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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1047

TESTING OF WARHEADS FOR
AIR TARGET GUIDED MISSILES

53rd Partial Report

FRAGMENTATION OF WARHEADS 121-B

FINAL Report

Copy No. 14

Task

Assignment NP6 607-1-32

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REFERENCE DEPARTMENT
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NPG REPORT NO. 1047

Fragmentation of Warheads 127-B

PART A

SYNOPSIS

1. This test of rod-expelling warheads, Naval Ordnance Laboratory Models #127-B, was conducted to determine: (a) the rod velocities, (b) the angular distribution (relative to the axis of the warhead) of the rods, and (c) rod condition when detonated statically.

2. a. The median rod velocity for warhead No. 127-B-2 was 130 ft./sec.

b. Rods from both warheads were randomly distributed about the circumference of the warhead from 1° to 9° apart.

c. All of the rods broke completely from the end plates and remained intact after detonation.

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Fragmentation of Warheads 127-B

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Fragmentation of Warheads 127-B

PART B

INTRODUCTION

1. AUTHORITY:

This test was authorized by reference (a) and conducted under Task Assignment NPG-Re3f-607-1-52, reference (b).

2. REFERENCES:

- a. NOL Conf Work Request WG/32/52 of 17 June 1952
- b. BUORD Conf ltr NP9' Re3f-EJHL:edb Ser 25777 of 18 September 1951
- c. NPG Conf Report No. 930 of 29 February 1952
- d. NPG Conf Report No. 850 of 1 September 1951

3. BACKGROUND:

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

b. The Naval Ordnance Laboratory requested in reference (a) that two model warheads, Naval Ordnance Laboratory Models #127-B-1 and #127-B-2, be statically detonated for rod velocity and spatial distribution tests. The warheads are similar to Naval Ordnance Laboratory Models #127 (reference (c)) and #115 (reference (d)), except that #127-B has a plastic rather than an aluminum fairing. The rod velocity desired is between 100 and 150 ft./sec.

4. OBJECT OF TEST:

This test of rod-expelling warheads, Naval Ordnance Laboratory Models #127-B, was conducted to determine: (a) the rod velocities, (b) the angular distribution (relative to the axis of the warhead) of the rods, and (c) rod condition when detonated statically.

5. PERIOD OF TEST:

- | | |
|-------------------------------------|--------------|
| a. Date Project Letter | 17 June 1952 |
| b. Date Necessary Material Received | 23 June 1952 |
| c. Date Commenced Test | 17 July 1952 |
| d. Date Completed Test | 17 July 1952 |

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Fragmentation of Warheads 127-B

PART C

DETAILS OF TEST

6. DESCRIPTION OF ITEMS UNDER TEST:

a. Rod-expelling warheads, Naval Ordnance Laboratory Models #127-B-1 and #127-B-2, contain 72 hot rolled round steel rods, 0.500 diameter by 13.00 long, arranged in four concentric circular rows. These warheads are identical in design to the warheads #127, reference (c), shown in Figures 1-3. The inner and outer rows of rods are silver brazed to the end plates. The warheads are encased in a 0.063 plastic fairing as opposed to an aluminum fairing in the Model #127 warhead. The two warheads, Models #127-B-1 and #127-B-2, weighing 59.5 lbs. each, differ only in the construction of the plastic fairings. Both fairings have the same dimensions and both are made of glass fiber bonded with a polyester resin, but mat glass fiber is used in the #127-B-1 while #127-B-2 uses a woven glass fiber. The woven fiber (#127-B-2 fairing), which is weaker in one direction than in the other, was oriented on the warhead to favor longitudinal breakup (parallel to rods) on detonation.

b. The expelling charge for each warhead consisted of a 13.50 column of 0.430 diameter tetryl pellets weighing 52 grams loaded into a steel tube which had a wall thickness of 0.062. The charge was inserted into the cavity which extended along the longitudinal axis of each warhead and initiated at the base.

7. PROCEDURE:

a. Velocity and angular distribution of the rods were obtained in a 30 foot radius arena. Each warhead was placed nose down in the center of the arena with its axis vertical and the center of the warhead 6-1/2 feet above ground level. Cane fiberboard panels were placed around the circumference of the arena in the longitudinal zones from 350° to 50° and from 123° to 183° so that the impacts on the fiberboard could be distinguished on the 35mm Fastax film. Figure 4 shows the arena set-up for the test.

b. Velocities were recorded by two 35mm Fastax cameras utilizing the high-speed photographic technique. Camera No. 1 covered zone 350° to 50° and Camera No. 2 covered zone 123° to 183°.

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Fragmentation of Warhead 127-B

8. RESULTS AND DISCUSSION:

a. Detailed rod velocities and distribution data are given in Tables I and II. Satisfactory velocity and distribution data, as well as sample fragments, were obtained for the Naval Ordnance Laboratory Model #127-B-2. Rod angular distribution data and sample fragments only were obtained for Naval Ordnance Laboratory Model #127-B-1 because the cameras did not operate.

b. Angular distribution data are given in Table I and shown in Figures 5 through 8. Sample fragments are shown in Figures 9 and 10. The rods were randomly distributed about the circumference of the warhead from 1° to 9° apart. All rods remained intact after detonation. The median rod velocity (Table II) for warhead #127-B-2 was 130 ft./sec. It may be assumed that the median velocity for warhead #127-B-1 was approximately the same since both warheads had only minor fairing differences and identical expelling charges. These velocities are slightly higher than the 100 ft./sec. median rod velocity reported for warhead #127 (reference (c) data) which had a smaller expelling charge. The larger expelling charge and the weaker fairings in the models #127-B account for the complete breaking of the rods from the end plates and the slightly higher rod velocities.

PART D

CONCLUSIONS

9. a. The median rod velocity for warhead No. 127-B-2 was 130 ft./sec.

b. Rods from both warheads were randomly distributed about the circumference of the warhead from 1° to 9° apart.

c. All the rods broke completely from the end plates and remained intact after detonation.

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Fragmentation of Warheads 127-B

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

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Fragmentation Division
Terminal Ballistics Department

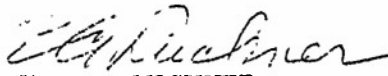
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Commander, Naval Proving Ground


E. A. RUCKNER
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Ordnance Officer
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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Fifty-Third Partial Report
on
Testing of Warheads for Air Target Guided Missiles

Final Report
on
Fragmentation of Warheads 127-B

Project No.: NPG-Re3f-607-1-52
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Date: SEP 29 1952

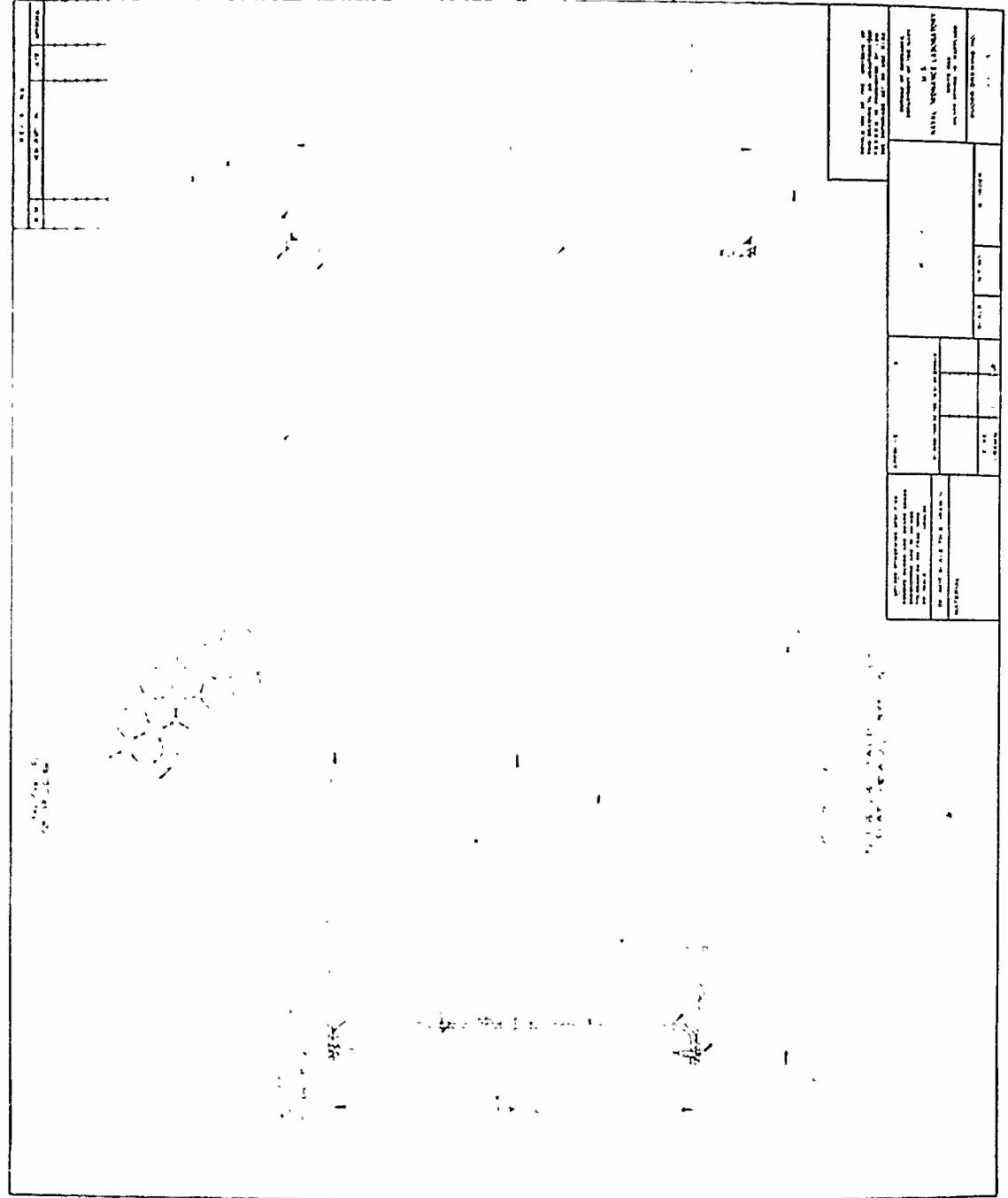
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26 Nov 1951

Rod-expelling Warhead NOL Model 127
BUORD Drawing No. SK 351302
Figure 1

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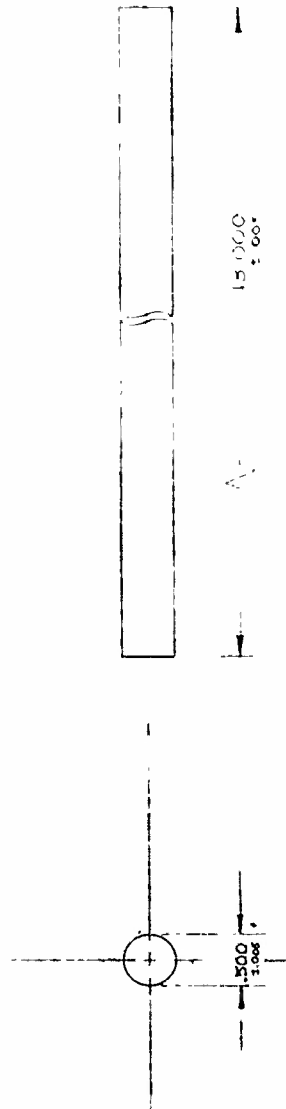


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26 Nov 1951
Rod for Rod-expelling Warheads NOL Models 127 and 128
BUORD Drawing No. SK 347455
Figure 2

REVISIONS		
SYM	DESCRIPTION	DATE



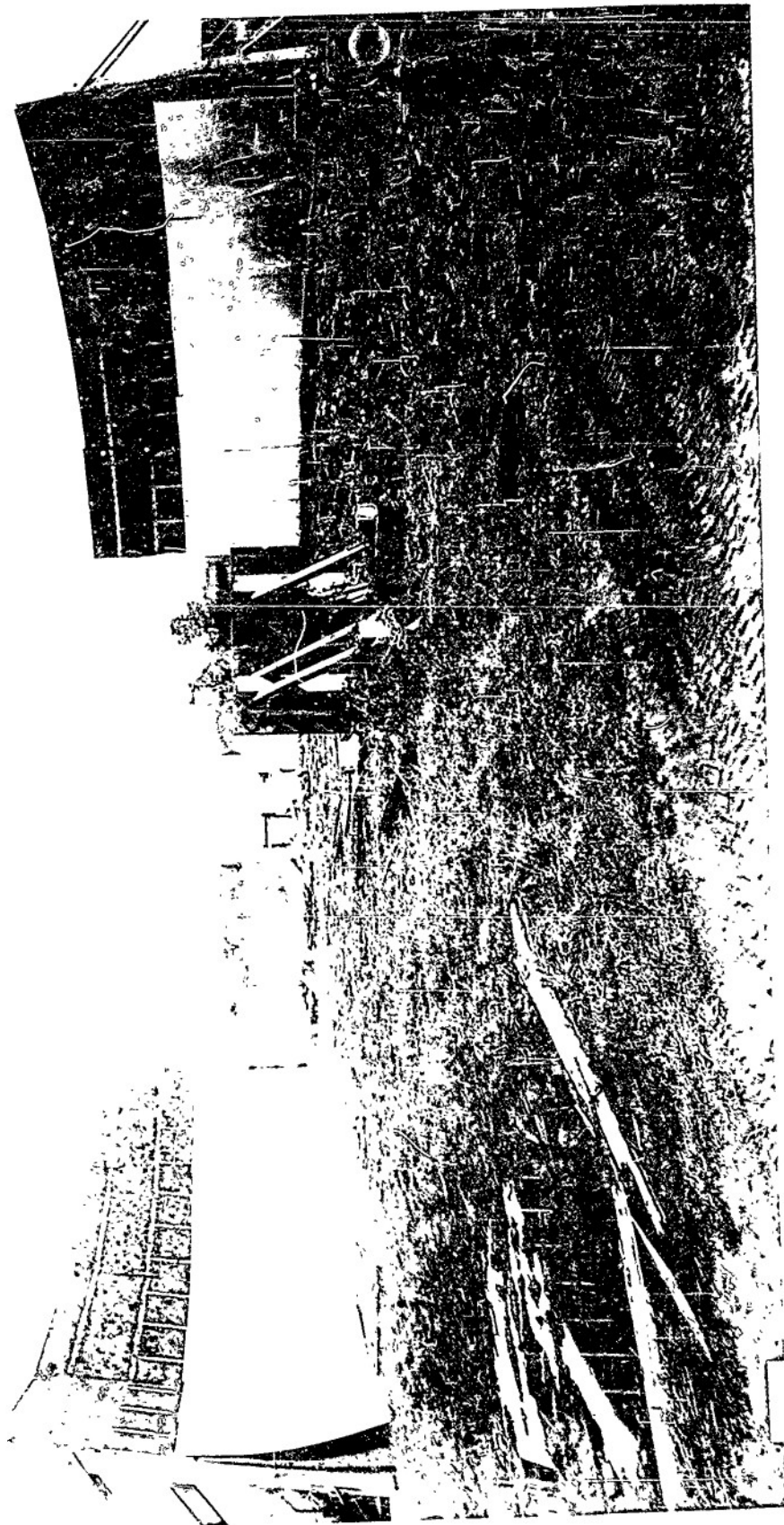
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ROD FOR TRIAL WARHEAD #128		BUORD DRAWING NO. SK-347455	
APPROVED BY INJECTION OF THE CHIEF OF BUREAU	18	SCALE FULL	UNIT WT. JOB ORDER
CHECKED DRAWN	GR FF N 18 51	MATERIAL HOT ROLLED STEEL BAR STOCK	

NP9-47027

26 Nov 1951

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Field Set-up for Fragmentation Test of Rod-expelling warheads, NOL Models 127 and 128
Figure 4



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Fragmentation of Warheads 127-B

TABLE I (a)

ANGULAR DISTRIBUTION DATA

Rd. 1 - Warhead #127-B-1
Weight of Warhead - 59.5 lbs

Tetryl Booster - 52 grams

Longitudinal Zone

No. of Rods

351°	1
353°	1
358°	1
2°	1
9°	1
12°	1
21°	1
23°	1
31°	1
33°	1
41°	1
43°	1
85°	1
130°	1
133°	1
140°	1
145°	1
151°	1
153°	1
160°	1
162°	1
170°	1
174°	1
181°	1

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APPENDIX C

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Fragmentation of Warheads 127-B

TABLE I (b)

ANGULAR DISTRIBUTION DATA

Rd. 2 Warhead #127-B-2
Weight of Warhead - 59.5 lbs.

Tetryl Booster - 52 grams

<u>Longitudinal Zone</u>	<u>No. of Rods</u>
353°	1
357°	1
4°	1
11°	1
12°	1
19°	1
27°	1
29°	1
33°	1
35°	1
41°	1
50°	1
60°	1
83°	1
130°	1
134°	1
140°	1
143°	1
150°	1
155°	1
160°	1
161°	1
170°	1
172°	1
179°	1

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APPENDIX C

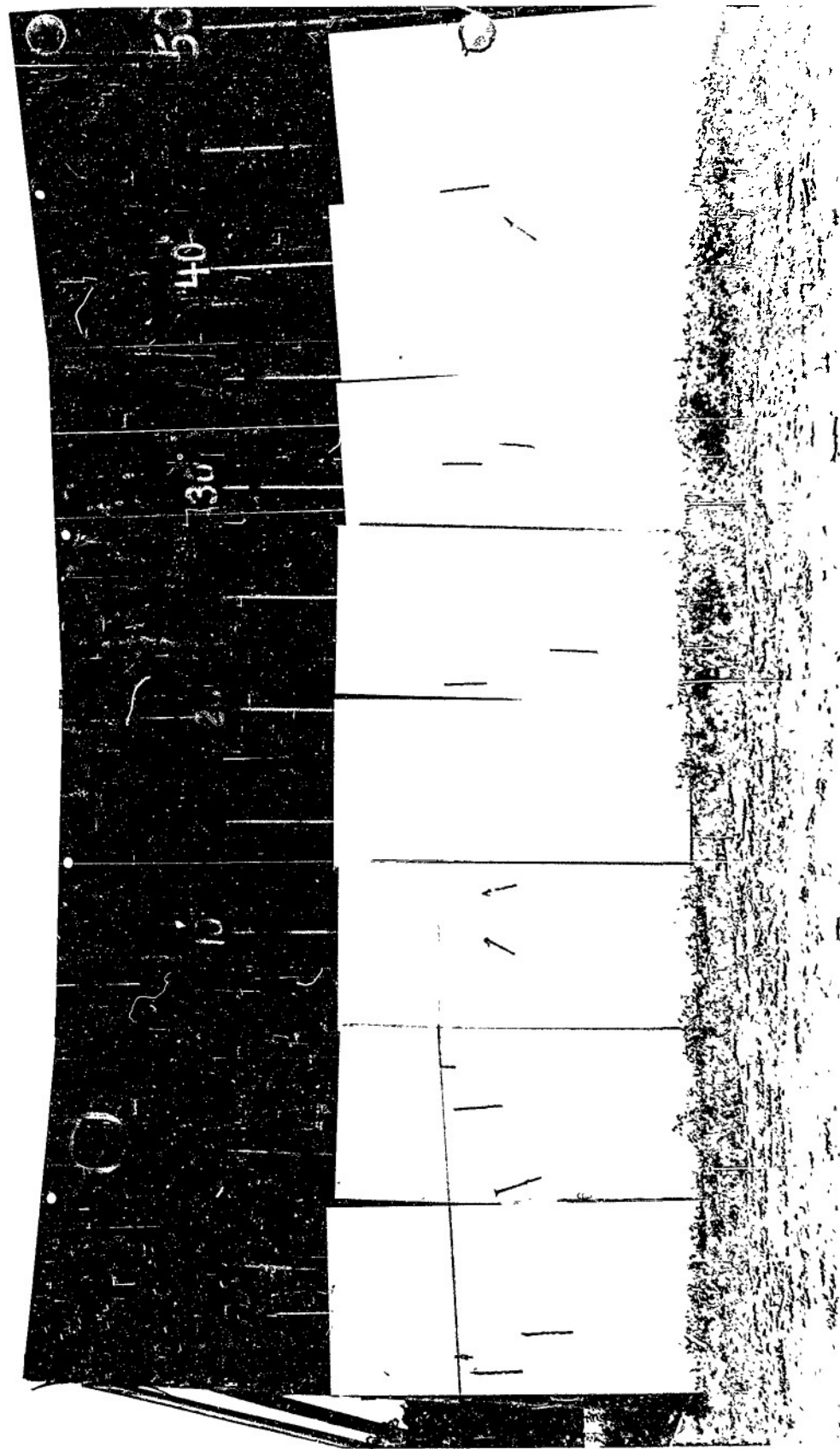
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17 JULY 1952

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View of longitudinal zone 350°-50° after detonation of Warhead Model (29-1) showing red impacts on fiberboard.

FIGURE 5



NP9-53726

17 JULY 1952

View of longitudinal zone 123°-183° after detonation of barbed total 127-2-1 showing 1703
impacts on fiberboard.

FIGURE 6



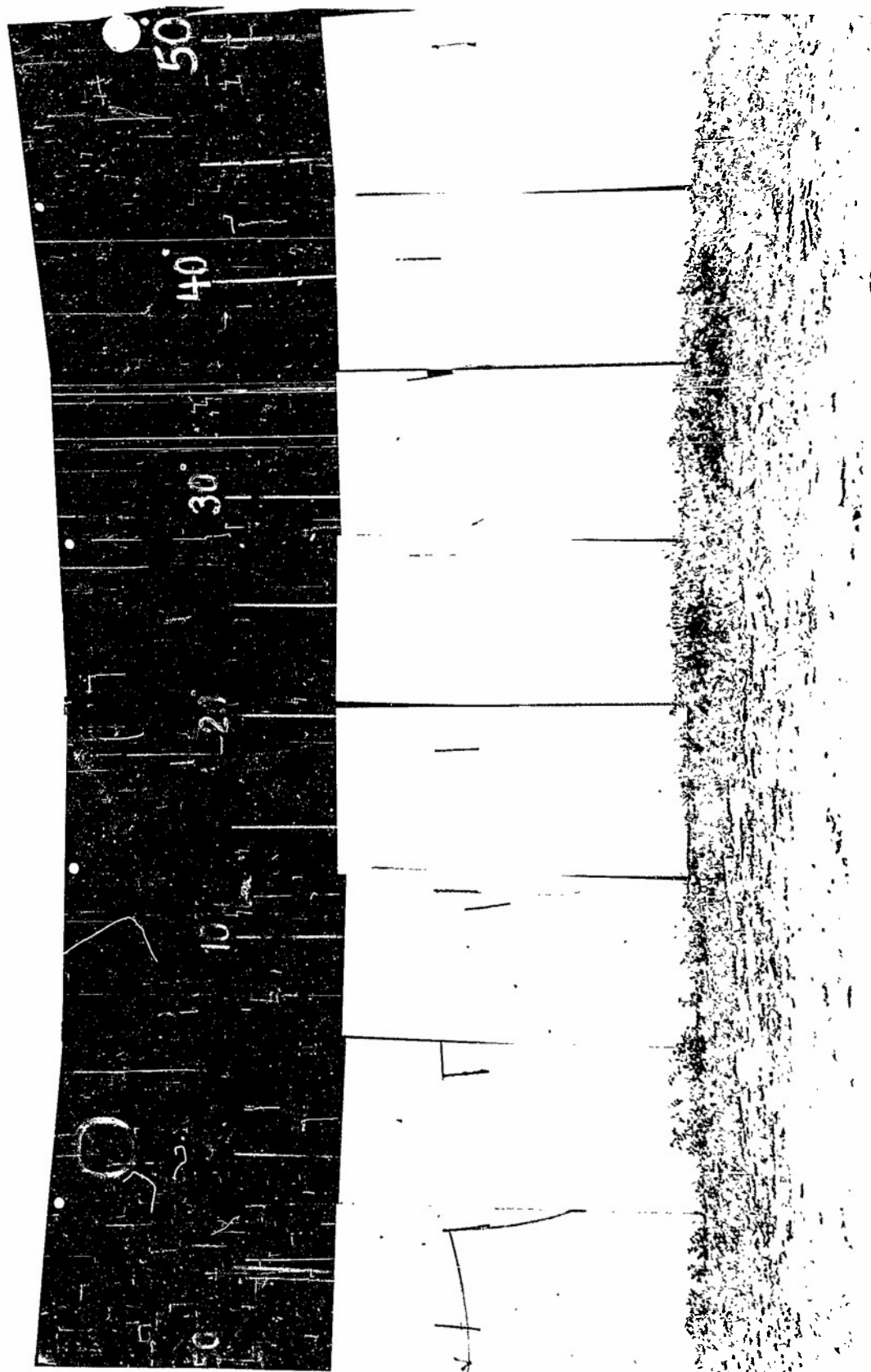
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View of longitudinal zone 35°-50° after detonation of Warhead Model 127-B-2 showing rod impacts on fiberboard.

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FIGURE 7



PO-40728
17 JULY 1952
Went on long flight for 1st day of mission of 40728
17 JULY 1952
17 JULY 1952



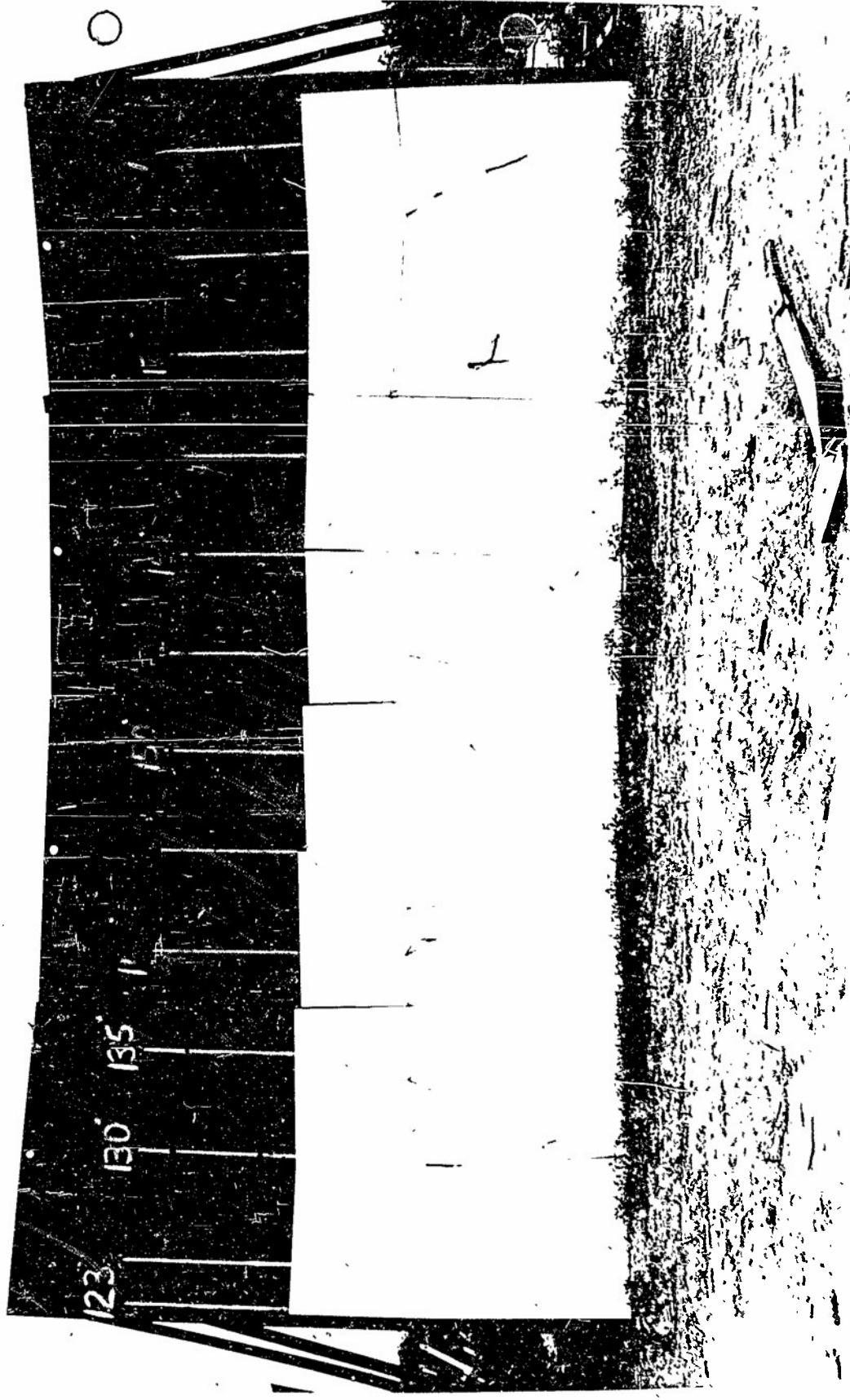
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View of longitudinal zone 120-135 after detonation of Karhe 1 model 127-1-2 showing rod impacts on fiberboard.



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Fragmentation of Warheads 127-E

TABLE II

FRAGMENT VELOCITY DATA

30 Ft. Radius Arena 990 Frames per sec.
35mm Fastax Camera 1 Filler: Tetrvl
Rd. 2 - Warhead #127-B-2 Filler Weight: 52 grams
Total Weight 59.5 lbs.

<u>Zone</u>	<u>Frame in Which Hit Occurred</u>	<u>No. Rods</u>	<u>Velocity (f/s)</u>
4°	162	1	180
29°	196	1	150
12°	206	1	140
35°	230	1	130
11°	236	1	130
33°	238	1	120
50°	241	1	120
19°	244	1	120
27°	246	1	120
353°	269	1	110
357°	269	1	110
Median			125
Average			130

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Fragmentation of Warheads 127-B

TABLE II (Continued)

FRAGMENT VELOCITY DATA

30 Ft. Radius Arena 990 Frames per sec.
35mm Fastax Camera 2 Filler: Teteryl
Rd. 2 - Warhead #127-B-2 Filler Weight: 52 grams
Total Weight: 59.5 lbs.

<u>Zone</u>	<u>Frame in Which Hit Occurred</u>	<u>No. Rods</u>	<u>Velocity (f/s)</u>
134°	196	1	150
150°	210	1	140
143°	224	1	130
130°	236	1	130
155°	236	1	130
170°	244	1	120
160°	248	1	120
140°	253	1	120
Median			130
Average			130

FRAG NO. 1226

WARHEAD NO 127-B-1
WEIGHTS BELOW FRAGMENTS IN GRAMS.
RODS.

N.P.9 50723

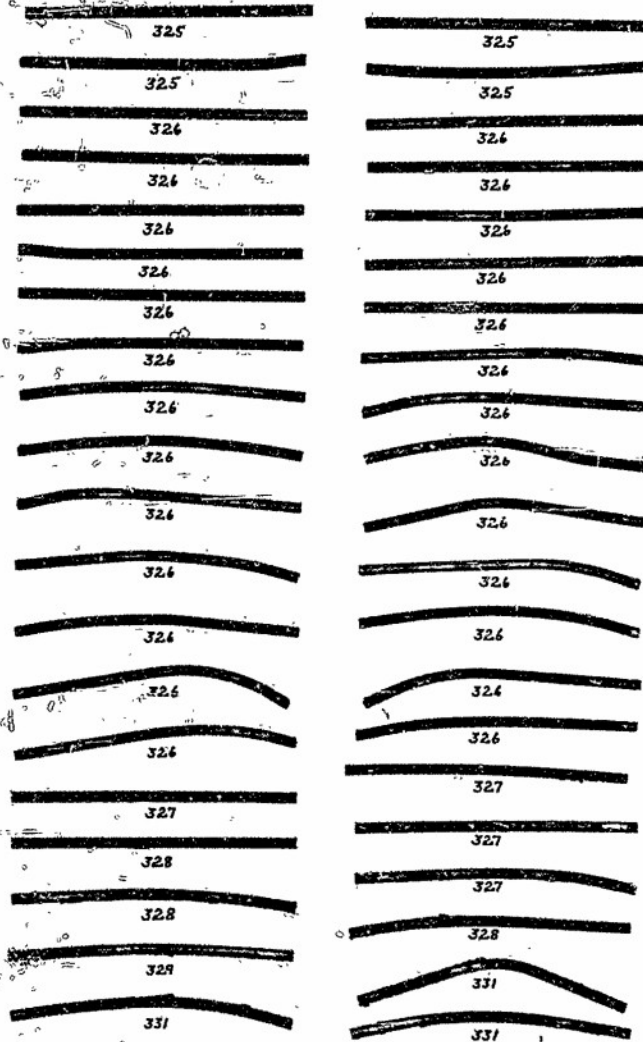
FAIRING

END PLATES.

36

420

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SCALE 1"

NP9-50723

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Rods, End plates, and Fairing recovered from Warhead Model 127-B-1.

FIGURE 9

FRAG NO. 1467

END PLATES.



WARHEAD NO 127-B-2
BELOW FRAGMENTS IN GRAMS.
RODS.

N.P.9 50734

FAIRING.



Investigation, and Police Subverted from National Police Force

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Fragmentation of Warheads 127-B

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