<table>
<thead>
<tr>
<th>UNCLASSIFIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD NUMBER</td>
</tr>
<tr>
<td>AD035574</td>
</tr>
<tr>
<td>CLASSIFICATION CHANGES</td>
</tr>
<tr>
<td>TO: unclassified</td>
</tr>
<tr>
<td>FROM: confidential</td>
</tr>
<tr>
<td>LIMITATION CHANGES</td>
</tr>
<tr>
<td>TO: Approved for public release; distribution is unlimited.</td>
</tr>
<tr>
<td>FROM: Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; DEC 1952. Other requests shall be referred to Naval Proving Ground, Dahlgren, VA.</td>
</tr>
<tr>
<td>AUTHORITY</td>
</tr>
<tr>
<td>31 Dec 1964, DoDD 5200.10; USNSWC ltr dtd 29 Jan 1976</td>
</tr>
</tbody>
</table>

THIS PAGE IS UNCLASSIFIED
THIS REPORT HAS BEEN DELIMITED AND CLEARED FOR PUBLIC RELEASE UNDER DOD DIRECTIVE 5200.20 AND NO RESTRICTIONS ARE IMPOSED UPON ITS USE AND DISCLOSURE.

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.
Experimental Ballistic Test of Modified Mk 149 Nose Fuse

SYNOPSIS

1. Inasmuch as the Mk 149 rocket nose fuze in present service use has consistently failed the 25 ft. acceptance drop test, Swank, Inc., manufacturer of the fuze under contract from the Navy, proposed a modification which they felt would correct this failure and make the fuse safer to handle. Samples of the fuze were submitted to the Naval Proving Ground for ballistic evaluation.

2. a. This test was conducted to determine the operability of the modified fuse under the following conditions:

<table>
<thead>
<tr>
<th>Part</th>
<th>Desired Velocity</th>
<th>Target</th>
<th>Obliquity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1800 ft./sec.</td>
<td>1/8&quot; mild steel</td>
<td>0°</td>
</tr>
<tr>
<td>2</td>
<td>1800 ft./sec.</td>
<td>1/8&quot; mild steel</td>
<td>Maximum for consistent operation</td>
</tr>
<tr>
<td>3</td>
<td>1800 ft./sec.</td>
<td>240 or greater homogeneous armor plate</td>
<td>Maximum for consistent operation</td>
</tr>
</tbody>
</table>

3. It is concluded that:

   a. The modified Mk 149 nose fuze will function consistently in a 5"0 rocket head Mk 6 upon 1/8" MS at 0° obliquity.

   b. The fuse will function consistently in a 5"0 rocket head Mk 6 upon 1/8" MS at obliquities up to and including 75°.

   c. The fuse as modified will function upon 3450 Class B armor in Mk 25 shaped charge heads up to obliquities of 70°. However, 70° seems to be the critical angle and functioning at this angle cannot be considered as consistent.

   d. The modified fuse compares favorably ballistically in all respects with the present Mk 149 fuse. In addition, the Naval Ordnance Laboratory reports it will successfully pass the 25 ft. drop test.
## Experimental Ballistic Test of Modified Mk 149 Nose Fuze

### Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synopsis</td>
<td>1</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>2</td>
</tr>
<tr>
<td>Authority</td>
<td>3</td>
</tr>
<tr>
<td>References</td>
<td>3</td>
</tr>
<tr>
<td>Background</td>
<td>3</td>
</tr>
<tr>
<td>Object of Test</td>
<td>3</td>
</tr>
<tr>
<td>Period of Test</td>
<td>4</td>
</tr>
<tr>
<td>Representatives Present</td>
<td>4</td>
</tr>
<tr>
<td>Description of Item Under Test</td>
<td>4</td>
</tr>
<tr>
<td>Description of Test Equipment</td>
<td>5</td>
</tr>
<tr>
<td>Procedure</td>
<td>5</td>
</tr>
<tr>
<td>Results</td>
<td>6</td>
</tr>
<tr>
<td>Conclusions</td>
<td>8</td>
</tr>
<tr>
<td>Appendix A - Impact Records</td>
<td>1-10 (Incl)</td>
</tr>
<tr>
<td>Appendix B - Summary of Results</td>
<td>TABLE I 1-2 (Incl)</td>
</tr>
<tr>
<td>Appendix C - NPG Photographs</td>
<td>FIGURES 1-9 (Incl)</td>
</tr>
<tr>
<td>Appendix D - Distribution</td>
<td>1-2 (Incl)</td>
</tr>
</tbody>
</table>
Experimental Ballistic Test of Modified Mk 149 Nose Fuze

PART B

INTRODUCTION

1. AUTHORITY:

This test was authorized by reference (a) and conducted under Task Assignment NPG-Re2b-11-1-52.

2. REFERENCES:

a. NOL Spdltr DP:HSW:dlg NP/NOL/XL-1(2628) Ser 3438 of 6 June 1952
b. NPG Work Request from NOL 8003-A of 12 June 1952
c. NPG Work Request from NOL 8003-B of 16 July 1952
d. NOL Spdltr TF:CLP:ebt NP/NOL/XL-1(2852) Ser 4194 of 15 July 1952

3. BACKGROUND:

Inasmuch as the Mk 149 rocket nose fuze in present service use has consistently failed the 25 ft. acceptance drop test, Swank, Inc., manufacturer of the fuze under contract from the Navy, proposed a modification which they felt would correct this failure and make the fuze safer to handle. Samples of the fuze were submitted to the Naval Proving Ground for ballistic evaluation.

4. OBJECT OF TEST:

a. This test was conducted to determine the operability of the modified fuze under the following conditions:

<table>
<thead>
<tr>
<th>Part</th>
<th>Desired Velocity</th>
<th>Target</th>
<th>Obliquity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1800 ft./sec.</td>
<td>1/8&quot; mild steel</td>
<td>0°</td>
</tr>
<tr>
<td>2</td>
<td>1800 ft./sec.</td>
<td>1/8&quot; mild steel</td>
<td>Maximum for consistent operation</td>
</tr>
<tr>
<td>3</td>
<td>1800 ft./sec.</td>
<td>2&quot;0 or greater homogeneous armor plate</td>
<td>Maximum for consistent operation</td>
</tr>
</tbody>
</table>

NOTICE: THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.
Experimental Ballistic Test of Modified Mk 149 Nose Fuze

5. PERIOD OF TEST:
   a. Date Project Letter 6 June 1952
   b. Dates Necessary Material Received 18 June 1952
      22 July 1952
   c. Date Commenced Test 22 July 1952
   d. Test Completed 21 August 1952

6. REPRESENTATIVES PRESENT:
   Mr. C. L. Pettingill Naval Ordnance Laboratory
   Mr. L. J. Shkolnik Naval Ordnance Laboratory

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:
   a. The Mk 149 nose fuze was developed for use with various
      fin-stabilized aircraft rockets. It is a point detonating, air-
      arming fuze.

   b. Arming is accomplished by a combination of air stream and
      acceleration forces acting as the rocket is launched. Figure 1
      shows the general arrangement of the fuze. Acceleration retracts
      the setback block, releasing the firing pin propeller assembly.
      The propeller, acted on by the air stream, screws the firing pin
      out until the shutter is released. The shutter is then rotated
      into the armed position by the shutter spring. It is locked by a
      detent in such a position that the detonator in the shutter is in
      line with the firing pin and the lead-in to the booster.

   c. The modification to the fuze consists of a redesign in the
      firing pin. As manufactured by Swank, Inc. of Attleboro, Mass.,
      it is now a two piece pin with the forward section hollowed out.
      The diameter of the pin has been slightly increased and the firing
      pin guide has been changed correspondingly (see Figure 2). The
      shoulder on the firing pin has been altered so that slippage past
      the shutter has been prevented. This modification is intended to
      weaken the firing pin to a point where it will collapse on a drop
      of 25 ft. or more instead of driving through into the booster.
Experimental Ballistic Test of Modified Mk 149 Nose Fuse

8. DESCRIPTION OF TEST EQUIPMENT:

Launcher: NPG 1050 ft.

Propulsion: 540 HVAR Mk 10 Mod 5 rocket motors

Camera: 35mm Mitchell

Velocity: Potter Chronograph and Oscillograph

9. PROCEDURE:

a. Part I of this test consisted of firing rounds against 1/8" mild steel plate at 0° obliquity. The fuzes were assembled in 540 rocket heads Mk 6 Mod 1 TNT loaded. Propulsion in all phases of the test was accomplished by two 540 HVAR motors in tandem, to obtain a desired velocity of 1800 ft./sec.

b. Part II of this test was conducted against 1/8" mild steel plate at obliquities ranging from 45° to 75° to determine the maximum for consistent operability. Owing to a premature detonation on the 2nd round, smoke-puff loaded heads (250-300 grams, black powder) replaced the TNT loaded heads as requested by reference (d). Reference (c), which requested the use of smoke-puff loaded heads instead of HE loaded heads, superseded reference (b) at this time. A 35mm Mitchell camera was used to record the fuze action upon impact. At the time of the premature detonation, it was believed that the cause might have been a shearing of the pin joining the two sections of the firing pin. An air jet test, as requested in reference (c), was therefore performed on four fuzes to determine the ability of this assembly pin to withstand the shearing forces which occur at the end of the firing pins forward travel. This test consisted of securing the inert rounds, containing modified, inert Mk 149 fuzes, to a table immediately in front of the Naval Proving Ground air jet. When the air jet had reached its maximum velocity (500 M.P.H.), the arming wire was removed by the use of a lanyard. When the propeller ceased to spin, indicating the end of the firing pin screw-out, the air jet was turned off.

c. Part III of the test consisted of firing modified fuzes in 540 shaped charge heads Mk 25 against 3450 Class B armor to determine the maximum obliquity for consistent operation against thick armor targets. The heads were TNT loaded.
Experimental Ballistic Test of Modified Mk 149 Nose Fuze

10. RESULTS:

a. The results are summarized below:

<table>
<thead>
<tr>
<th>Part I</th>
<th>No.</th>
<th>Striking Rds.</th>
<th>Velocity</th>
<th>Target</th>
<th>Obl.</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1800</td>
<td>1/8&quot; MS</td>
<td>0°</td>
<td>4 HO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part II</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
b. On round 2 of Part II, there was a premature detonation which damaged the launcher (Figure 3). It was believed at the time that this may have been caused by a shearing of the pin joining the two sections of the firing pin thus allowing the lower part of the pin to slide into the detonator. However, after the premature detonation of the smoke-puff loaded head on round 18, the remnants of a bird were found at the scene indicating that perhaps the trouble occurred as a result of the round striking such an obstacle on the rails. On round 20 a dead catbird (Dumetella carolinensis) weighing 1.1 oz. was secured at the launcher muzzle so that the firing pin of the nose fuze would strike it (Figure 4). The fuze detonated upon impact with the bird confirming suspicions and relieving the fuze of responsibility for the premature detonations. The test was temporarily delayed until an alarm system could be installed on the launcher to drive off the birds to prevent further fuze action on the launcher.

c. Rounds 3 through 11 of Part II did not have the acceleration setback pin in the fuzes removed. It was found that in using two motors for propulsion the head motor was still accelerating at the target, thus preventing the fuze from arming. This condition was corrected by using a single motor on rounds 6 through 11 so that acceleration was completed prior to target impact.

d. No impacts above 75° obliquity were attempted because of the poor striking accuracy at these high angles.

e. Figure 5 is a typical view of fuze detonation after impact with 3/8" MS plate at 75° obliquity.

f. The rounds that were duds on Part III deflagrated on the side wall of the butt.

g. On round 2 of Part III, a bulge 9" x 12" was produced on the back side of the plate approximately 1340 behind the opening. Back spalling of the target plate occurred on rounds 3 and 6 (see Figures 6 through 9). This behavior is ascribed to the reflection and reinforcement of shock waves in the plate arising from the detonation of the rocket head in its proximity as in the case of the squash-head projectile. Figure 9 shows a sketch of the area in which spalling occurs, further indicating that consistent functioning can not be reasonably effected with this round at impact angles of 70° or greater because of the geometry of the nose.
Experimental Ballistic Test of Modified Mk 149 Nose Fuze

PART D

CONCLUSIONS

11. It is concluded that:

a. The modified Mk 149 nose fuze will function consistently in a 540 rocket head Mk 6 upon 1/8" MS at 0° obliquity.

b. The fuze will function consistently in a 540 rocket head Mk 6 upon 1/8" MS at obliquities up to and including 75°.

c. The fuze as modified will function upon 3450 Class B armor in Mk 25 shaped charge heads up to obliquities of 70°. However, 70° seems to be the critical angle and functioning at this angle cannot be considered as consistent.

d. The modified fuze compares favorably ballistically in all respects with the present Mk 149 fuze. In addition, the Naval Ordnance Laboratory reports it will successfully pass the 25 ft. drop test.
Experimental Ballistic Test of Modified Mk 149 Nose Fuze

The tests upon which this report is based were conducted by:
F. W. Kasdorff, Rocket Battery Officer
Rocket Battery Division
Terminal Ballistics Department

This report was prepared by:
R. G. Song, Ensign, USNR, Rocket Battery Firing Officer
Rocket Battery Division
Terminal Ballistics Department

This report was reviewed by:
R. H. Lyddane, Director of Research
Terminal Ballistics Department
E. L. LeVstik, Lieutenant Commander, USNR
Terminal Ballistics Batteries Officer
Terminal Ballistics Department
W. B. Robertson, Lieutenant Commander, USN
Terminal Ballistics Officer
Terminal Ballistics Department
C. C. Bramble, Director of Research
Ordnance Group

APPROVED: J. F. Byrne
Captain, USN
Commander, Naval Proving Ground

E. A. Ruckner
Captain, USN
Ordnance Officer
By direction

CONFIDENTIAL
SECURITY INFORMATION
This report is transmitted for your information and file. Additional information may be obtained by addressing:

Chief, Washington USAF Engineering Field Office
Room 4229, Main Navy Building
Washington 25, D.C.

The telephone extension is 62471 or 65569 on the Department of Defense Exchange.

Twenty-Second Partial Report on Research, Development, and Tests of Aircraft Rocket Fuze Systems

Final Report on Experimental Ballistic Test of Modified Mk 149 Nose Fuze

Project No.: NPG-Re2b-11-1-52
Copy No.: 24
No. of Pages: 9

CONFIDENTIAL
SECURITY INFORMATION

Date: DEC 3 1952
IMPACT RECORD

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 0093
IMPACT DATE 8-20-52
MFG TEST NO. 2222-1.25

OBJECT  Functioning Test of Modified Mk. 149 Rocket Nose Fuze
in 510 Rocket Head Mk. 25 vs Plate #BD277.

Reference: NAVORD ltr. dated
Reference: NAVORD ltr. dated
Task Assignment No. NAVORD 28-114-1.25 dated

PLATE TARGET

Gage 375 Class B
Maker Carnegie
No. BD277 Group
Dimensions 121" x 40.7"

OBLIQUITY 55°

ROCKET

HEAD: Cal. 5" Type Shaped Charge
Mark 25 Mod 1 No. - Wt. 51.35#

Maker Houdaille Corp.
Lot No. RHC2-7-8A-52
Filler: Type Var Comp. Wt. 16#

Fuses Mk. 149 No. 23

Boosters 1 Wt. of head (as fired) 51.35#

MOTOR: Cal. 5" Mk. 14 Mod 5
Motor temp. 86° Wt. 89.30#

Mean Velocity, f/s: Starting 1732 Residual

Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round

Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS:

LAUNCHER 1050ft. Rocket Launcher

CONFIDENTIAL
SECURITY INFORMATION
**IMPACT RECORD**

**U. S. NAVAL PROVING GROUND**

**DAHLGREN, VIRGINIA**

**IMPACT NO.** 40094

**IMPACT DATE** 6-20-50

**NPG TEST NO.** T-2222-1.25

---

**OBJECT**

Functioning Test of Modified Mk. 149 Rocket Nose Fuze

In 540 rocket Head Mk. 25 vs Plate #50277.

---

**Reference:**

NPG 149

Reference: Board list

Task Assignment No.

---

**PLATE TARGET**

<table>
<thead>
<tr>
<th>Gage</th>
<th>CLASS</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maker</td>
<td>Carnegie</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>50277</td>
<td>Group</td>
</tr>
<tr>
<td>Dimensions</td>
<td>124&quot; x 405&quot;</td>
<td></td>
</tr>
<tr>
<td>OBLIQUITY</td>
<td>45°</td>
<td></td>
</tr>
</tbody>
</table>

---

**ROCKET**

**HEAD:**

Cal. 5" Type Shaped Charge

Mark 25 Mod 1 No. - Wt. 51.46#

Maker: Houdaille Corp.

Lot No.: RH02-7-HA-52

Filler: Type Cast Convb. 16#

Fuzes: Mk. 149 No. 24

---

**BOOSTERS**

Wt. of head (as fired) 51.46#

---

**MOTOR:**

Cal. 5" Mk. 10 Mod 5

Motor temp. 86°

Wt. 83.7#

---

**EXPLORATIVE INFORMATION**

Distance of burst behind plate

Condition of recovered round

| Head was in (EFFECTIVE) (INEFFECTIVE) condition. |

---

**LAUNCHER**

1050 Ft. Rocket Launcher

---

**ROCKET PERFORMANCE**

Mean

Flight Velocity, f/s: **Striking** 1686 Residual

Fuse functioning

Explosive action (High Order) (Low Order) (None)

Distance of burst behind plate

Condition of recovered round

---

**REMARKS:**

---

**Photo No.** 899-61102

**Signed**

F. W. Kasdorf

ORD. ENG.
IMPACT RECORD
U.S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

OBJECT: Functioning Test of Modified Mk. 149 Rocket Nose Fuse in 540 Hooker Hand Mk. 25 vs Plate #BD277.

IMPACT RECORD
U.S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

PLATE TARGET

Test No. T-2222-1.25

IMPACT DATE 8-20-52

ROCKET

HEAD: Cal. 5" Type Shaped Charge
Mark 25 Mod. 1 No. 1 Wt. 51.16 lb
Maker Houdaille Corp.
Lot No. BHC2-7-HA-52
Filler: FractaComp Wt. 16 lb
Fuses Mk. 1/9 No. 25

ROCKET PERFORMANCE

Mean

Flight Velocity, f/s: 1698 Residual

FUSE FUNCTIONING

Explosive action (High Order) (Low Order) (None)

Condition of recovered round

Head was in (EFFECTIVE) (IN EFFECTIVE) condition.

REMARKS:

Photo No. NPN-21129a TPO 1720 Signed F.W. Readoff

CONFIDENTIAL
SECURITY INFORMATION
IMPACT RECORD

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 40106
IMPACT DATE 8-21-52

NPG TEST NO. T-2222-1.25

OBJECT: Functioning Test of Modified Mk.169 Rocket Nose Fuze

in 570 rocket. Head Mk.25 vs Cl.B Plate.

Reference: NPG 1tr. (262)-1 Ser 3/5 dated
Reference: BU0** 1tr. No. Serial Data: 4th Feed dated 6 June 1952
Task Assignment No. NPG-2011-1 dated

PLATE TARGET

Gage 325 Class B
Maker Carnegie
No. 80277 Group -
Dimensions 12x11.106

OBLIQUITY 75°

ROCKET

HEAD: Cal. 5" Type Shaped Charge
Mark 25 Mod 1 No. Wt. 51.93#
Maker Houdaille Corp.
Lot No. BUCZ-7-HA-52
Fuzes Mk.149 No.26

Boosters 1
Wt. of head (as fired) 51.93#

MOTOR: Cal.5" Mk. 10 Mod 5
Motor temp. 80° Wt. 89.30#

COMPLETE ROUND: Mark ______ Mod ______
Wt. (as fired) ______ Wt. (burned) ______

OTHER INFORMATION

LAUNCHER 1050 ft. Rocket Launcher

ROCKET PERFORMANCE

Mean

Flight Velocity, f/s: 1693 Residual
Fuse functioning
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round

Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS:

Photo No. _______ Signed _______

CONFIDENTIAL
SECURITY INFORMATION

F.W. Kassorff
ORD. ENG.
IMPACT RECORD
U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

IMPACT NO. 40108
IMPACT DATE 8-21-52
NPG TEST NO. T-222-1.25

OBJECT
In 1.1 Rocket Head Mk. 23 vs 0.18 Plate.

Reference: NPG ltr. dated
Reference: BuOrd ltr. Mark 52 dated
Task Assignment No. (2528) Ser 2419 of dated June 1952

PLATE TARGET

HEAD:
Cal. 5" Type Shaped Charge
Mark 25 Mod 1 No. - Wt. 51.10#

ROCKET:
Cal. 5" Mk. 10 Mod 5
Motor temp. 86° Wt. 88.45#

PLATE TARGET

Cage 375 Class B
Maker Carnac
No. RM277 Group -
Dimensions 124" X 400"

HEAD:
Cal. 5" Type Shaped Charge
Mark 25 Mod 1 No. - Wt. 51.10#

ROCKET:
Cal. 5" Mk. 10 Mod 5
Motor temp. 86° Wt. 88.45#

OBLIQUITY 70°

PENETRATION
Complete
Thickness at impact 395
No. of impact on plate 9
Dist. from nearest impact 56"
Dist. from near edge 39.39"
Impact area 3" X 5.5" 1.2/4 X 1.1/2"
Spall: Front 0 Back 3/8 X 12 3/4"

Cracks:
0
Punching (thrown) started
Back Button (thrown) (scratched)
Bulge 0
Through opening 1" X 1-3/4"

ROCKET PERFORMANCE

Mean Velocity, f/s: 1702 Residual

Flight
Puze functioning
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round

Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS:

Photo No. NPG-51103

CONFIDENTIAL
SECURITY INFORMATION

Signed F. W. Kusdorff
ORD. ENG.
# Impact Record

**U.S. Naval Proving Ground**

**Impact No.** 40109

**Impact Date** 8-21-52

**NPG Test No.** T-2222-1.25

## Object

Functioning Test of Modified Mk 149 Rocket Nose Fuse in 5.5" Rocket Head Mk. 25 vs Cl B Plate.

**Reference:** NPG ltr. NUL Splitter Finned 44F Mk/WRA/11 dated

**Reference:** NAGEM ltr. (C/38) 69439-90 dated 6 June 1932

## Plate Target

**Gage** 3/8

**Class** B

**Maker** Carnegie

**No.** 50277 Group

**Dimensions** 7/8" x 406"n

**Obliquity** 70°

## Rocket

**Head:** Cal. 5" Type Shaped Charge Mark 25 Mod 1 No. 1 Wt. 51.02 lbs

**Maker:** Houdaille Corp.

**Lot No.** GHZ-7-RA-51

**Filler:** Typewriter Comp. 15

**Fuzes:** Mk 149 No. 29

### Penetration

**Thickness at impact** 5/8

**No. of impact on plate** 6

**Dist. from nearest impact** 2 1/2

**Dist. from near edges and center** 1 1/2

**Impact area** 7/8"x 406"n

**Spall:** Front Back

**Dish:** Spur

**Cracks:**

**Punching (thrown) (started)**

**Back Button (thrown) (started)**

**Bulge**

**Through opening**

## Rocket Performance

**Mean Flight Velocity, f/s:**

**Fuse Functioning**

**Explosive action (High Order) (Low Order) (None)**

**Distance of burst behind plate**

**Condition of recovered round**

**Head was in (EFFECTIVE) (INEFFECTIVE) condition.**

### Remarks:

### Launch:

1050 Ft. Rocket Launcher

### Other Information:

**LAUNCHER** 1050 Ft. Rocket Launcher

**Other Information**

**MOTOR** Cal. 5M Mk. 25 Mod 1

**Motor temp.** 85°

**Wt. (as fired)** 139.22 lbs

**Wt. (burned)**

**COMPLETE ROUND**

**Mark** 2

**Mod** 1

**Wt. (as fired)** 139.22 lbs

**LAUNCHER** 1050 Ft. Rocket Launcher

**Signed** F.W. Kusdorff

**ORD. ENG.**

**Confidential**

**Security Information**
**IMPACT RECORD**

**U. S. NAVAL PROVING GROUND**

**DAHLGREN, VIRGINIA**

**IMPACT NO.** 10110

**IMPACT DATE** 8-21-52

**MFG TEST NO.** T-2222-1.25

---

**OBJECT**

Functioning Test of Modified Mk.1149 Rocket Nose Fuze in .70 Rocket Head Mk.25 vs C1.8 Plate.

**PLATE TARGET**

- **Gage:** 3/45
- **Class:** 1
- **Maker:** Carnegie
- **No.:** TT695
- **Group:** 2-751-328
- **Dimensions:** 113" X 384"

**ROCKET**

- **HEAD:** Cal. 5" Type Shaped Charge
  - **Mark:** 25 Mod 1 No. - Wt. 51.42#
  - **Maker:** Houdaille Corp.
  - **Lot No.:** RHC2-7-41-31
  - **Filler:** Type 3-18#
  - **Fuses:** Mk.119 No. 30
- **Boosters:** 1
- **Wt. of head (as fired):** 51.42#
- **MOTOR:** Cal. 5" Mk. 10 Mod 5
  - **Motor temp.:** 80° Wt. 89.25#
- **COMPLETE ROUND:** Mark Mod
- **Wt. (as fired):** 140.67#
- **Wt. (burned):**

**OTHER INFORMATION**

- **ALL:** RMDn-267-5-31
- **LAUNCHER:** 1050 Ft. Rocket Launcher

---

**ROCKET PERFORMANCE**

- **Flight Velocity, f/s:** TWIN-TRK 1773 Residual
- **Fuse functioning**
- **Explosive action (High Order) (Low Order) (None)**
- **Distance of burst behind plate**
- **Condition of recovered round**
  - **Head was in (EFFECTIVE) (INEFFECTIVE) condition.**

**REMARKS:**

---

**Photo No.**

 confidence signed F.W. Kasdorf

security information

F.W. Kasdorf
ORD. ENG.
NAVORD FORM 1883 (New 3/48)

IMPACT RECORD

U. S. NAVAL PROVING GROUND
DAHLOREN, VIRGINIA

IMPACT No. 40111
IMPACT DATE 8-21-52

NPG TEST No. T-2222-1.25

OBJECT
Functioning Test of Modified Mk.149 Rocket Nose Fuze in 5/16" Rocket Head Mk.25 vs 0.118" Plate.

Reference: NPG ltr. dated
Reference: BuOrd ltr. dated
Task Assignment No. (3828) Ser. 3113 dated

IMPACT RECORD
U. S. NAVAL PROVING GROUND
DAHLOREN, VIRGINIA

IMPACT No. 40111
IMPACT DATE 8-21-52

NPG TEST No. T-2222-1.25

PLATE TARGET

Gage 3/16
Class B
Maker Carnegie
No. TP 695 Group C-751-322
Dimensions 11 3/4 x 3 1/4

OBLIQUITY 70°

ROCKET

HEAD: Cal. 5" Type Shaped Charge
Mark 25 Mod 1 No. - Vt. 51.46#
Maker Houdaille Corp.
Lot No. UHC-7-H4-51
Filler: TYPE at Complete Vt. 16#
Fuzes Mk.149 No.31

Boosters 1
Wt. of head (as fired) 51.46#

MOTOR: Cal. 5" Mk. 10 Mod 5
Motor temp. 80° Vt. 78.46#

COMPLETE ROUND: Mark Mod
Wt. (as fired) 140.91
Wt. (burned)

OTHER INFORMATION
ALN: RLDA 207-3-51

LAUNCHER 1050 Ft. Rocket Launcher

ROCKET PERFORMANCE

Mean

Mean Velocity, f/s: Striking 1779 Residual

Fuzes functioning
Explosive action (High Order) (Low Order) (None)
Distance of burst behind plate
Condition of recovered round

Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS:

CONFIDENTIAL

Photo No. 5

SECURITY INFORMATION

Signed F.W. Kusdorff

ORD. END.
IMPACT RECORD

U.S. NAVAL PROVING GROUND

Dahloneg, Virginia

IMPACT NO. 40112

IMPACT DATE 8-21-52

NPG TEST HOT-2222-1.25

OBJECT

Functioning Test of Modified Mk. 1/9 rocket Nose Fuse

in 5/8 Rocket Head Mk. 25 vs Cl.B Plate.

Reference: NPG ltr. No. 65 dated

Reference: NPG ltr. No. 65 dated

Task Assignment No. NPG Ref. 11-5-52 dated 6 June 1952

PLATE TARGET

NPG Flight Test 160 & 20

ROCKET

Gage 375 Class E

Maker: Carnarvon

No. TOP-95 Group C-751-222

Dimensions 10 3/8

OBLIQUITY 75°

PENETRATION Complete

Thickness at impact 19/16

No. of impact on plate 3

Dist. from nearest impact 25

Dist. from near edge 2 7/8 and 1 7/8

Impact area 2 1/2 X 2 1/2

Spall: Front 0 Back 3 x 2

Dish 0 Spur 1

Cracks 0

Punching (turned) (started)

Back Button (thrown) (skew)

Bulge 0

Through opening 1 1/2 X 2 1/2

BOOSTERS 1

Wt. of head (as fired) 51.13#

HEAD: Cal. 5" Type Shaped Charge

Mark 25 Mod 1 No. 1 Wt. 51.13#

Maker: Houdaille Corp.

Lot No. DMC-7/H-51

Filler: Type Cast Comp. 10%

Fuses: Mk. 149 No. 32

ROCKET PERFORMANCE

Mean Velocity, f/s: 1768 Residual

Flight Velocities

Explosive action (High Order) (Low Order) (None)

Distance of burst behind plate

Condition of recovered round

Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS:

Photo No. CONFIDENTIAL

SECURITY INFORMATION

Signed W. Kasdorf

ORD. SGT.
TABLE I

SUMMARY OF RESULTS

<table>
<thead>
<tr>
<th>Rd. No.</th>
<th>Date</th>
<th>Fused No.</th>
<th>Rocket Head</th>
<th>Velocity (ft./sec.)</th>
<th>Desired Velocity</th>
<th>Obtained Velocity</th>
<th>Obli.</th>
<th>Target</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6-23</td>
<td>5 Mk 6</td>
<td>1800</td>
<td>1874</td>
<td>0°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6-23</td>
<td>6 Mk 6</td>
<td>1800</td>
<td>1836</td>
<td>0°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6-23</td>
<td>7 Mk 6</td>
<td>1800</td>
<td>1857</td>
<td>0°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>6-23</td>
<td>8 Mk 6</td>
<td>1800</td>
<td>1863</td>
<td>0°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PART II

<table>
<thead>
<tr>
<th>Rd. No.</th>
<th>Date</th>
<th>Fused No.</th>
<th>Rocket Head</th>
<th>Velocity (ft./sec.)</th>
<th>Desired Velocity</th>
<th>Obtained Velocity</th>
<th>Obli.</th>
<th>Target</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6-23</td>
<td>9 Mk 6</td>
<td>1800</td>
<td>1858</td>
<td>60°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6-23</td>
<td>10 Mk 6</td>
<td>1800</td>
<td>---</td>
<td>60°</td>
<td>1/8&quot; MS</td>
<td>HO on Launcher at 1012' point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7-24</td>
<td>33 Mk 6</td>
<td>1800</td>
<td>1896</td>
<td>60°</td>
<td>1/8&quot; MS</td>
<td>Dud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7-24</td>
<td>34 Mk 6</td>
<td>1800</td>
<td>1791</td>
<td>50°</td>
<td>1/8&quot; VS</td>
<td>Dud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>7-24</td>
<td>35 Mk 6</td>
<td>1800</td>
<td>1822</td>
<td>50°</td>
<td>1/4&quot; MS</td>
<td>Dud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7-25</td>
<td>36 Mk 6</td>
<td>1300</td>
<td>1511</td>
<td>50°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7-25</td>
<td>37 Mk 6</td>
<td>1300</td>
<td>1297</td>
<td>50°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>7-25</td>
<td>38 Mk 6</td>
<td>1300</td>
<td>1292</td>
<td>50°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>7-25</td>
<td>39 Mk 6</td>
<td>1300</td>
<td>1296</td>
<td>50°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7-25</td>
<td>40 Mk 6</td>
<td>1300</td>
<td>1295</td>
<td>70°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>7-25</td>
<td>41 Mk 6</td>
<td>1300</td>
<td>1923</td>
<td>70°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7-28</td>
<td>12 Mk 6</td>
<td>1800</td>
<td>1794</td>
<td>75°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>7-28</td>
<td>13 Mk 6</td>
<td>1800</td>
<td>1515</td>
<td>75°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>7-28</td>
<td>14 Mk 6</td>
<td>1800</td>
<td>1833</td>
<td>75°</td>
<td>1/8&quot; MS</td>
<td>Missed Target</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>7-28</td>
<td>15 Mk 6</td>
<td>1800</td>
<td>1791</td>
<td>75°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>7-28</td>
<td>16 Mk 6</td>
<td>1800</td>
<td>1789</td>
<td>75°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>7-28</td>
<td>17 Mk 6</td>
<td>1800</td>
<td>1789</td>
<td>75°</td>
<td>1/8&quot; VS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>7-29</td>
<td>18 Mk 6</td>
<td>1800</td>
<td>1618</td>
<td>75°</td>
<td>1/4&quot; MS</td>
<td>HO on Launcher at 800' point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>7-29</td>
<td>19 Mk 6</td>
<td>1800</td>
<td>1826</td>
<td>75°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>7-29</td>
<td>20 Mk 6</td>
<td>1800</td>
<td>1776</td>
<td>75°</td>
<td>1/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>7-29</td>
<td>21 Mk 6</td>
<td>1800</td>
<td>1618</td>
<td>75°</td>
<td>3/8&quot; MS</td>
<td>HO on Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>7-30</td>
<td>22 Mk 6</td>
<td>1800</td>
<td>1772</td>
<td>75°</td>
<td>3/8&quot; VS</td>
<td>HO at Launcher Muzzle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## TABLE I (Continued)

<table>
<thead>
<tr>
<th>Rd. No.</th>
<th>Impact No.</th>
<th>Date (Mo.-Dy.)</th>
<th>Fired No.</th>
<th>Fuse</th>
<th>Rocket No.</th>
<th>Desired Velocity (ft./sec.)</th>
<th>Obtained Velocity (ft./sec.)</th>
<th>Obs.</th>
<th>Target</th>
<th>Fuse Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40093</td>
<td>8-20</td>
<td>23</td>
<td>Mk 25</td>
<td>1800</td>
<td>1732</td>
<td>55°</td>
<td>3/16&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>2</td>
<td>40094</td>
<td>8-20</td>
<td>24</td>
<td>Mk 25</td>
<td>1800</td>
<td>1686</td>
<td>65°</td>
<td>3/16&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>3</td>
<td>40095</td>
<td>8-20</td>
<td>25</td>
<td>Mk 25</td>
<td>1800</td>
<td>1698</td>
<td>70°</td>
<td>3/16&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>4</td>
<td>40106</td>
<td>8-21</td>
<td>26</td>
<td>Mk 25</td>
<td>1800</td>
<td>1693</td>
<td>70°</td>
<td>3/16&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>5</td>
<td>40107</td>
<td>8-21</td>
<td>27</td>
<td>Mk 25</td>
<td>1800</td>
<td>1696</td>
<td>70°</td>
<td>3/16&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>6</td>
<td>40108</td>
<td>8-21</td>
<td>28</td>
<td>Mk 25</td>
<td>1600</td>
<td>1700</td>
<td>70°</td>
<td>3/16&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>7</td>
<td>40109</td>
<td>8-21</td>
<td>29</td>
<td>Mk 25</td>
<td>1800</td>
<td>1750</td>
<td>70°</td>
<td>3/16&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>8</td>
<td>40110</td>
<td>8-21</td>
<td>30</td>
<td>Mk 25</td>
<td>1800</td>
<td>1773</td>
<td>70°</td>
<td>3/8&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>9</td>
<td>40111</td>
<td>8-21</td>
<td>31</td>
<td>Mk 25</td>
<td>1800</td>
<td>1779</td>
<td>70°</td>
<td>3/8&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
<tr>
<td>10</td>
<td>40112</td>
<td>8-21</td>
<td>32</td>
<td>Mk 25</td>
<td>1800</td>
<td>1768</td>
<td>65°</td>
<td>3/8&quot;</td>
<td>Class B</td>
<td>EC</td>
</tr>
</tbody>
</table>
MARK 149
A.I.R. NOSE FUZE

WEATHER CAP
SAFETY PIN
WEATHER CAP SPRING
VANES
VANE BOSS
CLAMP
CLAMP PIN
VANE LOCKING PIN
UPPER SET-BACK BLOCK
FUZE BODY
STRIKER

LOWER SET-BACK BLOCK
UPPER SPACER SLEEVE
SET-BACK SPRING
SHUTTER LOCKING PIN
STRIKER GUIDE
SPRING LOADED DETENT
DETONATOR
LOWER SPACER SLEEVE
STOP PIN
DET. SHUTTER
BOOSTER LEAD-IN
LEAD-IN PLATE
BOOSTER
BOOSTER CUP

SECTION "A"—"A"
Experimental test of Modified Mk 149 Nose Fuze in 540 Rocket Head Mk 6 - smoke puff loaded. View: Dead catbird (weighing 1.1 ozs) suspended in rails at muzzle end of launcher to test possibility of fuze action upon impact with such an obstacle.

Figure 4
**View of 3" 5 Class B armor after impacts with 570 Shaped Charge Rocket Heads Mk 25 containing the Modified Mk 149 nose fuze. Note bulge behind opening on rd. 2 and large spall resulting from rd. 3.**

<table>
<thead>
<tr>
<th>Rd. No.</th>
<th>Target</th>
<th>Obl.</th>
<th>Velocity (f/s)</th>
<th>Penetration</th>
<th>Entrance</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 7/16&quot; Class B</td>
<td>55°</td>
<td>1732</td>
<td>Complete</td>
<td>2 1/2&quot; x 4&quot;</td>
<td>2 3/4&quot; x 3&quot;</td>
</tr>
<tr>
<td>2</td>
<td>3 7/16&quot; Class B</td>
<td>65°</td>
<td>1686</td>
<td>Complete</td>
<td>3&quot; x 6&quot;</td>
<td>2&quot; x 3&quot;</td>
</tr>
<tr>
<td>3</td>
<td>3 7/16&quot; Class B</td>
<td>70°</td>
<td>1698</td>
<td>Complete</td>
<td>4&quot; x 8&quot;</td>
<td>1&quot; x 1 5/8&quot;</td>
</tr>
</tbody>
</table>

Figure 6
View of 3.75 Class B armor plate after impact of 5.0 Shaped Charge Rocket, Head Mk 25 containing Modified Mk 149 nose fuze. Note large spall area behind opening.

<table>
<thead>
<tr>
<th>Rd. No.</th>
<th>Target</th>
<th>Obl.</th>
<th>Striking Velocity (f/s)</th>
<th>Penetration</th>
<th>Impact Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>3 7/16&quot; Class B</td>
<td>70°</td>
<td>1702</td>
<td>Complete</td>
<td>3&quot; x 8&quot;</td>
</tr>
</tbody>
</table>

Figure 7
NP9-51104

21 August 1952

Experimental test of modified Mk 149 Nose Fuze in 770 Shaped Charge Head Mk 25.

View: Fragment resulting from spall on the backside of a 3/5 Class 3 Armor Plate on rd. 3. This piece measured 6"x5 1/2"x1/4".

Figure 2.

U.S.N.P.G. DAHLGREN, VIRGINIA

6 INCHES
FIG. 9 - EXPERIMENTAL BALLISTIC TEST OF MODIFIED MK 199 ROCKET NOSE FUZE

VIEW: MOD. MK 199 FUZE IN 5" ROCKET HEAD MK 25 (SHAPED CHARGE) WITH 5" HVAR MOTOR VS. 3" CLASS 6 ARMOR PLATE AT 70° OBLIQUITY. NOTE 5 PALL THROWN FROM BACK FACE DUE TO EXPLOSIVE WAVES TRANSMITTED THROUGH PLATE ON IMPACTS ABOVE 65° OBLIQUITY.

CONFIDENTIAL
SECURITY INFORMATION

27 AUGUST 1982
R.G.S.
Experimental Ballistic Test of Modified Mk 149 Nose Fuse

DISTRIBUTION

Bureau of Ordnance
Adj
Re2
Re2b
Re3d
Re3e
Re2c

Chief of Ordnance
Department of the Army
Attn: ORDTX-AR

Commanding General
Aberdeen Proving Ground
Aberdeen, Maryland
Attn: Technical Information Section
Development and Proof Services

Commander, Operational Development Force
U. S. Atlantic Fleet, U. S. Naval Base
Norfolk, Virginia

Navy Research Section
Library of Congress
Washington 25, D. C.
(via BUORD Re2b)

Chief of Ordnance
Department of the Army
Attn: ORDTQ

BUAER
Attn: Armament Section

NATC, Patuxent River, Maryland

Naval Liaison Officer
USAFPGC, Eglin Field, Florida

NOTS, Inyokern, California

CONFIDENTIAL SECURITY INFORMATION 1
APPENDIX D
Experimental Ballistic Test of Modified Mk 149 Nose

DISTRIBUTION (Continued)

U. S. Air Force
Air Force Engineering Field Office
Room 1833, Main Navy Building
Navy Department, Washington, D. C. 2

Commander (DF)
Naval Ordnance Laboratory (Fuzes) 3

NOP, Macon, Georgia 1

Picatinny Arsenal
Dover, New Jersey 1

NOTS, Inyokern, California
Rocket Reports 1

Chief of Ordnance, Department of the Army
Attn: ORDIU 1

Commanding General
Air Force Armament Center
Eglin Air Force Base, Florida
Attn: Technical Library 1

Local:

OT 1
OV 1
File 1