at USAF, DORQ at SAC, ADPSP-4 at ASD, General Betts, Attn: Colone Griffin at DMA, Div 7100, Lenander at Sandia Corporation, McCraw at ALO. Reference (A) SWVWT-15-5- Secret RD Msg, (b) Lenander to Betts 11 May, Confidential RD Telegraphic Message. This msg in three parts. Part I. Representatives of AEC, ALO, Sandia Corporation, and AFSWC met on 19 May to discuss time schedules related to testing, CDR, and FPU of the 53 Program. Part II. A normal weapon developme program utilizes the period between CDR and FPU to verify the system and make minor changes required to correct deficiencies revealed during system testing. In the TX-53 program many factors have contributed t an abnormally delayed drop test program which in turn is expected to delay the final design verification. Part III. The three month delay in FPU, which seems apparent to the representatives of AFSWC and the A design agency who attended the meeting, is a delay resulting from a slow drop test program which in turn re sulted from the extremely difficult design problems encountered. Any further delay in the FPU is now depe dent upon the test results in the remaining eleven units in the Sandia laydown drop test program.

DOE/OSD
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SCP-1

JOHN J. DISHUCK
Colonel, USAF
Director
Development Directorate

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HEADQUARTERS FIELD COMMAND
DEFENSE ATOMIC SUPPORT AGENCY
SANDIA BASE, ALBUQUERQUE, NEW MEXICO

FCDDI

13 Feb 1962

SUBJECT: Interim Development Report for the TX-53 Basic Assembly and TX-53 Bomb SC-4621 (WD) (U)

TO: President
Sandia Corporation
Sandia Base
Albuquerque, New Mexico

1. The subject report has been reviewed in coordination with representatives of the interested Services.

2. This review has established that the design meets:

a. All requirements of the approved Military Characteristics (MC) except for the following:

(1) Warhead (See MC 2. 1. 1). There is no warhead entity of the TX-53 bomb. The BA-53 includes the warhead portion of the bomb as well as all the fuzing and firing components except the impact firing (deformation) switch. This deviation is acceptable to the Department of Defense (DOD).

(2) Reliability (See MC 2. 3. 1). There are no reliability figures associated with a warhead since none exists. [redacted] This deviation is acceptable to the DOD.

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(3) Continuity Monitoring (See MC 2. 3. 3). Power external to the BA-53 is required for electrical continuity monitoring. (T-304C). This deviation is acceptable to the DOD.

(4) Length (See MC 3. 2. 1. 2). Effective length of the TX-53 is 148. 75 inches to the rear automatic deployment cover. Compatibility of this length with designated carriers is satisfactory. This deviation is acceptable to the DOD.

(5) Weight (See MC 3. 2. 1. 3). Weight is approximately 8850 pounds. This deviation is acceptable to the DOD.

(6) Aircraft compatibility (See MC 3. 2. 2). No B-70 capability exists. Atomic Energy Commission, Division of Military Applications (AEC-DMA) has directed that no further development effort will be expended since the carrier is nonexistent. This deviation is acceptable to the DOD.

DOE b(3)

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FCDD1
SUBJECT: Interim Development Report for the TX-53 Basic Assembly and
TX-53 Bomb SC-4621 (WD) (U)

DOE b(3)

[redacted]

b. All other presently known operational, logistic and safety requirements of the DOD except the following:

DSWA b(3) b(1) 1.5(a)

[redacted]

DSWA b(3) b(1) 1.5(a)

(3) It is requested that the complete TX-53 bomb, as a unit, be subjected to vibrational testing. Air Force Special Weapons Center has offered the use of their vibration test facility at Kirtland Air Force Base and will cooperate with Sandia Corporation in determining the correct vibrational input to be used in this test. It is not desired that this test will compromise meeting the presently planned FPU date, if it appears such a compromise will occur.

3. It is considered that the design will be acceptable to the DOD at such time as the fire safety of the weapon can be reasonably assured.

H. C. DONNELLY
Major General, USAF
Commander

Copies furnished:
CH, DASA
Mgr, AEC-ALO
Comdr, AFSWC
CO, NWEF

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APPENDIX B

MILITARY CHARACTERISTICS

Note: Comments to the Military Characteristics are made only where the design does not meet the requested Military Characteristics. Comments are given the paragraph number corresponding to the Military Characteristic.

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MILITARY CHARACTERISTICS FOR [redacted] ULL-FUZING OPTION WEAPON (AIR, GROUND IMPACT, AND LAYDOWN BURST) (C)

DOE (b)(3)

Approved by MLC:
25 November 1958
Amendment Number 1
Approved 4 August 1959
Amendment Number 2
Approved 30 September 1959
Amendment Number 3
Approved 19 April 1960

Military characteristics	Comments
1. GENERAL	
1.1 Purpose: These Military Characteristics delineate the requirement of the Department of Defense for a [redacted] ull-fusing option weapon. (Air burst, ground impact burst, and laydown delayed burst.)	DOE (b)(3)
1.2 Contingencies: Should it appear impracticable to meet any of these characteristics or should it appear that meeting any criterion specified herein will unduly delay development or production of this weapon or require unreasonable amounts of critical material, prompt notification shall be made to the DOD.	
1.3 Competing Characteristics: In the event that compliance with the following characteristics results in conflicts, the following priorities shall be observed:	
1.3.1 Safety from nuclear disaster to friendly installations.	
1.3.2 Acceptable reliability.	
1.3.3 Simplicity of operation.	
1.3.4 Ease of maintenance.	
2. WARHEAD CHARACTERISTICS	2. There will be no entity of the TX-53 stockpiled as a warhead. The basic assembly includes the warhead portion of the bomb as well as all the fuzing and firing components except the impact firing (deformation) switch.
2.1 General Considerations:	2.1 The basic assembly is compatible with the bomb described in paragraph 3.
2.1.1 The warhead shall be compatible with the bomb described in paragraph 3.	
2.1.2 Maximum economy of nuclear material shall be a design objective.	
2.1.3 The warhead shall be designed to minimize nuclear contamination resulting from detonation of the HE by any means other than the intended firing system.	
2.1.4 Packaging of warhead materials shall minimize toxic and other hazards to assembly, maintenance and operating personnel.	

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Military characteristics	Comments

2.2 Operational Considerations:

2.2.1 This warhead shall provide the maximum attainable yield consistent with other limitations.

*2.2.2 To insure a continuing retrofit and minor maintenance capability by the military at depot level, the design agency will give particular attention to reasonable component accessibility in order to permit the replacement of limited life items, to permit engineering improvements, and to permit the exchange of components for which functional integrity cannot be predicted.

2.2.3 This warhead shall be capable of carriage and delivery in the B-58 (Pod).

Comments: 2.2.3 The basic assembly is compatible with the B-58 (pod).

2.3 Reliability Considerations:

2.3.1 The probability of this warhead producing the desired full scale nuclear yield, after receipt of arming and firing signals in their proper sequence shall be The reliability of this warhead shall not be dependent upon continuity monitoring immediately prior to employment.

Comments: 2.3.1 Analysis indicates that the reliability of the TX-53 basic assembly will be

2.3.2

2.3.3 Any continuity monitoring system used shall be isolated insofar as practicable from functional circuits and shall not require external electrical power. Monitoring currents shall be limited to a value below that which will operate the most sensitive component. The connectors or controls and indicators for the continuity monitoring system shall be accessible at the exterior of the warhead.

Comments: 2.3.3 Power external to the weapon is required for continuity monitoring. The T-304C will provide the necessary power and will properly limit the monitoring current.

2.4 Safety Considerations:

**2.4.1 The probabilities for a premature nuclear detonation from random component failure for the environments specified herein are:

**2.4.1.1 During storage, transportation, handling, and maintenance of the completely assembled warhead not in the bomb -- less than 1 in 10^6.

**2.4.1.2 During storage, transportation, handling, and maintenance of the completely assembled warhead in the bomb -- 1 in 10^6.

2.4.2

2.4.3 Maximum safety during ground handling, maintenance, storage and logistic transportation shall be assured by the provision in the warhead for positive electrical isolation of the warhead arming and firing circuitry from possible arming and

*Amendment Number 3.
**Amendment Number 2.

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Military characteristics	Comments
firing potentials including the weapon power supply. This device shall have the following operational characteristics:	
2.4.3.1 Require a simple and discrete act involving obvious intent to activate;	
2.4.3.2 Provide obvious, positive, and external indication to responsible personnel of the UNSAFE condition;	
2.4.3.3 Require simple manual restoration to SAFE condition.	
2.4.3.4 In addition, two separate and continuous input signals shall be required to electrically arm the warhead.	
2.4.4 During separate warhead storage, all external connectors shall be provided with sealed protective caps and all access openings shall be provided with seal protected fasteners. The seals must be such that they must be broken to remove the caps or fasteners.	2.4.4 This is not applicable since nc warhead entity of the TX-53 exists.
2.4.5 If the electrical arming of the warhead is such that when armed, electrical energy is stored awaiting a firing signal to detonate the warhead, a device shall be incorporated to safely dissipate the electrical energy in the minimum time possible not to exceed ten minutes and not to interfere with normal arming-firing sequence.	
3. **BOMB CHARACTERISTICS**	
3.1 General Considerations:	
*3.1.1 The bomb shall be rugged, reliable, and simple in design; be easy and safe to monitor, store, transport, and handle; and be designed to minimize the possibility of human error. It shall provide for carriage of the warhead described in paragraph 2.	3.1.1 Provision is made for carriag the basic assembly. No warhead ent exists.
3.1.2 Standard components shall be utilized wherever practicable and uniform functional design consistent with other nuclear bombs shall be utilized unless sufficient advantage can be shown for deviation therefrom.	
3.2 Operational Considerations:	
3.2.1 None of the following values shall be exceeded:	
3.2.1.1 Outside diameter, 50 inches.	
3.2.1.2 Overall length, 148 inches.	3.2.1.2 The effective length of the b is approximately 144 inches; howeve the length to the peak of the tent-shap automatic deployment cover is appro mately 148.75 inches.
3.2.1.3 Weight, 8500 pounds.	3.2.1.3 The weight of the TX-53 bo is approximately 8850 pounds.
3.2.2 The bomb shall be capable of internal carriage and release from the following aircraft: B-47, B-52, B-70.	3.2.2 The requirement for carriage the B-70 has been deleted. No B-70 TX-53 capability exists.

*Amendment Number 3.

Military characteristics	Comments
3.2.3 This bomb shall be compatible with suspension, release, wiring, power, control, and monitoring systems of the designated carriers.	
3.2.4 This bomb shall be capable of being delivered as a laydown weapon in addition to air and ground impact burst.	

3.2.7 This bomb shall be designed to operate with the following fuzing and firing options:

3.2.7.1 Air burst, (free fall or retarded option to be ground selectable.)

3.2.7.2 Contact burst (ground or shallow water), (free fall or retarded to be ground selectable).

*3.2.7.3 Delayed burst, with a time delay sufficient to allow safe escape with no damage to the slowest designated carrier in normal flight maneuver.

3.2.8 Parachute failure.

3.2.8.1

DSWA b(1) 1.5(2)

3.2.8.2 In event of parachute failure after release in laydown option, the weapon shall not detonate with nuclear yield (i.e., fail safe).

3.2.9 This bomb shall be designed to permit simplified procedures and minimum final strike preparation time.

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*Amendment Number 1.

Military characteristics	Comments

3.2.10 This bomb shall be designed to allow maintenance as stated in paragraph 2.2.2 for the warhead.

3.2.11 The activation of the bomb fuzing and firing, retardation, and laydown system shall be independent of aircraft power at release. If required, aircraft power may be used to perform auxiliary functions; however, these requirements for aircraft power shall be clearly established with the DOD before such use is considered acceptable.

3.2.12 The bomb requirement for aircraft power shall be compatible with power available in the designated aircraft under normal in-flight operating conditions as specified by the DOD.

3.3 Environmental Considerations:

3.3.1 This bomb shall withstand, without functional impairment, or reduction of operational reliability:

3.3.1.1 The environment criteria and forces of acceleration specified in the Stockpile-to-Target Sequence, applicable portions of MIL-E-5272B; MIL-A-8591B(ASG) and Joint Environmental Task Group Report SC-2943(TR).

3.3.1.2 Storage in the bomb bay of the specified carriers for at least 30 days in its strike configuration ready for immediate employment.

3.3.2 The completely assembled bomb and its handling equipment shall be capable of being transported by road, rail, ship, and aircraft without loss of functional reliability.

3.3.3 Vulnerability to blast, fragments, and to thermal, electromagnetic, and nuclear radiation shall be minimized, consistent with the protection provided by and the vulnerability of its carrier to those countermeasures.

3.3.4 This bomb shall be packaged so that it can be air-lifted by the following USAF aircraft: C-119, C-123, C-124, C-130, C-133.

3.3.5 This bomb shall require no special environmental conditions for storage.

3.4 Reliability Considerations:

DOE b(3)

3.4.2 The reliability of this bomb shall not be dependent upon continuity monitoring immediately prior to take-off.

Military characteristics	Comments

3.4.4 If a ground continuity monitoring system is used, the continuity loop(s) of the warhead shall also be used for monitoring the desired bomb fuze components. The current shall be provided by the monitoring system used for the warhead. Monitoring currents shall be limited to a value below that which will operate the most sensitive component. The bomb shall be constructed so that the warhead monitoring system controls and indicators are accessible from outside the bomb.

3.5 Safety Considerations:

*3.5.1 The probability of premature detonation from random component failure alone for the environments specified herein shall be:

*3.5.1.1 During storage, transportation, handling, and maintenance of the bomb in an unready condition -- less than 1 in 10^6.

*3.5.1.2 During storage, transportation, handling, maintenance, assembly, and monitoring of the bomb in a completely assembled for strike configuration -- 1 in 10^6.

3.5.1.3 After initiation of the drop sequence and during the period wherein a nuclear detonation might endanger the launching aircraft or crew, 1 in 2,000, exclusive of parachute failure.

3.5.2 Release of the bomb in an unarmed condition must result in a nuclear dud weapon.

3.5.3 Manual safing, but not manual arming, and continuous visual indication of the safe or unsafe condition shall be provided during ground handling.

*3.5.4 The bomb shall also contain a SAFING device which is remotely controllable and reversible when the bomb is loaded in the strike aircraft. Provision shall be made so that positive indication of the UNSAFE condition can be determined from a remote location in the crew's space. The objective shall be the provision of positive safing of the weapon making it suitable for an aerial or surface maneuver above or across friendly territory in peace and war, and to prevent nuclear yield in the event of an accident or an inadvertent release.

3.5.5 All safety devices shall be designed so that after a normal armed release impact, they do not provide a means for the enemy's dudding the weapon.

4. MAINTAINING AND HANDLING EQUIPMENT

4.1 Equipment for maintaining and handling the bomb shall be such that these operations can be performed simply and rapidly with the minimum opportunity for human error.

4.2 Current and proposed handling equipment for present bombs and bombs being developed shall be utilized when practical. The most suitable features of such equipment shall be employed whenever practical in the development of any new equipment.

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*Amendment Number 2.

Military characteristics	Comments
4.3 The handling equipment required shall be light in weight, few in numbers, adequately identified, transportable by common carriers, compact, and as easy to handle as is consistent with its functions.	
4.4 Handling equipment and packaging shall be capable of withstanding environmental conditions required of the bomb in the areas where these are used together.	
5. This document is classified SECRET-RESTRICTED DATA in its entirety because it reveals design characteristics of a nuclear weapon.	

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APPENDIX C

STOCKPILE-TO-TARGET SEQUENCE

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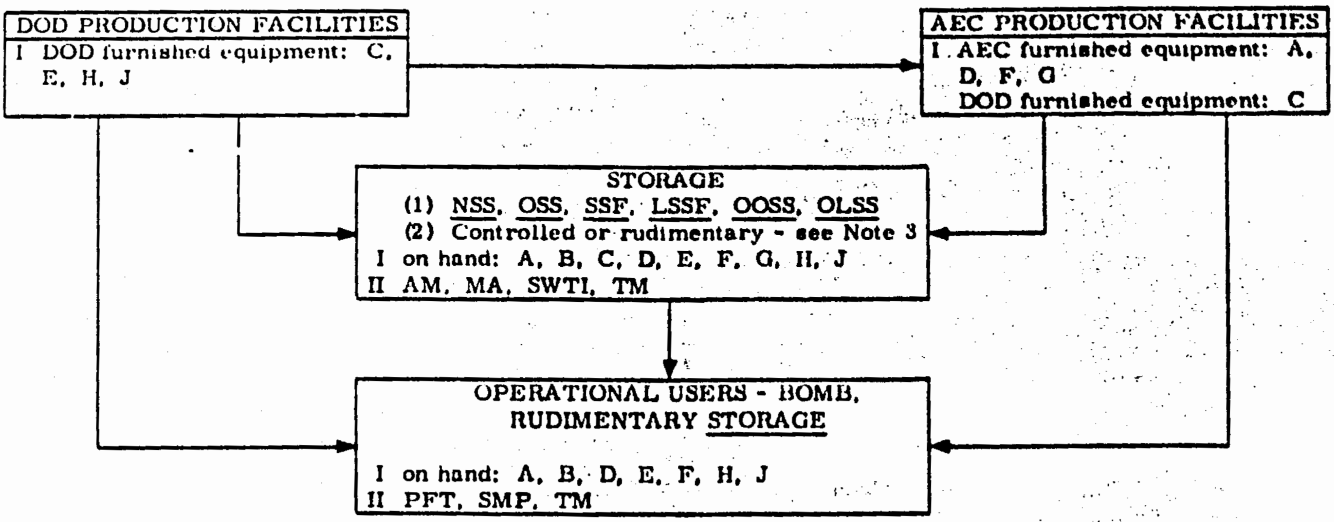
SECTION I

TX-53 Stockpile-to-Target Sequence



KEY
I Atomic weapons material (see List I)
II Procedures (see List II)

List I - Atomic Weapons Material

A. TX-53 bomb
B. TX-53 bomb - (clip-in suspension system installed)
C. Parachute
D. AEC produced test and handling equipment
E. DOD produced test and handling equipment
F. AEC produced OST (Type 2) bombs
G. AEC produced Type 3A Trainers
H. DOD clip-in suspension system
J. DOD produced practice weapons

List II - Procedures

AM Authorized modifications
MA Maintenance. (See Note 4).
PFT Preflight test (visual inspection and go/no-go continuity test)
SMP Strike mission procedures (loading, post-loading and strike) - as defined by applicable technical publications and operations orders.
SWTI Special weapons transfer inspection (includes reacceptance inspections) - (visual inspection and go/no-go continuity test) - See Note 4.
TM Tritium monitoring (as required by applicable publications) - See Note 2.

NOTES:

1. All underlined items are defined in AEC-DASA Glossary TP 4-1 (AF T.O. 11N-4-1).

2. Tritium Monitoring procedures and equipment at other than AEC locations will be determined by Operational Commander in accordance with AEC-DASA TP 20-7. The equipment is not listed in the STS since it is not essential to weapon capability.

3. "Controlled" and "Rudimentary" refer to environmental capability of storage location. Controlled environment is one in which temperature is maintained between 70° and 90°F and relative humidity below 50%. Rudimentary environment is represented by Ordnance Igloo, tarpaulin, and aircraft bomb bay for periods up to 30 days.

4. An electrical continuity test ("Go-no-go") will be used. A bad continuity check is cause for weapon rejection. The weapon will not be recertified for operational use until the necessary maintenance and testing has been performed as required by applicable technical publications.

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SECTION II

Environment for TX-53 Bomb

1. TRANSPORTATION

1.1 Truck and/or trailer

1.1.1 Type (6x6, Flat bed trailer, van, etc.)

1. MHU-7/M trailer

2. Flat bed trailer

3. Straddle carrier

1.1.2 Type road, maximum speed and average mileage per trip

1. Type II mobility

1.1.3 Tiedown information (restrained or unrestrained)

1. Both restrained and unrestrained tiedown

1.1.4 Remarks and/or additional information (extremes of natural environment, if applicable)

1. Temperature extremes of -60° to +120°F

1.2 Rail

1.2.1 Type car (ATMX, flat car, etc.)

1. No plan for rail shipment

1.3 Sea

1.3.1 Type ship (submarine, aircraft carrier, ammunition ship, etc.)

1. No plan for sea shipment

1.4 Air Cargo

1.4.1 Type aircraft (C-124, C-130, etc.)

1. C-124 and C-133

1.4.2 Method of loading (ramp, lift, etc.)

1. Ramp

2. Internal hoist

1.4.3 Tiedown method

1. Chains and cables to aircraft tiedown brackets

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2. HANDLING

2.1 Ground Transport

2.1.1 Type tow vehicle

1. 6x6 vehicle

2. Commercial vehicle

2.1.2 Single or multiple tow (if multiple, state maximum number)

1. Single

2.1.3 Maximum speed over surface conditions

1. Type II mobility

2.2 Other handling (lifts, hoists, etc.)

2.2.1 Type (overhead monorail, etc.)

1. Overhead hoists

2. Crane

3. MHU-7/M lift

2.2.2 Purpose (brief description)

1. Bomber aircraft loading by MHU-7/M

3. STORAGE

3.1 Type (site, aircraft, uncontrolled, ship stowage)

1. Aircraft - 30 days

2. Site - indefinite

3.2 Location (arctic, tropic, etc.)

1. All climatic conditions

3.3 Remarks and/or additional information (extreme natural and induced environments, etc.)

1. Strategic targets to include contact or laydown [redacted]

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SECTION III

MISSION PROFILE

B-47 Aircraft

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MISSION PROFILE
B-52 Aircraft

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TYPICAL B-52
AIRBORNE ALERT MISSION

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B-70 AIRCRAFT

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ENVIRONMENTAL DATA REFERENCES

Transmitted to Sandia Corporation as part of normal B-70 Joint Working Group functions.

Report number	Title	Classification
NA-58-231	Performance Specification Environmental Control Subsystem Group B-70 Air Vehicle Weapon System B-70	S
NA-58-225	Preliminary Weapon System Specification for B-70 Weapon System	S
NA-58-1709	Preliminary Study on Environmental Control Methods for Weapons B-70 Weapon System	S
NA-57-1066	Performance Specification Alternating Current Power Characteristics and Utilization Requirements for B-70 Air Vehicle, B-70 Weapon System	U
TFD-58-788 NA (Special Report)	Summary of B-70 Store Characteristics	S
Joint Working Group Minutes	1st Meeting 17 Nov 58 2nd Meeting 6 Jan 59 3rd Meeting 14 Apr 59	S S S
NA-58-1093	Compatibility Study TX-41-B-02 in B-70 Air Vehicle	S
AFSWC	Proposal for Joint B-70/Nuclear Bomb Capability Development and Test Program 7 May 58	S
NA-56-1201	Summary of Aerodynamic Force Coefficients for a Series of Isolated Bluff Store Shapes as Derived from Wind Tunnel Tests	S
NA-57-1223	Special Weapons Report Weapon System 110A	
NA-59-278	Data Submittal Schedule, B-70 Weapon System	U
NA-58-LA-0120	Supersonic Wind Tunnel Test of the 0.035 Scale Bluff Store Shapes for the Weapon System 110A/L Airplane	S
NA-59-172	Acoustical Environment of the B-70 Airplane	S

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APPENDIX D

SCHEMATICS

(The schematics to be used in this report are reductions of Drawings 165207 and 165206)

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3. Structural Design Criteria, TX-53/Basic TX-53, Report No. B-53-1282-01, dtd January 28, 1960.

4. Sandia Corporation, Proposed Ordnance Characteristics of the TX-53 Basic Weapon and the TX-53 Bomb, SC-4267(TR), SRD, August 1959.

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