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U S NAVAL PROVING GROUND
DAHLGREN VIRGINIA

REPORT NO 1089

TESTING OF WARHEADS FOR
AIR TARGET GUIDED MISSILES
59th Partial Report

ROD WARHEADS MODEL NO 126

FINAL Report

Copy No. 10

Task

Assignment NPG-Re3f-607-1-53

Classification CONFIDENTIAL
SECURITY INFORMATION

NAVY DEPT.

1953 FEB 12 PM 2 09

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Rod Warheads, Model No. 126
-----PART ASYNOPSIS

1. This test was conducted to determine the fragmentation characteristics of 8" diameter rod warhead No. 126, composition C-3 loaded. The warhead case is comprised of 60 keystone shaped rods which are copper brazed to form a 12" long sleeve. Two of the six warheads tested had circumferential grooves inside the sleeves which were designed to break the rods into 4" rod lengths.

2. a. Warhead No. 126 without circumferential grooves can be expected to produce approximately 35 rod-like fragments of 9" to 10-1/2" in length. The other rods will be broken approximately in half.

b. Warhead No. 126 with circumferential grooves was satisfactory in producing rod-like fragments 4" in length as designed.

c. All warheads produced average rod-like fragment velocities in the order of 4800 ft./sec.

Rod Warheads, Model No. 126

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APPENDIX D - DISTRIBUTION. 1-2	(Incl)

Rod Warheads, Model No. 126
-----PART BINTRODUCTION

1. AUTHORITY:

This test was authorized by references (a) and (b) and conducted under Task Assignment NPG-Re3f-607-1-53, reference (c).

2. REFERENCES:

- a. NOL Conf ltr NP/NOL/X11 (861) Ser 01499 of 3 July 1952
- b. NOL Conf ltr NP/NOL/X11 (1042) Ser 020142 of 2 Oct 1952
- c. BUORD Conf ltr NP9-Re3f-RKJ:gg Ser 42699 of 29 July 1952
- d. NPG Conf Report No. 1009 of 14 July 1952

3. BACKGROUND:

a. Reference (c) authorized the Naval Proving Ground to work directly with the Naval Ordnance Laboratory in the development and testing of warheads for guided missiles.

b. References (a) and (b) requested that six (6) warheads No. 126, comprised of keystone shaped rods copper brazed together, be tested. This test is a continuation of the rod-warhead studies conducted jointly by the Bureau of Ordnance, the Naval Ordnance Laboratory, the Johns Hopkins University Applied Physics Laboratory, and the Naval Proving Ground. Reference (d) reported the results of the initial phase of the studies which were on Warhead No. 125, having a grooved warhead case.

4. OBJECT OF TEST:

This test was conducted to determine the fragmentation characteristics of 8" diameter rod warhead No. 126, composition C-3 loaded.

5. PERIOD OF TEST:

- | | |
|---|-----------------|
| a. Dates Project Letters | 3 July 1952 |
| | 2 October 1952 |
| b. Date All Necessary Material Received | 10 October 1952 |
| c. Date Commenced Test | 31 July 1952 |
| d. Date Test Completed | 6 November 1952 |

Rod Warheads, Model No. 126

6. REPRESENTATIVES PRESENT:

This test was witnessed in part by Messrs. H. W. Semon, L. E. Hightower, D. J. Stretmator, G. T. Boswell, and W. W. Weber representing the Naval Ordnance Laboratory.

PART CDETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. Rod warheads Nos. 126-1 through 126-4: 8.000 O.D. by 12.000 long, with 0.375 wall thickness. Each warhead case is made by welding both ends of a sleeve made up of 60 full-length keystone shaped rods. The sleeve is forced through a ring which forms it to an 8" outside diameter. The angle between the non-parallel sides of the individual rods after forming is such that longitudinal "V" shaped grooves, approximately 0.060 wide and 0.250 deep, are produced around the inside of the case. Each warhead contains a 2.000 O.D. central conduit tube having a 1/16" thick wall. End plates are secured to the warhead case by screws. Individual rods are made 13.000 long and brazed; after brazing, the entire case is machined to a 12.000 length. Photographs of the warhead case and individual rod before forming are shown in Figures 1 and 2.

b. Rod Warheads Nos. 126-5 and 126-6: Same as described above with the addition of two (2) circumferential grooves 0.125 wide by 0.187 deep around the inside of the case at 4" intervals from either end of the sleeve.

c. All six (6) warheads were fully loaded with composition C-3 at the Naval Proving Ground and the weights are as follows:

Warhead No.	Fired at	Empty Wt. (lbs.)	Comp C-3 Wt. (lbs.)	Total Wt. (lbs.)
126-1	Cane fiberboard pit	31.46	26.59	58.05
126-2	Waterpit	31.57	26.36	57.93
126-3	Waterpit	31.48	26.43	57.91
126-4	Waterpit	31.32	26.31	57.63
126-5	Waterpit	31.11	26.64	57.75
126-6	Waterpit	31.30	26.31	57.61

A 1.825 diameter by 1" thick tetryl booster with a engineers' special blasting cap was used on all rounds for initiating the warhead at one end.

Rod Warheads, Model No. 126

8. PROCEDURE:

a. Warhead 126-1:

This round was placed vertically in the center of a 10' square, 4' deep, cane fiberboard pit which had a 2' square opening in its center. The warhead was boosted at the top end. After the detonation, the cane fiberboard and pit were screened for fragments.

b. Warheads 126-2 through 126-6:

Each round was suspended horizontally over a water pit which had a 15' x 15' opening and was designed to trap 1/6 of all fragments in polar angle zone 60° - 120°. On Warheads Nos. 126-3 and 126-4 the waterpit had 1' and 2-1/2' thick cane fiberboard packs placed just above the water to cushion the fragments before water entry.

c. 20' high vertical steel panels 40' from the warhead were used to obtain space distribution data and fragment flashes which were recorded by two (2) 35mm Fastax cameras for determining fragment velocity data.

9. RESULTS AND DISCUSSION:

a. The keystone rods of Warheads Nos. 126-1 through 126-4 all lost approximately 2" - 3" of one end. About 50% of the 60 rods in each warhead were 9" - 10-1/2" long although some of the waterpit recovered rods do not show this. The cane fiberboard pit recovery of Warhead No. 126-1 and the plate impact data of Warheads Nos. 126-2 through 126-4 bear out this fact. The water impact is enough to break the majority of the rods into 3" to 6" long fragments; hence, the waterpit recovered rounds, Figures 3 to 6, are not indicative of the rod lengths produced. The space distribution data do give a good indication of rod length, since the rod impact length on the plate is established regardless of the rod behavior on impact.

b. The circumferential grooves inside Warheads Nos. 126-5 and 126-6 were satisfactory in producing 4" length rod fragments, Figures 7 and 8. Those fragments which were slightly less than 4" in length were probably obtained from the initiated end of the warhead sleeve. Rod lengths on plate impacts were in agreement with waterpit recovery data.

Rod Warheads, Model No. 126

c. All warheads tested produced average rod fragment velocities in the order of 4800 ft./sec. Detailed velocity data are listed in Table I.

d. Rod fragment impact lengths which were measured on 20' high vertical steel panels at 40' from the warheads were as follows:

<u>Warhead No.</u>	<u>Average Angle from Nose</u>	<u>Rod Lengths (inches)</u>
126-2	98°	7", 9", 9", 9"
126-3	92°	8", 8", 10", 10", 10-1/2"
126-4	98°	4-1/2", 5-1/2", 6-1/2", 10", 10"

<u>Warhead No.</u>	<u>Average Angle from Nose</u>			<u>Average Rod Lengths (inches)</u>		
	<u>Row #1</u>	<u>Row #2</u>	<u>Row #3</u>	<u>Row #1</u>	<u>Row #2</u>	<u>Row #3</u>
126-5	88°	96°	101°	3"	4"	4"
126-6	88°	98°	102°	3-1/2"	4"	4"

PART D

CONCLUSIONS

10. a. Warhead No. 126 without circumferential grooves can be expected to produce approximately 35 rod-like fragments of 9 to 10-1/2" in length. The other rods will be broken approximately in half.

b. Warheads No. 126 with circumferential grooves was satisfactory in producing rod-like fragments 4" in length as designed.

c. All warheads produced average rod-like fragment velocities in the order of 4800 ft./sec.

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NPG REPORT NO. 1089

Rod Warheads, Model No. 126

The tests upon which this report is based were conducted by:

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Fragmentation Division
Terminal Ballistics Department

This report was prepared by:

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Commander, Naval Proving Ground



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Ordnance Officer
By direction

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NPG REPORT NO. 1089

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Fifty-ninth Partial Report

on

Testing of Warheads for
Air Target Guided Missiles

- - - - -

Final Report

on

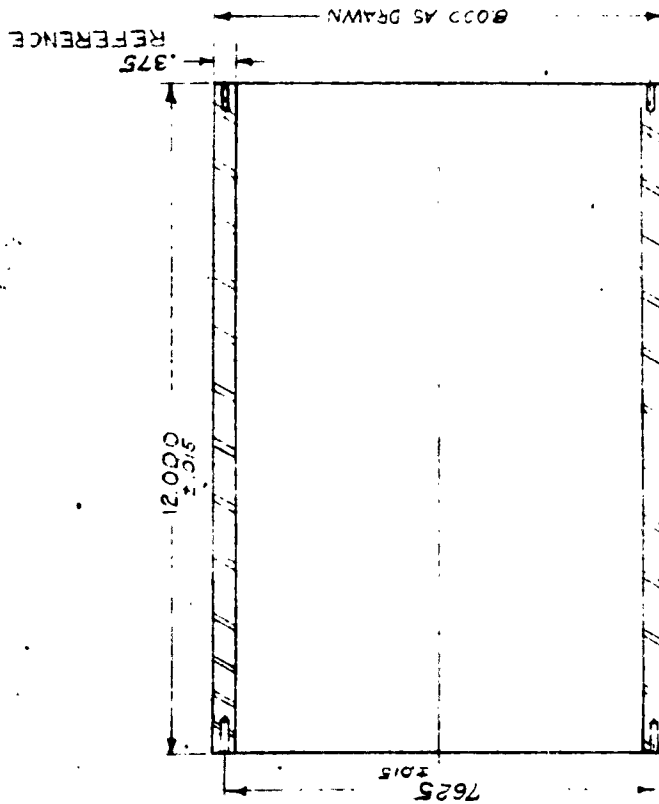
Rod Warheads, Model No. 126

Project No.: NPG-Re3f-607-1-53
Copy No.: 12
No. of Pages: 7

Date:

FEB 11 1953

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[illegible]

NOTE : MACHINE EQUAL AMOUNTS FROM EACH END OF ROD
-ASSEMBLY (SK 353/50) TO OBTAIN LENGTH SHOWN

DRILL & TAP FOR NO 8-32
MACH. SCR. 1/2" LG - 4 HOLES
IN EACH END OF CASE

REVELATION OF THE CONTENTS OF THIS MESSAGE TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW. SEE ESPIONAGE ACT AND WIRE TAP ACT.

• CASE
TRIAL WARHEAD NO.
126

SK-347516

JOE ORDER

UNIT WT.

SCALE

5FKP5	12-10-9
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CHECKED
DRAWN

RECOMMENDATIONS OF LATENT HEAVY APPLY

NEXT ASSY	USED ON APPLICATION

DRIVING CRIMINALS

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3	Case 3	Case 3	Case 3	Case 3
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5	Case 5	Case 5	Case 5	Case 5
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72	Case 72	Case 72	Case 72	Case 72
73	Case 73	Case 73	Case 73	Case 73
74	Case 74	Case 74	Case 74	Case 74
75</				

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SK-347517

REVISIONS		
SYN	DESCRIPTION	DATE

0.375
± 0.002

13.000
± 0.05

0.428
± 0.001

0.30
± 0.01



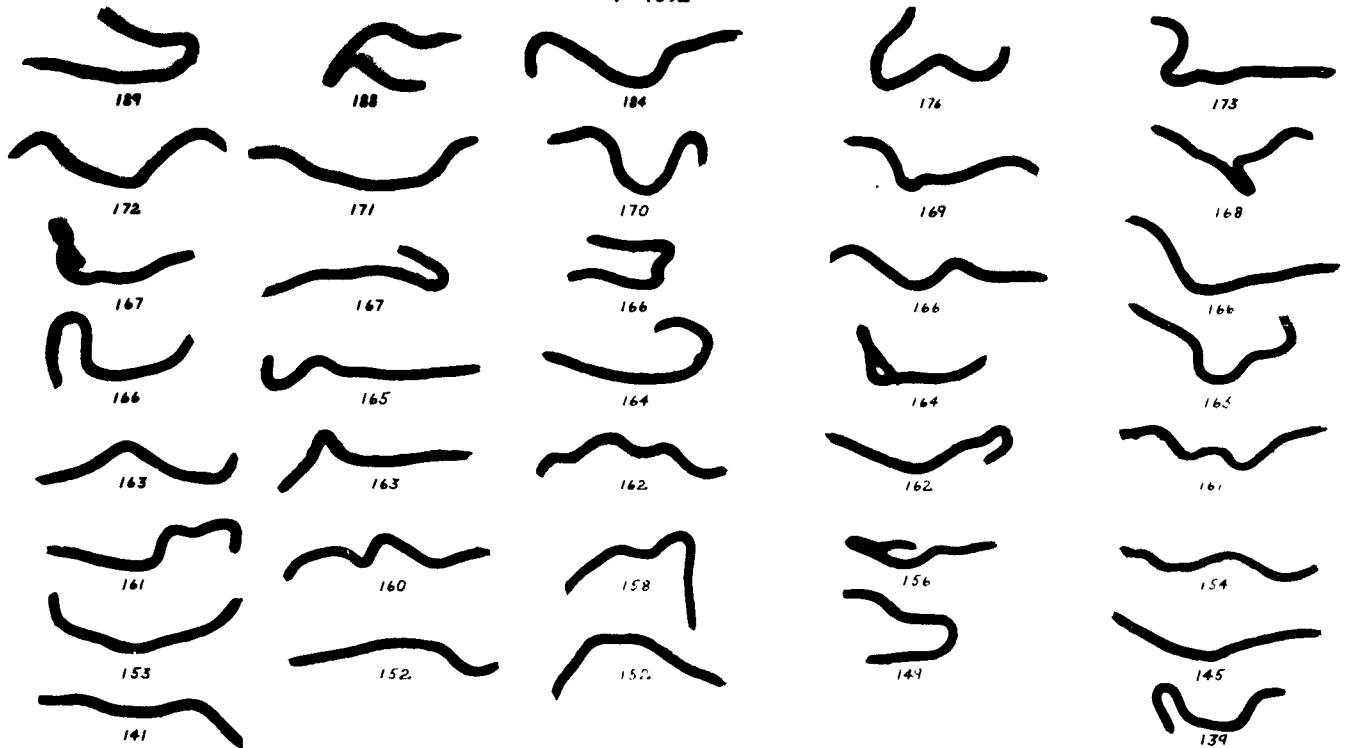
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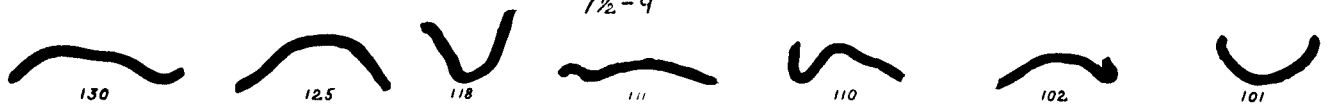
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CANE FIBER BOARD PIT RECOVERY WARHEAD NO 126
WEIGHTS BELOW FRAGMENTS IN GRAMS.

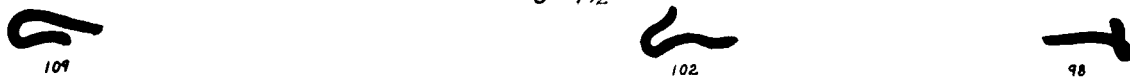
9"-10½"



7½"-9"



6"-7½"



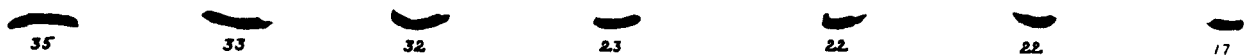
4½"-6"



3"-4½"



1½"-3"



SCALE 1"

FRAG NO. 1673

WARHEAD NO 126 WATER PIT RECOVERY

N.P.9 50881

0 - 5/8	Gms.
	PCS.
5/8 - 1 1/4	Gms.
22	Gms.
18	PCS.
1 1/4 - 2 1/2	Gms.
12	Gms.
21	PCS.
2 1/2 - 5	Gms.
11	Gms.
39	PCS.
5 - 10	Gms.
7	Gms.
49	PCS.
10 - 20	Gms.
23	Gms.
326	PCS.
20 - 40	Gms.
16	Gms.
425	PCS.
40 - 80	Gms.
16	Gms.
	PCS.
	Gms.

WEIGHTS BELOW FRAGMENTS IN GRAMS

Plate 1 displays 18 fish specimens, each labeled with a number and a letter. The specimens are arranged in a grid-like fashion, showing various morphological features. The labels are as follows:

- Row 1: 5'' 7R, 4 6L, 4'' 59, 3'' 48, 1 104, 5 8X
- Row 2: 1 1, 1 2, 1 3, 1 4, 1 5, 1 6
- Row 3: 1 7, 1 8, 1 9, 1 10, 1 11, 1 12

SCALE 1"

N.P. 51467

99 Gms.

FIGURE 7

8" ROD WAREHD NO 126-6

8 ROD WAREHD NO 126-6	
0 - 5/8	GMS.
	PCS.
88	GMS.
5/8 - 1 1/4	GMS.
30	PCS.
25	GMS.
1 1/4 - 2 1/2	GMS.
13	PCS.
21	GMS.
2 1/2 - 5	GMS.
7	PCS.
22	GMS.
5 - 10	GMS.
4	PCS.
29	GMS.
10 - 20	GMS.
7	PCS.
90	GMS.
20 - 40	GMS.
3	PCS.
70	GMS.

8" Rod Warhead No. 126-6. Fragments Recovered from Water Pit.
FIGURE 8

Rod Warheads, Model No. 126
-----TABLE IFRAGMENT VELOCITY DATA

40 Ft. Radius Arena	8-14-52	Waterpit
Rd. 2 '8" Warhead No. 126-2	Filler:	Comp. C-3
Total Weight: 57.93 lbs.	Filler Weight:	26.36 lbs.
<u>Frame in Which Hit Occurred</u>	<u>No. Rod-like Fragments</u>	<u>Velocity (f/s)</u>
35mm Fastax Camera #1		2520 Frames per sec.
20	4	5040
Average		5040
35mm Fastax Camera #2		2340 Frames per sec.
19	3	4930
20	1	4680
Average		4870

Rod Warheads, Model No. 126
-----TABLE I (Continued)

40 Ft. Radius Arena	8-26-52	Waterpit
Rd. 3 8" Warhead No. 126-3	Filler:	Comp. C-3
Total Weight: 57.91 lbs.	Filler Weight:	26.43 lbs.
<u>Frame in Which Hit Occurred</u>	<u>No. Rod-like Fragments</u>	<u>Velocity (f/s)</u>
35mm Fastax Camera #1		2220 Frames per sec.
18	4	4930
19	1	4670
Average		4880
35mm Fastax Camera #2		2280 Frames per sec.
19	4	4800
20	1	4560
Average		4750

Rod Warheads, Model No. 126
-----TABLE I (Continued)

40 Ft. Radius Arena	9-4-52	Waterpit
Rd. 4 8" Warhead No. 126-4	Filler:	Comp. C-3
Total Weight: 57.63 lbs.	* Filler Weight:	26.31 lbs.
<u>Frame in Which Hit Occurred</u>	<u>No. Rod-like Fragments</u>	<u>Velocity (f/s)</u>
35mm Fastax Camera #1		3120 Frames per sec.
25	3	4990
26	2	4800
Average		4910
35mm Fastax Camera #2		3120 Frames per sec.
25	3	4990
26	2	4800
Average		4910

Rod Warheads, Model No. 126
-----TABLE I (Continued)

40 Ft. Radius Arena 10-23-52
 Rd. 5 8" Warhead No. 126-5 Filler: Comp. C-3
 Total Weight: 57.75 lbs. Filler Weight: 26.64 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Rod Fragments</u>	<u>Velocity (f/s)</u>
35mm Fastax Camera #1		3240 Frames per sec.
26	7	4980
27	3	4800
28	2	4630
29	1	4470
30	2	4320
Median		4950
Average		4780
35mm Fastax Camera #2		2940 Frames per sec.
23	4	5110
24	3	4900
25	3	4700
26	2	4520
27	2	4360
28	1	4200
Median		4850
Average		4750

Rod Warheads, Model No. 126
-----TABLE I (Continued)

40 Ft. Radius Arena 11-6-52
Rd. 6 8" Warhead No. 126-6 Filler: Comp. C-3
Total Weight: 57.61 lbs. Filler Weight: 26.31 lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Rod Fragments</u>	<u>Velocity (f/s)</u>
35mm Fastax Camera #1		3510 Frames per sec.
28	4	5010
29	5	4840
30	1	4680
31	1	4530
32	3	4390
33	1	4250
Median		4830
Average		4720

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Rod Warheads, Model No. 126

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Attn: Mr. Edward R. C. Niles) 1

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