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From: Chief, Naval Technical Mission to Japan.
To : Chief of Naval Operations.

Subject: Target Report - Japanese Ordnance Research, Article 1 - Gunfiring of Bombs at the Kamegakubi Naval Proving Ground.

Reference: (a)"Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Subject report, dealing with Target O-39 of Fascicle O-1 of reference (a), is submitted herewith.

2. The investigation of the target and the target report were accomplished by Lt. Comdr. J.R. Lyman, USNR, assisted by Lt.(jg) R.R. Boggess, USNR, as interpreter.

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JAPANESE ORDNANCE RESEARCH - ARTICLE 1

GUNFIRE TESTING OF BOMBS AT THE KAMEGAKUBI NAVAL PROVING GROUND

"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945

FASCICLE O-1, TARGET O-39

FEBRUARY 1946

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

ORDNANCE TARGETS

JAPANESE ORDNANCE RESEARCH, ARTICLE 1
GUNFIRE TESTING OF BOMBS AT THE
KAMEGAKUBI PROVING GROUND

The Japanese Navy developed a technique for impact testing of aircraft bombs and components, using ordinary bomb bodies provided with an adapter, stabilizers and gas seal to fit a special smoothbore gun.

TABLE OF CONTENTS

REFERENCES

A. Location of Target:

Japanese Naval Proving Ground, KAMEGAKUBI, Kurehashishima, Hiroshima Prefecture.

B. Japanese Personnel Interviewed:

Harao KATAOKA, Assistant Engineer, Ordnance Department, Kure Naval Arsenal (supervised construction of guns).

Mitsuo KANERO, Engineer, Ordnance Experimental Section, Kure Naval Arsenal (conducted tests).

C. Japanese Documents Forwarded Through ATIS to the Washington Document Center:

NavTechJap No.	ATIS No.	Title
ND50-3472	4302	MS notebook on experimental firing of bombs from guns.
ND50-3473	4303	Penetration curves of bombs vs. armor.

LIST OF ILLUSTRATIONS

INTRODUCTION

Toward the end of the war, the Japanese Navy wished to obtain accurate information concerning armor penetrating ability, fuze functioning, and impact sensitivity of its large aircraft bombs. An elaborate bomb-testing range with various types of targets was available at KASHIMA, but owing to the inherent errors of bombing, the results obtained there were unsatisfactory. A technique for duplicating the conditions of aerial bombing but utilizing the precision of gunfire was therefore developed at the Kamegakubi Proving Ground, near KURE.

The site was visited in December 1945, and key personnel concerned were interviewed.

This report deals chiefly with the method of testing, rather than with details of the results obtained.

THE REPORT

1. Guns Used and Ballistics

Three smoothbore guns were manufactured especially for this test, by machining the rifling and part of the liner out of ordinary rifled naval guns. A 33cm (13") gun was made from a 12" Vickers barrel; a 42.5cm (16".7) was an enlarged 36cm (14") gun; and a 55cm (21".7) was originally a 40cm/45 cal. (16".1) gun taken from the battleship NAGATO. The original breech mechanism for each was used unmodified.

The guns all fitted the proving ground large mount. They were breech-heavy as the result of the removal of metal from the barrel, and this condition was corrected through the use of a movable weight which was clamped on the barrel, as shown in Figure 1, at the appropriate spot for proper balance.

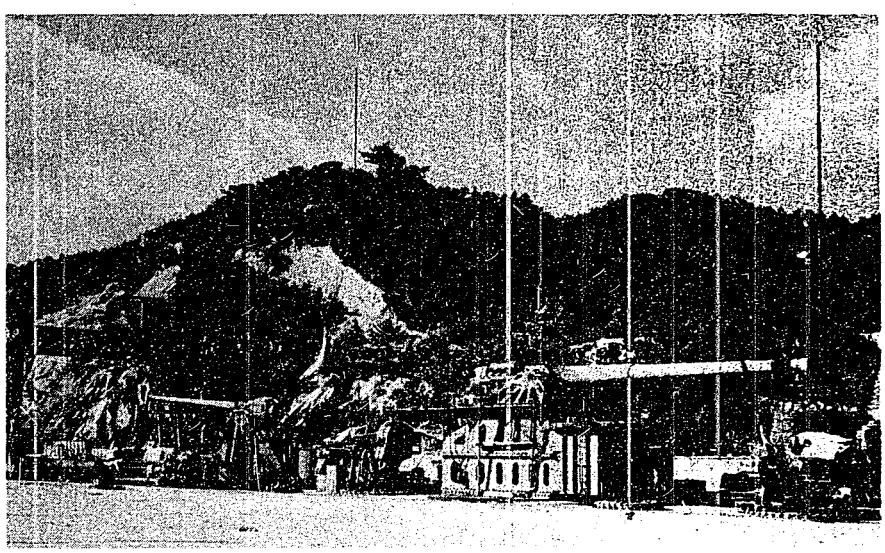

Figure 1
Proving Ground Large Mount With 55cm (21".7) Barrel
(Note counterweight near muzzle.)

As modified, the guns were fired with maximum bore pressures of the order of 5 to 7kg/sq. mm (3.2 to 4.5 tons p.s.i.). All tests were carried out at a striking velocity of 340m/sec (1035 f.s.) and obliquity of 20°, which were stated to correspond to a dropping altitude of 4000 meters (12,200 ft.). The powder used in the 55cm gun to fit these conditions was 14"/45 cal. or 8"/50 cal., depending on the weight of the bomb fired; the 42.5cm gun used 8"/50 cal. or 5"/40 cal. powder, while the 33cm gun used 5"/40 cal. or 4".7/45 cal. (12cm), depending on conditions.

2. Bombs

Figures 2 to 8 show the bombs as modified for this test. All but the largest bomb, which was evidently designed to fit the 55cm gun, were provided with a perforated cylindrical adapter of sheet steel welded on fore and aft. The

gauge of steel used was 1/4" for the 55cm and 42.5cm bombs and 3/16" for the 33cm bombs. The adapters were accurately dimensioned to the normal tolerance between projectile bourrelet and gun diameter.

A copper band, similar to the rotating band of a projectile for a rifled gun, but narrower, was fitted near the after edge of the adapter. This served as a gas seal and also determined the position at which the bomb was seated in the gun. It was stated that the location of the copper band on the adapter was not critical, but that it was usually placed as far aft as possible in order to permit the bomb to be seated farther into the gun and leave space behind the tail for the powder charge.

These adapters wiped off on impact with the plate, and it was felt that the forward weld was far enough from the nose of the bomb to exert no influence on the penetration characteristics of the bomb.

The 55cm diameter bomb shown in Figure 7 fitted the gun without an adapter. As modified for gunfire, the bomb body was provided with a narrow copper gas-check band similar to that on the adapters of the smaller bombs.

The tails used with the bombs for gunfire tests were of sheet steel of the same gauge as the adapters and were two calibers in length. They resembled the ordinary tails of Japanese aircraft bombs in that they consisted of fins fixed to a cone which in turn was joined to the base of the bomb by a circle of bolts. Unlike ordinary bomb tails, however, the fins did not project beyond the largest diameter of the bomb, their overall width being necessarily the same as the bourrelet diameter, and it was found that eight fins were required in order to stabilize the flight properly.

Early tests with bombs having only four tail fins showed that yaw averaged 10° at a yaw card 120m (400 ft.) from the muzzle, although after a greater distance of air travel the bombs tended to become stabilized. Using eight fins, the yaw at 120m was reduced to a negligible amount.

Like the adapters, the tail fins and tail cones were perforated, as shown in the photographs, to eliminate damage from the powder gases.

3. Results

The following table gives the reported performance of various bombs, inert-loaded to service weight, against armor plate at 20° obliquity and 340 m/s striking velocity (1035 f.s.):

GUN	BOMB	THICKNESS OF ARMOR PENETRATED
33cm Gun (13")	250 kg HE (550-lb)	65mm (2".55)
	500 kg AP (1100-lb)	150mm (5".9)
42.5cm Gun (16".7)	500 kg HE (1100-lb)	70mm (2".75)
	500 kg SAP (1100-lb)	80mm (3".1)
	800 kg AP (1760-lb)	175mm (6".9)
55cm Gun (21".7)	800 kg HE (1760-lb)	not available
	1500 kg AP (3300-lb)	200mm (7".9)

Tests also were made of live-loaded bombs against armor plate. It was found that trinitroanisole in the 800kg AP bomb detonated upon impact with plate under the test conditions described. A satisfactory desensitizer is stated to have been developed using a cavity liner of compressed sawdust and an alumium nose cap.

Inert-loaded bombs fitted with live fuzes also were fired against plate to test

fuze functioning on impact. The distance of 400 ft. from muzzle to plate permitted the fuzes to arm in the normal manner. Several of the expended bombs seen at KAMEGAKUBI had been cut in half with an oxygen torch and the filler removed from the nose section to allow examination of the fuze.

4. Disposition

The three guns described in this report have all been demolished as part of the demilitarization program, and the modified bombs found at KAMEGAKUBI have likewise been demolished or dumped at sea.

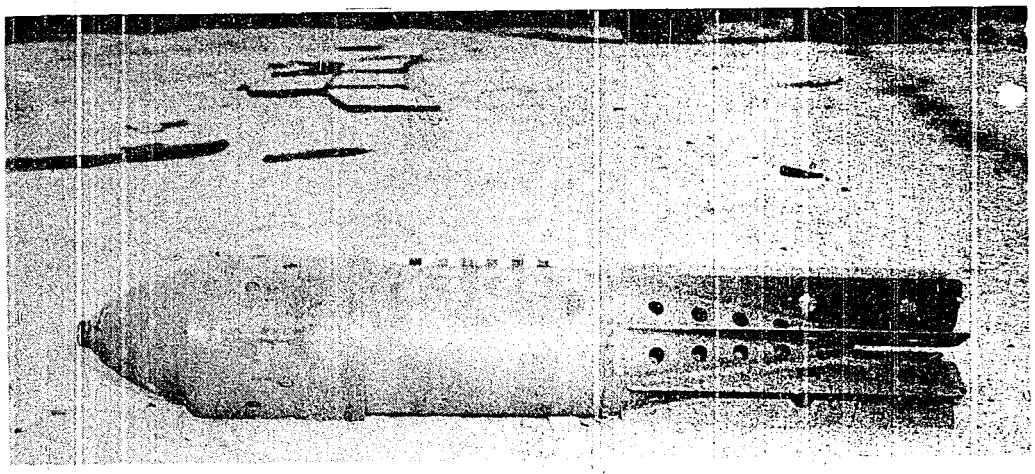

Figure 2
Tapered 30cm to 25cm (12" to 10") Diameter
Bomb Modified to Fit 33cm (13") Gun

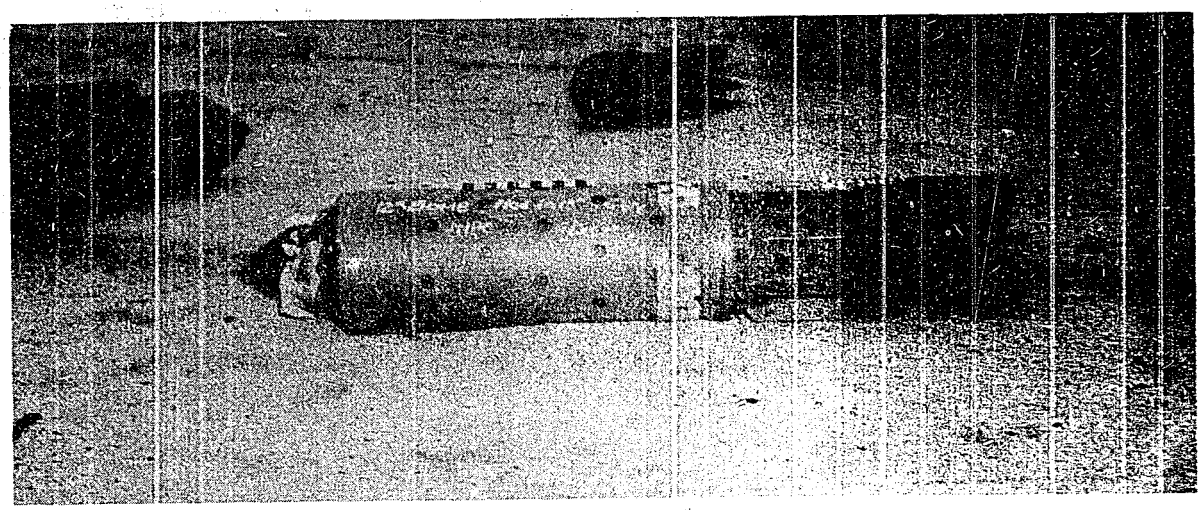

Figure 3
30cm (12") Diameter Bomb Modified to Fit
33cm (13") Gun

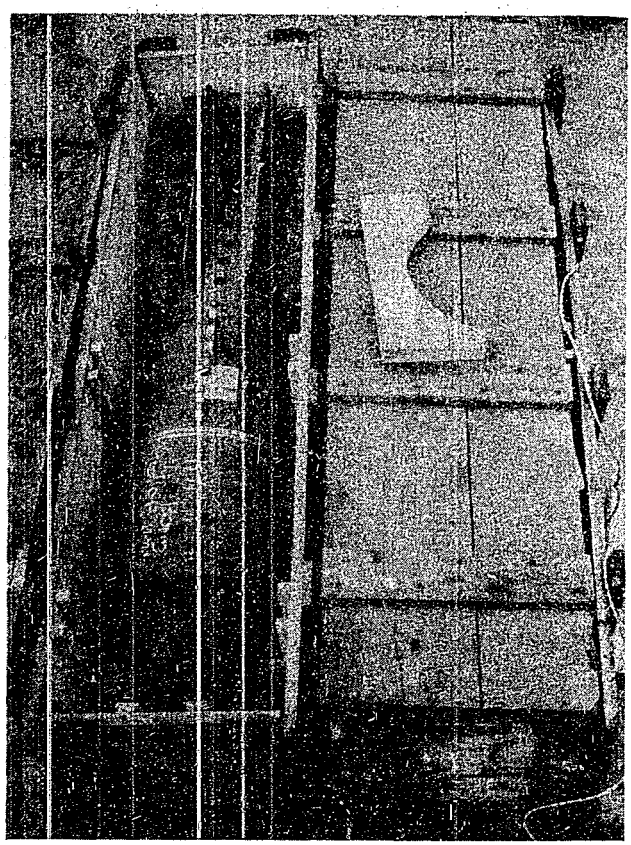

Figure 4
Tapered 40cm to 28cm (15-3/4" to 11") Diameter Bomb Modified to Fit 42.5cm (16.7") Gun

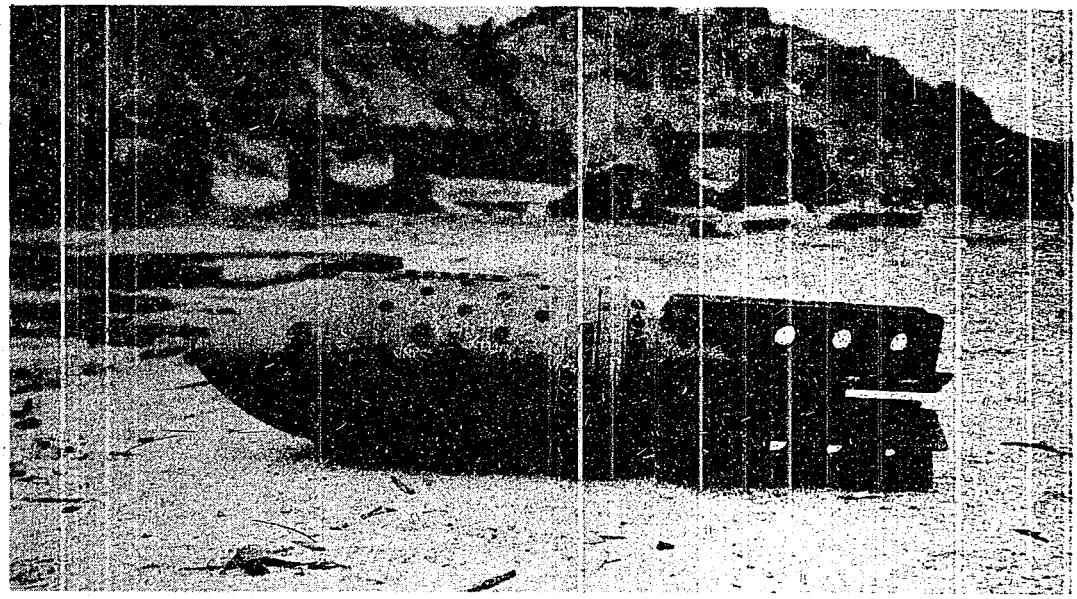

Figure 5
50cm (20") Diameter Bomb Modified to Fit 55cm (21.7") Gun

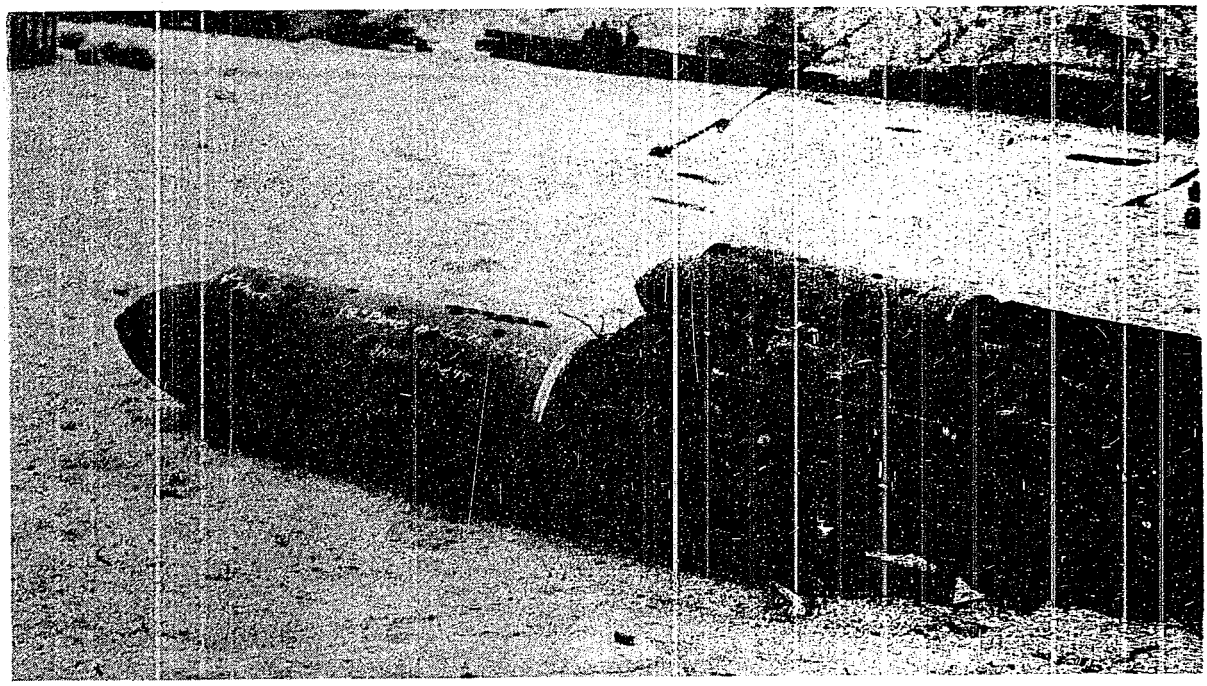

Figure 6
46cm (18") Diameter Bomb Modified to Fit
55cm (21."7) Gun

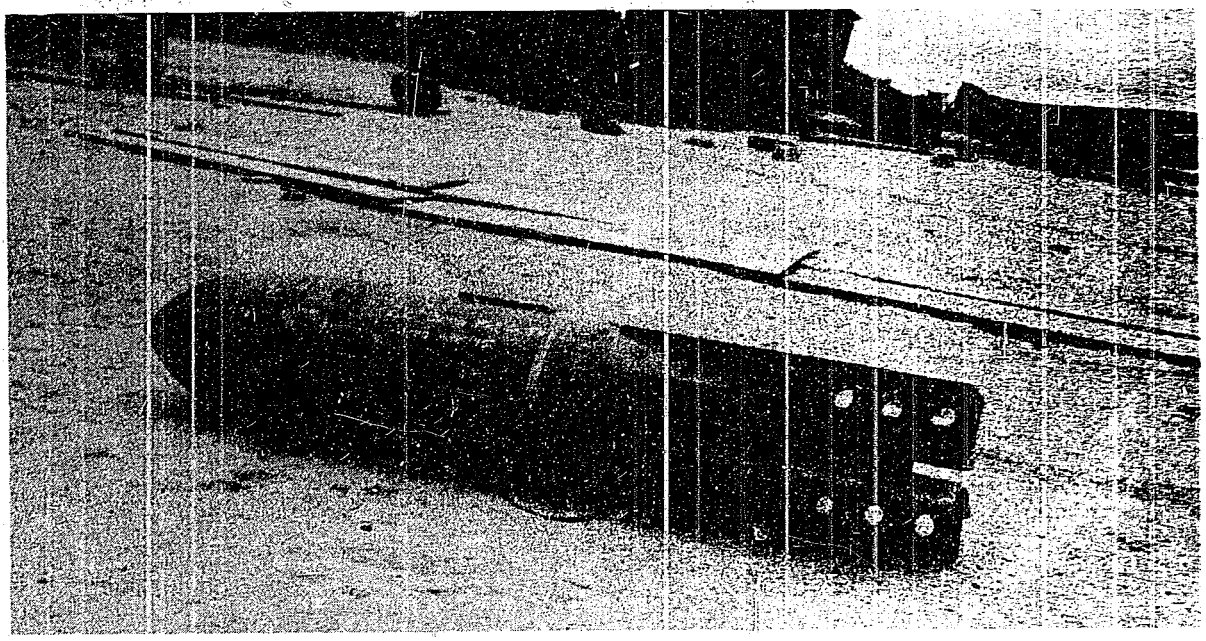

Figure 7
55cm (21."7) Diameter Bomb Modified for Firing
from 55cm Smoothbore Gun

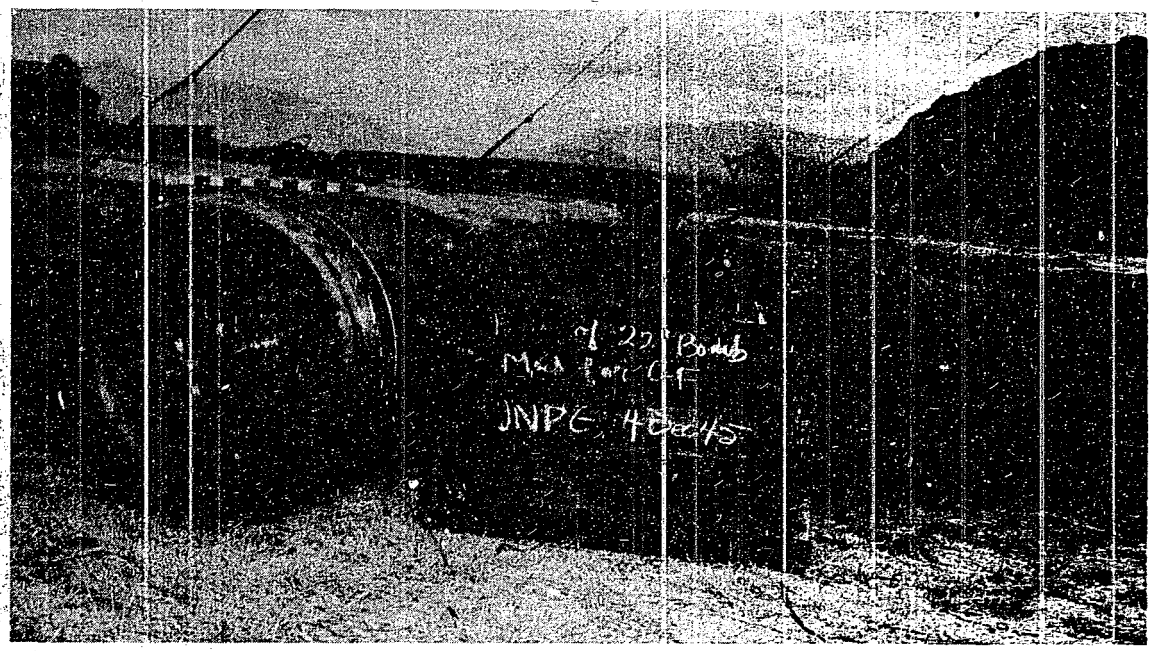

Figure 8
Base of 55cm (21.7") Diameter Bomb, Showing Holes for Four Fuzes

Figure 9
Tapered 48cm to 35cm (19" to 13") Bomb Modified to Fit 55cm (21.7") Gun