

UNCLASSIFIED

ATI 208900 -

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION, ALEXANDRIA, VIRGINIA

AUTHORITY

Naval Surface Weapons Center

- 29 Aug. 75



UNCLASSIFIED

FILE COPY



CONFIDENTIAL
SECURITY INFORMATION

983-0112

2p no. 7846

55-5-27864

U. S. NAVAL PROVING GROUND	
DAHLGREN, VIRGINIA	
208900	REPORT NO. 968
FRAGMENTATION OF PROJECTILES AND WARHEADS	
<u>18th</u> Partial Report	

STATIC FRAGMENTATION OF	
BRANDT 120mm MORTAR AMMUNITION	
<u>FINAL</u> Report	Task
Copy No. <u>9</u>	Assignment <u>MPG-Re2c-35-1-52</u>
	Classification <u>CONFIDENTIAL</u>
	<u>SECURITY INFORMATION</u>

NAVY DEPT.

1952 JUN 7 15 06

BURO
RECEIVED

JUN 7 1955

55 AA

21153

CONFIDENTIAL

Static Fragmentation of Brandt 120mm Mortar Ammunition

PART ASYNOPSIS

1. This test was conducted to determine the fragmentation characteristics of Light and Heavy Brandt 120mm mortar ammunition.
2. The fragmentation characteristics of the Light and Heavy 120mm Brandt Mortars were as follows:

	<u>Light</u>	<u>Heavy</u>
No. Hits in total polar zone 50° - 140°	873	1340
Median Fragment Velocity (ft/sec) in polar zone 80° - 110°	3930	4900
No. Head Fragments in weight Groups:		
5/8 - 2 1/2 grams	768	1236
2 1/2 - 10 grams	564	715
10 - 40 grams	237	188
40 - 160 grams	7	29

JUN 7 1955

55 AA 21153

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE OF CONTENTS

	<u>Page</u>
SYNOPSIS	1
TABLE OF CONTENTS.	2
AUTHORITY.	3
REFERENCES	3
BACKGROUND	3
OBJECT OF TEST	3
PERIOD OF TEST	3
DESCRIPTION OF ITEMS UNDER TEST.	4
PROCEDURE.	5
RESULTS AND DISCUSSION	6
CONCLUSIONS.	7
APPENDIX A - 120mm MORTARS, PHOTOGRAPHS. . . .	FIGURES 1-3 (Incl)
APPENDIX B - FRAGMENT SPACE DISTRIBUTION . . .	TABLE I 1-2 (Incl) TABLE II 1-2 (Incl)
APPENDIX C - FRAGMENT VELOCITY DATA.	TABLE III 1-6 (Incl) TABLE IV 1-6 (Incl)
APPENDIX D - FRAGMENT MASS DISTRIBUTION. . . .	TABLES V-VI (Incl) FIGURES 4-13 (Incl)
APPENDIX E - DISTRIBUTION.	1-2 (Incl)

CONFIDENTIAL
SECURITY INFORMATION

Static Fragmentation of Brandt 120mm Mortar Ammunition
-----PART BINTRODUCTION

1. AUTHORITY:

This test was authorized by reference (a) and conducted under Task Assignment NPG-Re2c-35-1-52, reference (b).

2. REFERENCES:

- a. BUORD Conf ltr NP9 Re2c-HRK:bac Ser 28034 of 7 Nov 1951
- b. BUORD Conf ltr NP9 Re2c-HRK:saw Ser 23964 of 4 Aug 1951
- c. CMC Restr ltr AO-11-mlb to BUOKD of 23 July 1951
- d. Picatinny Arsenal Restr Report Serial No. 1823 of 14 Aug 1951

3. BACKGROUND:

The Commandant of the Marine Corps requested the Bureau of Ordnance in reference (c) to give standard Navy tests for storage compatibility, handling, shipment, and fragmentation of Brandt 120mm mortar ammunition. Reference (a) requested the Proving Ground to determine the fragmentation characteristics of light and heavy Brandt 120mm mortar ammunition.

4. OBJECT OF TEST:

This test was conducted to determine the fragmentation characteristics of light and heavy Brandt 120mm mortar ammunition.

5. PERIOD OF TEST:

- | | |
|---|------------------|
| a. Date Project Letter | 7 November 1951 |
| b. Date All Necessary Material Received | 3 January 1952 |
| c. Date Commenced Test | 8 January 1952 |
| d. Test Completed | 18 February 1952 |

Static Fragmentation of Brandt 120mm Mortar Ammunition

PART C

DETAILS OF TEST

6. DESCRIPTION OF ITEMS UNDER TEST:

Two types of Brandt 120mm Mortars, light and heavy, were tested. Reference (d) contained examination data of both types which were obtained by Picatinny Arsenal. Some of these data are included in the following descriptions.

a. Light Mortar	<u>Approx. Wt. and Dimensions</u>
Empty shell, w/o Fin Assembly	18.9 lbs.
Nose Fuze, modified at NOL	.4 lbs.
Fin Assembly (empty)	3.2 lbs.
*Explosive Load	5.9 lbs.
Total Weight before fragmentation	28.4 lbs.
Length of Shell with adapter	16.15 inches
Diameter at Bourrelet	4.682 inches
Wall thickness at forward bourrelet	0.478 inches
Wall thickness 1" forward of base cavity	0.329 inches
b. Heavy Mortar	<u>Approx. Wt. and Dimensions</u>
Empty shell, w/o Fin Assembly	24.0 lbs.
Nose Fuze, modified at NOL	.4 lbs.
Fin Assembly (empty)	3.2 lbs.
*Explosive Load	9.7 lbs.
Total Weight before fragmentation	37.3 lbs.
Length of shell with adapter	21.91 inches
Diameter at Bourrelet	4.684 inches
Wall thickness at forward bourrelet	0.381 inches
Wall thickness 1" forward of base cavity	0.244 inches

* The explosive loads of these mortars were as follows:

<u>Charge</u>	<u>Explosive</u>	<u>Light</u>	<u>Heavy</u>
Booster	Picric Acid	.04	.05
Core	TNT	.23	1.12
Bursting	TNT	<u>5.68</u>	<u>8.54</u>
Total explosive charge weight:		5.95	9.71

Static Fragmentation of Brandt 120mm Mortar Ammunition

All mortars detonated in these tests were with empty fin assemblies. All fuzes were combination point detonating or delay, Type V18-1-R, and were modified by the Naval Ordnance Laboratory for static detonation. Photographs of these mortars are shown in Figures 1, 2, and 3.

7. PROCEDURE:

a. Space distribution data were obtained in a 30' radius semi-circular space distribution arena having 1/8" mild steel panels 5' high, marked off into 5° polar angle zones about the axis of the mortar with the nose pointing toward 0°. Complete penetrations of the panels were recorded.

b. Fragment velocity determinations were obtained by the usual high speed photographic technique in a 30 foot radius arena. The camera used was a 35mm Fastax. Fragment velocities obtained are the mean velocities over the first thirty feet of travel of beam spray (polar angle 80° - 110°) fragments.

c. The determination of fragment mass distribution was conducted in a sawdust-filled chamber. Each mortar was supported on its side in a cane fiberboard box. After each detonation, the sawdust was sifted and the fragments collected with the tail (fin) assembly fragments and the fuze fragments separated and classified separately from the mortar body fragments.

d. The forty rounds of mortars were fired as follows:

<u>Mortar Type</u>	<u>No. of Rounds</u>		
	<u>Mass</u>	<u>Space</u>	<u>Velocity</u>
Heavy	5	9	6
Light	5	9	6

Static Fragmentation of Brandt 120mm Mortar Ammunition

8. RESULTS AND DISCUSSION:

a. Space Distribution:

Detailed space distribution data are listed in Tables I and II and the nine (9) round average of fragment hits per total zones are summarized as follows:

<u>Polar Zone</u>	<u>Light Mortar</u>	<u>Heavy Mortar</u>
0°-50°	4	8
50°-90°	232	293
90°-110°	590	928
110°-140°	51	119
140°-180°	<u>0</u>	<u>0</u>
Totals (0°-180°)	877	1348

The heavy 120mm mortar produced an average of approximately 50% more fragment hits than the light mortar.

b. Fragment Velocity:

Detailed fragment velocity data are listed in Tables III and IV and are summarized as follows:

<u>Mortar Type</u>	<u>6 Rd. Average Median Fragment Velocity</u> <u>Polar Angle Zone (80°-110°)</u>
Light	3930 ft./sec.
Heavy	4900 ft./sec.

The average median fragment velocity of the heavy 120mm mortar was approximately 25% higher than that of the light 120mm mortar.

Static Fragmentation of Brandt 120mm Mortar Ammunition

c. Mass Distribution:

Detailed fragment mass distribution data are listed in Tables V and VI and photographs of each round are shown in Figures 4 to 13 inclusive. The data are summarized as follows.

<u>Mortar Type</u>	<u>5 Rd. Average Number of Fragments</u>					
	<u>5/8-2 1/2</u>	<u>2 1/2-10</u>	<u>10-40</u>	<u>40-160</u>	<u>160-640</u>	<u>640+</u>
	<u>grams</u>	<u>grams</u>	<u>grams</u>	<u>grams</u>	<u>grams</u>	<u>grams</u>
Light	768	564	237	7	0	0
heavy	1236	715	183	29	1	0

PART DCONCLUSIONS

9. The fragmentation characteristics of the Light and heavy 120mm Brandt Mortars were as follows:

	<u>Light</u>	<u>Heavy</u>
No. Hits in total polar zone 50° - 140°	873	1340
Median Fragment Velocity (ft/sec) in polar zone 80° - 110°	3930	4900
No. Head Fragments in weight Groups:		
5/8 - 2 1/2 grams	768	1236
2 1/2 - 10 grams	564	715
10 - 40 grams	237	188
40 - 160 grams	7	29

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

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

V. PHILIPCHUK, Fragmentation Battery Officer,
Fragmentation Division,
Terminal Ballistics Department

This report was prepared by:

V. PHILIPCHUK, Fragmentation Battery Officer,
Fragmentation Division,
Terminal Ballistics Department

This report was reviewed by:

R. H. LYDDANE, Director of Research
Terminal Ballistics Department
W. B. ROBERTSON, Lieutenant Commander, USN
Terminal Ballistics Batteries Officer
Terminal Ballistics Department
R. T. RUELE, Lieutenant Commander, USN
Terminal Ballistics Officer
Terminal Ballistics Department
C. C. BRAMBLE, Director of Research, Ordnance Group

APPROVED: IRVING T. DUKE
Rear Admiral, USN
Commander, Naval Proving Ground


C. T. MAURO
Captain, USN
Ordnance Officer
By direction

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 968

**U. S. NAVAL PROVING GROUND
DALLGREN, VIRGINIA**

Eighteenth Partial Report

on

Fragmentation of Projectiles and Warheads

Final Report

on

**Static Fragmentation of
Brandt 120mm Mortar Ammunition**

JUN 7 1955

55 A A

21153

**Project No.: NPG-Re2c-35-1-52
Copy No.: 9
No. of Pages: 8**

Date: MAY 6 1952

**CONFIDENTIAL
SECURITY INFORMATION**

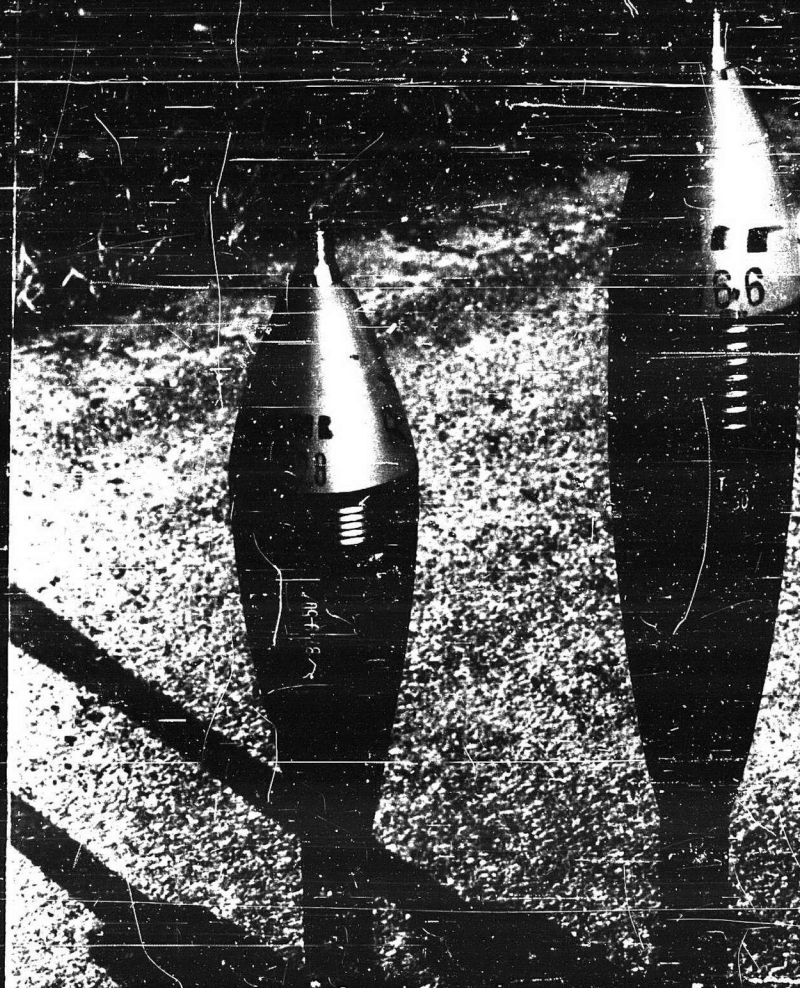
NP0-48549

8 JANUARY 1952

CONFIDENTIAL
SECURITY INFORMATION

Light and Heavy Braadt 120mm Mortar Ammunition

Figure 1



CONFIDENTIAL DAHLGREN, VIRGINIA

NPd-47541

8 JANUARY 1952

CONFIDENTIAL
SECURITY INFORMATION

- Sectioned View of Light Brardt 120mm Mortar.
1. Bursting Charge
 2. Core
 3. Shell Body
 4. Booster Cup
 5. Booster Charge
 6. Fuze Well Cup
 7. Adapter

Figure 2



NP9-47542

18 JANUARY 1952

CONFIDENTIAL
SECURITY INFORMATION

Sectioned View of Heavy Brant 120mm Mortar.
3. Shell-body
4. Booster Surround
5. Booster Charge
6. Fuze Well Cup
7. Booster Cup
8. Nose Adapter

1. Bursting Charge
2. Core

Figure 3



Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE I

SPACE DISTRIBUTION DATA

30' Radius Space Arena
1/8" MS panels 5" high
120mm Light Brandt Mortars

8 January 1952

Zone, Degrees	Rd. <u>1</u>	Rd. <u>2</u>	Rd. <u>3</u>	Rd. <u>4</u>	Rd. <u>5</u>	Rd. <u>6</u>	Rd. <u>7</u>	Rd. <u>8</u>	Rd. <u>9</u>
0-5	.5	.5		.5			.5		
5-10									
10-15									
15-20									
20-25									
25-30									
30-35								1	1
35-40									
40-45									
45-50									
50-55				1					
55-60	1	1		2	1	1		1	
60-65	3		1	1	3	1	1		2
65-70	1	2	1		1			2	1
70-75	3	1	1	1		1			1
75-80	1	3				1		1	1
80-85	1	1	1		1		2		
85-90		4			2			2	1
90-95	4	1	6	3	4	8	2	5	3
95-100	3	4	7	4		2	4	2	3
100-105	5	6	6	5	3	5	4	3	9
105-110	4	3	3	4	5	2	7	1	4
110-115			1		1			1	1
115-120				1	2	1			
120-125					1	1			
125-130			1			1	1		1
130-135			1				1	1	
135-140									
140-145									
145-150									
150-155									
155-160									
160-165									
165-170									
170-175									
175-180									

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE I (Continued)SPACE DISTRIBUTION DATA

30' Radius Space Arena
1/8" MS panels 5" high
120mm Light Brandt Mortars

8 January 1952

<u>Zone, Degrees</u>	<u>Average Impacts Per 5° Zone on Panel</u>	<u>Average Impacts Per Total 5° Zone</u>	<u>Average Impacts Per Unit Solid Angle</u>
0-5	0.2	.4	17
5-10			
10-15			
15-20			
20-25			
25-30			
30-35	0.2	4	14
35-40			
40-45			
45-50			
50-55	0.1	3	7
55-60	0.8	25	60
60-65	1.3	44	89
65-70	0.9	30	60
70-75	0.9	30	60
75-80	0.8	30	60
80-85	0.7	30	50
85-90	1	40	70
90-95	4	150	300
95-100	3.2	119	220
100-105	5.1	188	350
105-110	3.7	133	250
110-115	0.4	13	30
115-120	0.4	13	30
120-125	0.2	6	14
125-130	0.4	11	30
130-135	0.3	8	20
135-140			
140-145			
145-150			
150-155			
155-160			
160-165			
165-170			
170-175			
175-180			

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE II

SPACE DISTRIBUTION DATA

30' Radius Space Arena
1/8" M6 panels 5" high
120mm Heavy Brandt Mortars

8 January 1952

Zone, Degrees	Rd. <u>1</u>	Rd. <u>2</u>	Rd. <u>3</u>	Rd. <u>4</u>	Rd. <u>5</u>	Rd. <u>6</u>	Rd. <u>7</u>	Rd. <u>8</u>	Rd. <u>9</u>
0-5	.5	.5			.5	.5		.5	.5
5-10									
10-15									
15-20			1	1					
20-25	1								
25-30									
30-35									
35-40				1					
40-45									
45-50									
50-55									
55-60			1						
60-65	1	2	1		1		4	2	
65-70	2	2	1	1	3	1	3	3	2
70-75	1	2	2	4	1	2	2	2	2
75-80		1	1	4		1	2		1
80-85		1	2	3		8			
85-90	1		4						
90-95	7	3	1	3	3	3	3	2	6
95-100	11	4	5	6	4	7	9	6	9
100-105	2	8	7	7	13	6	6	10	6
105-110	6	10	9	6	9	6	7	7	9
110-115	4	2	2	2	2	3		1	1
115-120					2		1	4	1
120-125	1	1			1		1		
125-130		1							
130-135				1					
135-140	1	1							
140-145									
145-150									
150-155									
155-160									
160-165									
165-170									
170-175									
175-180									

CONFIDENTIAL
SECURITY INFORMATION

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE II (Continued)SPACE DISTRIBUTION DATA

30' Radius Space Arena
1/8" MS panels 5" high
120mm Heavy Brandt Mortars

8 January 1952

<u>Zone, Degrees</u>	<u>Average Impacts Per 5° Zone on Panel</u>	<u>Average Impacts Per Total 5° Zone</u>	<u>Average Impacts Per Unit Solid Angle</u>
0-5	0.3	.6	30
5-10			
10-15			
15-20	0.2	2	13
20-25	0.2	3	13
25-30			
30-35			
35-40	0.1	2	7
40-45			
45-50			
50-55			
55-60	0.1	3	7
60-65	1	30	70
65-70	2	70	140
70-75	2	70	140
75-80	1	40	70
80-85	1.6	60	110
85-90	0.6	20	40
90-95	3.4	128	230
95-100	6.8	250	470
100-105	7.2	270	500
105-110	7.7	280	530
110-115	1.9	66	130
115-120	0.9	30	60
120-125	0.4	12	30
125-130	0.1	3	7
130-135	0.1	3	7
135-140	0.2	5	13
140-145			
145-150			
150-155			
155-160			
160-165			
165-170			
170-175			
175-180			

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE III

FRAGMENT VELOCITY DATA

35mm Fastax Camera

3270 frames per sec.

Rd. 1, Light 120mm

TNT Filler

Total Weight 28.34 Lbs.

Filler Weight 5.95 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
21	5	4670
22	5	4460
23	12	4270
24	4	4090
25	5	3920
26	9	3770
27	7	3630
28	3	3500
29	4	3380
30	7	3270
31	5	3160
33	2	2970
Median		3900
Average		3840

Static Fragmentation of Brandt 120mm Mortar Ammunition
-----TABLE III (Continued)FRAGMENT VELOCITY DATA

35mm Fastax Camera

3270 frames per sec.

Rd. 2, Light 120mm

TNT Filler

Total Weight 28.44 Lbs.

Filler Weight 5.95 Lbs.

<u>Frame in which hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
21	3	4670
22	7	4460
23	14	4270
24	9	4090
25	7	3920
26	9	3770
27	8	3630
28	8	3500
29	7	3380
30	5	3270
31	3	3160
33	1	2970
Median		3950
Average		3860

Static Fragmentation of Brandt 120mm Mortar Ammunition
-----TABLE III (Continued)FRAGMENT VELOCITY DATA

35mm Fastax Camera

3240 frames per sec.

Rd. 3, Light 120mm

TNT Filler

Total Weight 28.23 Lbs.

Filler Weight 5.95 Lbs.

<u>Frame in which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
22	13	4420
23	9	4230
24	7	4050
25	6	3890
26	7	3740
27	8	3600
28	14	3470
29	6	3350
30	5	3240
31	1	3140
32	1	3040
Median		3800
Average		3810

Static Fragmentation of Brandt 120mm Mortar Ammunition
-----TABLE III (Continued)FRAGMENT VELOCITY DATA

35mm Fastax Camera

3210 frames per sec.

Rd. 4, Light 120mm

TNT Filler

Total Weight 28.24 Lbs.

Filler Weight 5.95 Lbs.

<u>Frame in which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
20	1	4820
21	15	4590
22	10	4380
23	7	4190
24	12	4010
25	12	3850
26	14	3700
27	11	3570
28	9	3440
29	4	3320
31	1	3110
Median		4010
Average		3950

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE III (Continued)

FRAGMENT VELOCITY DATA

35mm Fastax Camera

3090 frames per sec.

Rd. 5, Light 120mm

TNT Filler

Total Weight 28.28 Lbs.

Filler Weight 5.95 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
20	5	4640
21	10	4410
22	13	4210
23	14	4030
24	8	3860
25	10	3710
26	11	3570
27	15	3430
28	8	3310
29	1	3200
30	2	3090
Median		3950
Average		3850

CONFIDENTIAL
SECURITY INFORMATION

NPG REPORT NO. 968

.....

FRAGMENT VELOCITY DATA

3125 frames per sec.

TNT Filler

Filler Weight 5.95 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (i/s)</u>
21	5	4460
22	13	4260
23	9	4080
24	8	3910
25	11	3750
26	12	3610
27	6	3470
28	13	3350
29	7	3230
30	6	3130
Median		3940
Average		3730

6

APPENDIX C

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE IV

FRAGMENT VELOCITY DATA

35mm Fastax Camera

3225 frames per sec.

Rd. 1, Heavy 120mm

TNT Filler

Total Weight 36.91 Lbs.

Filler Weight 9.71 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
17	1	5690
18	6	5380
19	23	5090
20	38	4840
21	23	4610
22	12	4400
23	4	4210
Median		4920
Average		4810

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE IV (Continued)

FRAGMENT VELOCITY DATA

35mm Fastax Camera

3240 frames per sec.

Rd. 2, Heavy 120mm

TNT Filler

Total Weight 37.49 Lbs.

Filler Weight 9.71 Lbs.

<u>Frame in which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
18	15	5400
19	21	5120
20	26	4860
21	25	4630
22	18	4420
23	8	4230
24	4	4050
25	2	3890
Median		4900
Average		4770

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE IV (Continued)

FRAGMENT VELOCITY DATA

35mm Fastax Camera

3240 frames per sec.

Rd. 3, Heavy 120mm

TNT Filler

Total Weight 37.18 Lbs.

Filler Weight 9.71 Lbs.

<u>Frame in Which hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
16	1	6080
17	1	5720
18	9	5400
19	30	5120
20	34	4860
21	10	4630
22	6	4420
23	1	4230
24	3	4050
Median		5050
Average		4930

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE IV (Continued)

FRAGMENT VELOCITY DATA

35mm Fastax Camera

3240 frames per sec.

Rd. 4, Heavy 120mm

TNT Filler

Total Weight 36.68 Lbs.

Filler Weight 9.71 Lbs.

<u>Frame in which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
18	6	5400
19	18	5120
20	27	4860
21	24	4630
22	12	4420
23	5	4230
24	2	4050
25	2	3890
26	1	3740
27	3	3600
Median		4860
Average		4720

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

TABLE IV (Continued)

FRAGMENT VELOCITY DATA

35mm Fastax Camera	3210 frames per sec.
Rd. 5, Heavy 120mm	TNT Filler
Total Weight 37.20 Lbs.	Filler weight 9.71 Lbs.

<u>Frame in which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
18	17	5350
19	12	5070
20	18	4820
21	31	4590
22	11	4380
23	2	4190
Median		4940
Average		4810

Static Fragmentation of Brandt 120mm Mortar Ammunition
-----TABLE IV (Continued)FRAGMENT VELOCITY DATA

35mm Fastax Camera

3240 frames per sec.

Rd. 6, Heavy 120mm

TNT Filler

Total weight 37.33 Lbs.

Filler Weight 9.71 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
19	8	5120
20	25	4860
21	28	4630
22	17	4420
23	8	4230
24	2	4050
Median		4750
Average		4650

CONFIDENTIAL

Static Fragmentation of Brandt 120mm Mortar Ammunition

MFG REPORT NO. 968

TABLE V

MASS DISTRIBUTION DATA

FRAGMENTATION OF LIGHT 120mm BRANDT MORTARS:

NUMBER AND WEIGHT OF RECOVERED FRAGMENTS

Comp. Filler		Frag.										TOTAL		Photo. No.										
Rd. Wt. lb.	Wt. lb.	Grams	Wt.	Grams	Wt.	Grams	Wt.	Grams	Wt.	Grams	Wt.	Grams	Wt.											
No. lb.	lb.	Grams	Wt.	Grams	Wt.	Grams	Wt.	Grams	Wt.	Grams	Wt.	Grams	Wt.	No. MP9										
HEAD																								
1	28.29	5.95	564	418	485	722	412	1159	329	1581	236	2261	163	1754	70	83	2	--	217	90	8759	1787	48314	
2	28.65	5.95	461	392	472	668	389	1129	325	1555	235	2298	168	2097	79	315	7	--	187	82	9102	1757	48518	
3	28.33	5.95	367	278	324	605	354	1154	320	2052	293	2090	152	1687	62	247	9	--	223	88	8703	1602	48540	
4	28.35	5.95	382	320	365	574	327	1013	284	1584	226	2458	182	1824	67	594	13	--	154	127	8903	1591	48644	
5	28.31	5.95	374	328	387	555	323	1100	308	1809	263	2209	164	2027	77	290	6	--	207	107	8897	1635	48645	
TAIL																								
1	--	--	--	--	--	3	2	7	2	6	1	12	1	58	2	42	1	1019	1	--	--	1147	10	48314
2	--	--	--	--	--	2	1	3	1	12	2	24	2	75	3	--	--	1131	1	--	--	1247	10	48518
3	--	--	--	--	--	--	--	--	--	9	1	11	1	94	3	--	--	1129	1	--	--	1243	6	48540
4	--	--	--	--	--	--	--	4	1	--	--	47	4	65	2	--	--	1116	1	--	--	1232	8	48644
5	--	--	--	--	--	--	--	8	2	7	1	42	3	53	2	--	--	1122	1	--	--	1232	9	48645

HEAD

TAIL

1	--	--	--	--	--	3	2	7	2	6	1	12	1	58	2	42	1	1019	1	--	--	1147	10	48314
2	--	--	--	--	--	2	1	3	1	12	2	24	2	75	3	--	--	1131	1	--	--	1247	10	48518
3	--	--	--	--	--	--	--	--	--	9	1	11	1	94	3	--	--	1129	1	--	--	1243	6	48540
4	--	--	--	--	--	--	--	4	1	--	--	47	4	65	2	--	--	1116	1	--	--	1232	8	48644
5	--	--	--	--	--	--	--	8	2	7	1	42	3	53	2	--	--	1122	1	--	--	1232	9	48645

AVERAGE HEAD

28.39 -- 430 347 407 625 361 1111 313 1716 251 2263 166 1878 71 306 7.4 -- -- 198 99 8873 1674 --

AVERAGE TAIL

-- -- -- 1 .6 4.4 1.2 7 1 27 2.2 69 248.4 .2 1103 1 -- -- 1220 9 --

CONFIDENTIAL
SECURITY INFORMATION

APPENDIX D

MASS DISTRIBUTION DATA

FRAGMENTATION OF HEAVY 120mm BRANDT MORTARS.																													
NUMBER AND WEIGHT OF RECOVERED FRAGMENTS																													
No.	Frag.														TOTAL														
	0-0.625	0.625-1.25	1.25-2.5	2.5-5	5-10	10-20	20-40	40-80	80-160	160-320	320-640	640+	Total	wt.	No.	Gms.	No.	Gms.	No.	Gms.	No.	Gms.	No.	Gms.	No.	Gms.	No.	Gms.	
Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	
Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	Wt.	
No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	
71	826	604	723	1031	593	1367	397	1965	304	2157	164	1304	48	783	14	828	8	-	-	333	1	----	-	225	-	52	11423	2304	47291
71	847	571	679	976	570	1495	442	1940	287	1583	118	1403	49	1282	23	976	8	171	1	-	----	-	218	-	46	11459	2223	47422	
71	704	528	611	930	536	1505	427	1710	253	2020	148	1576	60	1084	19	943	9	228	1	-	----	-	234	-	50	11462	2114	47481	
71	836	507	698	1026	593	1425	404	1838	263	1773	128	1016	35	1221	24	1133	11	204	1	-	----	-	236	-	55	11315	2212	47539	
71	701	511	581	1040	596	1660	483	2072	314	1975	149	1034	41	1170	22	736	7	167	1	-	----	-	234	-	58	11300	2252	47570	
-	-	-	-	-	4	1	-	-	-	-	-	119	4	-	-	-	-	-	-	-	-	-	1110	1	-	-	1233	6	47291
-	-	-	-	-	-	-	-	-	-	29	2	-	-	113	2	-	-	-	-	-	-	1093	1	-	-	-	1235	5	47422
-	-	1	1	-	-	6	2	7	1	58	4	-	-	64	1	-	-	-	-	-	-	1097	1	-	-	-	1233	10	47481
-	-	-	-	-	-	-	-	6	1	38	3	-	-	66	1	-	-	-	-	-	-	1128	1	-	-	-	1238	6	47539
-	-	-	-	-	5	2	18	3	-	-	-	43	2	-	-	88	1	-	-	-	-	1086	1	-	-	-	1240	9	47570
71	783	564	658	1001	578	1490	431	1905	284	1902	141	1267	47	1108	20	923	9	154	0.8	67	0.2	----	-	229	-	52	11392	2221	--
-	-	0.2	0.2	-	-	3	1	6	1	25	2	32	1.2	49	0.8	18	0.2	-	-	-	-	1102	1	-	-	-	1236	7	--

APPENDIX D

CONFIDENTIAL

Static Fragmentation of Brandt 120mm Mortar Ammunition

MFG REPORT NO. 9

TABLE VI

MASS DISTRIBUTION DATA

FRAGMENTATION OF HEAVY 120mm BRANDT MORTARS:

NUMBER AND WEIGHT OF RECOVERED FRAGMENTS

Rd. No.	Comp. or Wt. lb.	Fragmentation Data										Fuzes		TOTAL
		0-0.625	0.625-1.25	1.25-2.5	2.5-5	5-10	10-20	20-40	40-80	80-160	160-320	320-640	640+	
No.	lb.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	Gms. Wt.	No. Gms. Wt.

HEAD

1	37.38 9.71	826	604	723	1031	593	1367	397	1965	304	2157	164	1304	48	783	14	828	8	-	-	333	1	-----	-	225	52	11423	2304	4
2	37.49 9.71	847	571	579	976	570	1495	442	1940	287	1583	118	1403	49	1282	23	976	8	171	1	-	-	-----	-	218	46	11459	2223	4
3	37.54 9.71	704	528	611	930	536	1565	427	1710	253	2020	148	1576	60	1084	19	943	9	228	1	-	-	-----	-	234	50	11462	2114	4
4	37.10 9.71	836	607	698	1026	593	1425	404	1838	263	1773	128	1016	35	1221	24	1133	11	204	1	-	-	-----	-	236	55	11315	2212	4
5	37.37 9.71	701	511	581	1040	596	1660	483	2072	314	1975	149	1034	41	1170	22	736	7	167	1	-	-	-----	-	234	58	11300	2252	4

TAIL

1	-	-	-	-	-	-	4	1	-	-	-	-	119	4	-	-	-	-	-	-	-	-	1110	1	-	-	1233	6	4
2	-	-	-	-	-	-	-	-	-	-	29	2	-	-	113	2	-	-	-	-	-	-	1093	1	-	-	1235	5	4
3	-	-	1	-	-	-	6	2	7	1	58	4	-	-	64	1	-	-	-	-	-	-	1097	1	-	-	1233	10	4
4	-	-	-	-	-	-	-	-	6	1	38	3	-	-	66	1	-	-	-	-	-	-	1128	1	-	-	1238	6	4
5	-	-	-	-	-	-	5	2	18	3	-	-	43	2	-	-	88	1	-	-	-	-	1086	1	-	-	1240	9	4

AVERAGE HEAD

37.38 9.71	783	564	658	1001	578	1490	431	1905	284	1902	141	1267	47	1108	20	523	9	154	0.8	67	0.2	-----	-	229	52	11392	2221	
------------	-----	-----	-----	------	-----	------	-----	------	-----	------	-----	------	----	------	----	-----	---	-----	-----	----	-----	-------	---	-----	----	-------	------	--

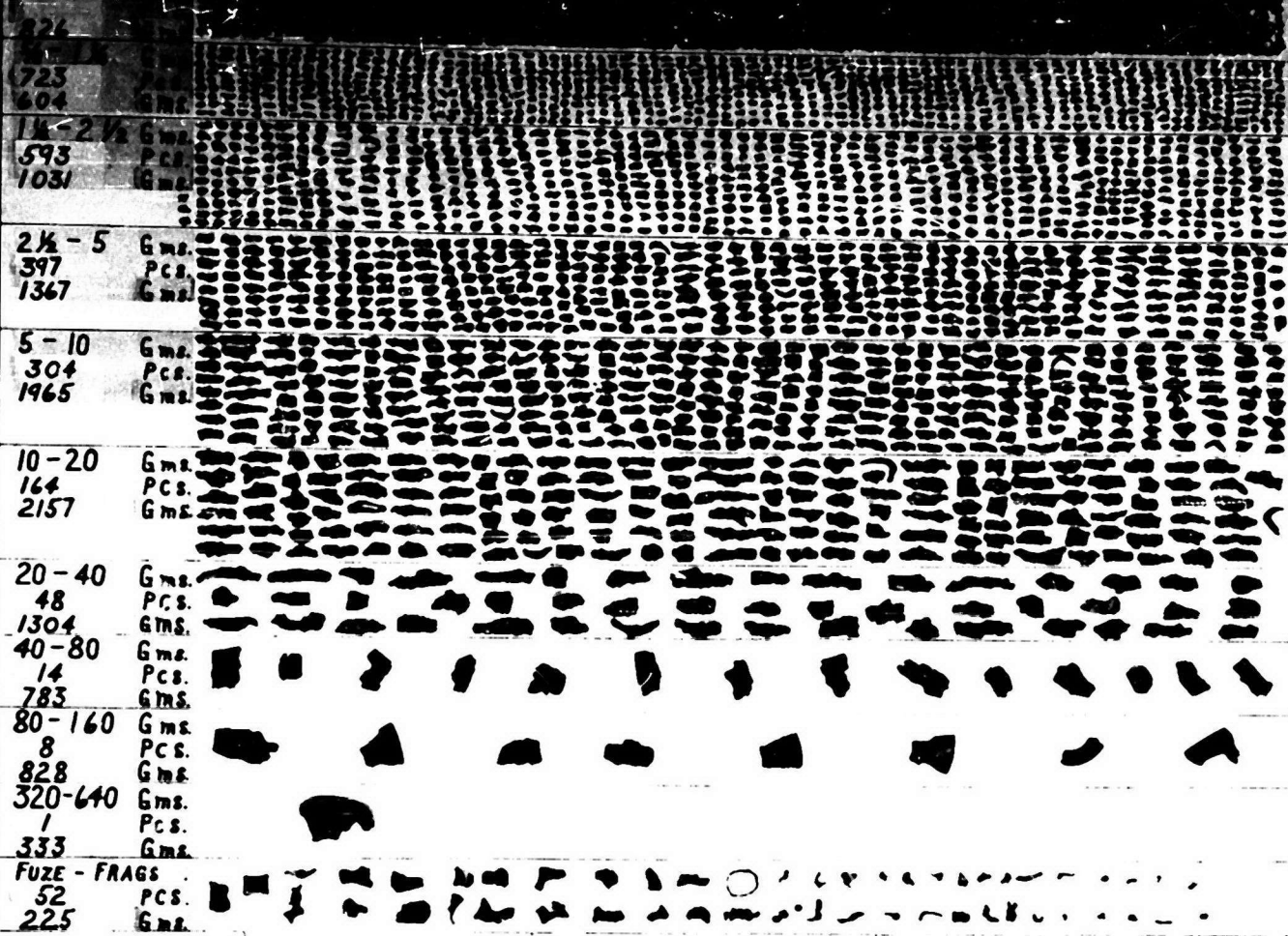
AVERAGE TAIL

-	-	-	0.2	0.2	-	-	3	1	6	1	25	2	32	1.2	4.9	0.8	18	0.2	-	-	-	-	1102	1	-	-	1236	7	
---	---	---	-----	-----	---	---	---	---	---	---	----	---	----	-----	-----	-----	----	-----	---	---	---	---	------	---	---	---	------	---	--

CONFIDENTIAL
SECURITY INFORMATION

APPENDIX D

47291



TAIL FRAGMENTS.	2 1/2 - 5	Gms.	20 - 40	Gms.	640 +	Gms.
	1	Pcs.	4	Pcs.	1	Pcs.
	4	Gms.	119	Gms.	1110	Gms.

SCALE 1"

NP-47291

9 JANUARY 1962

CONFIDENTIAL
SECURITY INFORMATION

Round No. 1, Mass Distribution of Heavy 120mm Granit Mortar.
Figure 4

5-10
287
1940

11-20
118
1583

20-40
49
1403

40-60
23
1282

80-160
8
976

160-320
1
171

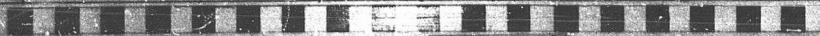
Fuze - FRAGS
46
218

TAIL
FRAGMENTS.

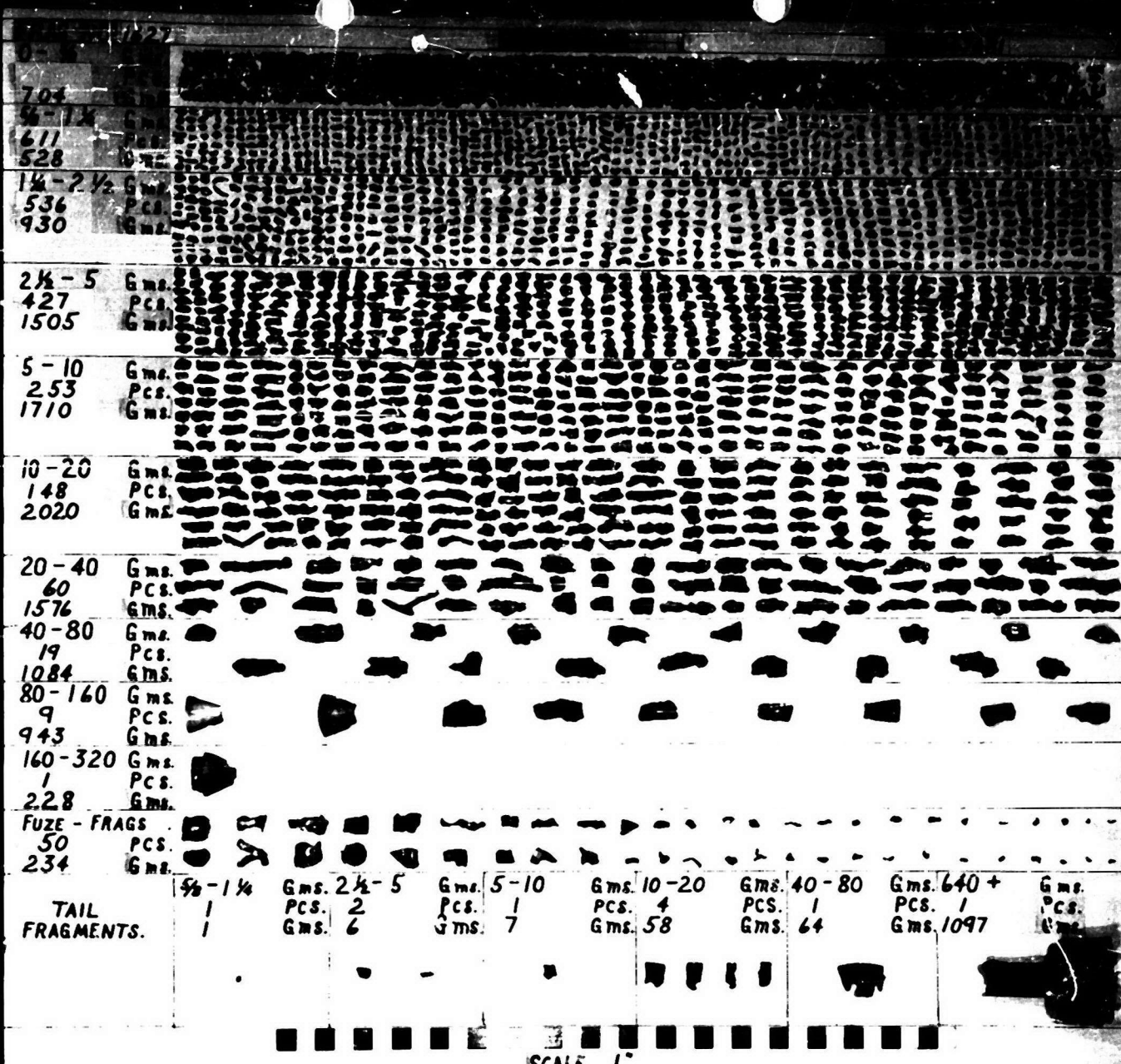
10-20 Gms.
2 Pcs.
29 Gms.

40-80 Gms.
2 Pcs.
113 Gms.

640+ Gms.
1 Pcs.
1093 Gms.



SCALE 1:1



NP9-47481

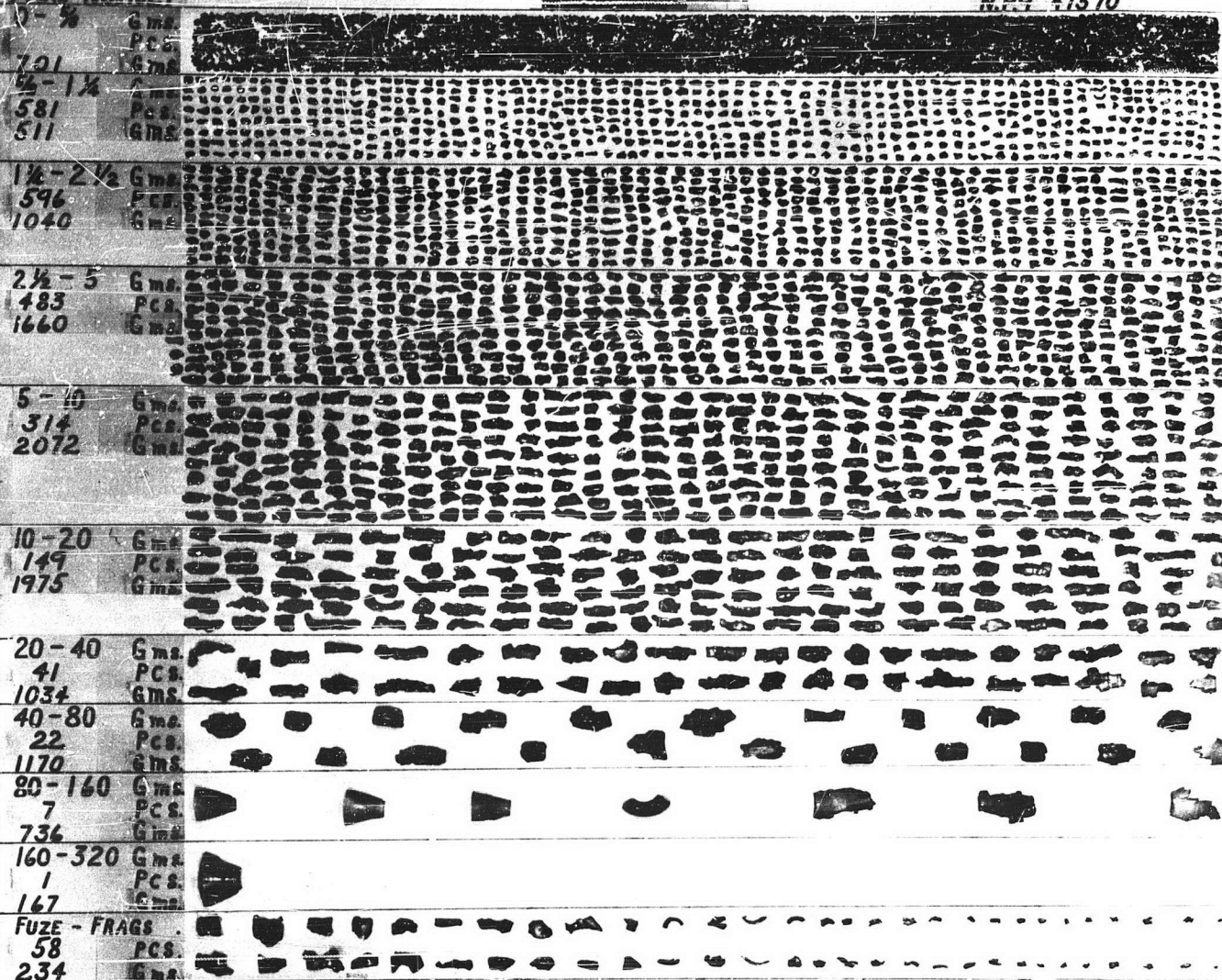
17 JANUARY 1952

CONFIDENTIAL
SECURITY INFORMATION

Round No. 3, Mass Distribution of Heavy 120mm Brandt Mortar.
Figure-6

FRAG NO 1624

NPG 47570



TAIL FRAGMENTS.	2 1/2 - 5 Gms	5 - 10 Gms	20 - 40 Gms	80 - 160 Gms	640 + Gms
	2	3	2	1	1
	5	18	43	88	1086

SCALE 1"

NPG-47570

25 JANUARY 1952

CONFIDENTIAL
SECURITY INFORMATION

Record No. 5, Mass Distribution of Heavy 120mm Brandt Mortar.

Figure 8

FRAG NO. 1630

N.P. 48314

0-2 Gms. 564
Pcs.

1/4-1/2 Gms. 485
Pcs. 418
Gms.

1/4-2 1/2 Gms. 412
Pcs. 722
Gms.

2 1/2-5 Gms. 329
Pcs. 1159
Gms.

5-10 Gms. 236
Pcs. 1581
Gms.

10-20 Gms. 163
Pcs. 2261
Gms.

20-40 Gms. 70
Pcs. 1754
Gms.

40-80 Gms. 2
Pcs. 83
Gms.

FUZE - FRAGS. 90
Pcs. 217
Gms.

TAIL FRAGMENTS.	1/4-2 1/2	Gms.	5-10	Gms.	20-40	Gms.	640 +	Gms.
	2	Pcs.	1	Pcs.	2	Pcs.	1	Pcs.
	3	Gms.	6	Gms.	58	Gms.	1019	Gms.
	2 1/2-5	Gms.	10-20	Gms.	40-80	Gms.		
	2	Pcs.	1	Pcs.	1	Pcs.		
	7	Gms.	12	Gms.	42	Gms.		

SCALE 1"

FRAG. NO. 1631

0 - 1/4 Gms. 461
PCs.
Gms.

1/4 - 1/2 Gms. 472
PCs. 392
Gms.

1/2 - 2 1/2 Gms. 389
PCs. 668
Gms.

2 1/2 - 5 Gms. 325
PCs. 1129
Gms.

5 - 10 Gms. 235
PCs. 1555
Gms.

10 - 20 Gms. 168
PCs. 2298
Gms.

20 - 40 Gms. 79
PCs. 2097
Gms.

40 - 80 Gms. 7
PCs. 315
Gms.

Fuz. - FR. Gms. 82
PCs. 187
Gms.

TAIL FRAGMENTS.	1 1/4 - 2 1/2	Gms. 1 PCs. 2 Gms.	5 - 10	Gms. 2 PCs. 12 Gms.	20 - 40	Gms. 3 PCs. 75 Gms.	640 +	Gms. 1 PCs. 1131 Gms.
	2 1/2 - 5	Gms. 1 PCs. 3 Gms.	10 - 20	Gms. 2 PCs. 24 Gms.				

SCALE 1"

11-41951

... ..
... ..
... ..

FRAG NO. 1632

0 - 1/4

Gms.
PCS.
Gms.

367

1/4 - 1/2

Gms.
PCS.
Gms.

324

278

1 1/2 - 2 1/2

Gms.
PCS.
Gms.

354

605

2 1/2 - 5

Gms.
PCS.
Gms.

320

1154

5 - 10

Gms.
PCS.
Gms.

293

2052

10 - 20

Gms.
PCS.
Gms.

152

2090

20 - 40

Gms.
PCS.
Gms.

62

1687

40 - 80

Gms.
PCS.
Gms.

9

247

FUZE - FRAGS

Gms.
PCS.
Gms.

88

223

TAIL
FRAGMENTS.

5 - 10

Gms.
Pcs.
Gms.

1

9

10 - 20

Gms.
Pcs.
Gms.

1

11

20 - 40

Gms.
Pcs.
Gms.

3

94

640 +

Gms.
Pcs.
Gms.

1

1129

SCALE 1"

REF ID: A5510

FEBRUARY 1952

CONFIDENTIAL

SECURITY INFORMATION

Round 1 - 3, Mass-Distribution of Light 120mm Brand Mortar.

Figure 11

N.P.9 48644

Gms.

G.M.S.

Gms.

PCS.
Gms

Gms.

PCS.
Cma

94

G ms.

ACS.

Q. 113.

Gms.

PCS.
C 700



Gms.

PCS.
Gms

and

Gms

Pcs.
Cms.

QMS

Gms

PCS
Gms

AGS

PCS

6. 7. 8.

Gms.

८६.

4 1113.

G m s.

P.C.S.

۷۱۱۵

Gms

PCs.

Gms.

Gms

Pcs.

Gms.

**TAIL
FRAGMENTS.**

SCALE 1"

NP9-48644

13 FEBRUARY 1952

~~CONFIDENTIAL~~
~~SECURITY INFORMATION~~

Round No. 4, Mass Distribution of Light 120mm Brandt Mortar.

Figure 12

FRAG. N° 1637

0 - 1/2 Gms.
374 PCS.
Gms.

1/2 - 1 1/4 Gms.
387 PCS.
328 Gms.

1 1/4 - 2 1/2 Gms.
323 PCS.
555 Gms.

2 1/2 - 5 Gms.
308 PCS.
1100 Gms.

5 - 10 Gms.
263 PCS.
1809 Gms.

10 - 20 Gms.
164 PCS.
2209 Gms.

20 - 40 Gms.
77 PCS.
2027 Gms.

40 - 80 Gms.
6 PCS.
290 Gms.

FUZE - FRAGS
107 PCS.
205 Gms.

TAIL FRAGMENTS.	2 1/2 - 5	5 - 10	10 - 20	20 - 40	640 +	
	Gms. 2	Gms. 1	Gms. 3	Gms. 2	Gms. 1	Gms.
	PCS. 8	PCS. 7	PCS. 42	PCS. 53	PCS. 1122	PCS.



SCALE 1"

CONFIDENTIAL

NPG REPORT NO. 968

Static Fragmentation of Brandt 120mm Mortar Ammunition

DISTRIBUTION (Continued)

Inst. for Cooperative Research JHU/1315 St. Paul St. Via: (District Chief, Phila. Ord District 1500 Chestnut St., Phila. 2, Pa. Attn: Mr. Edward R. C. Niles)	1
Commandant of the Marine Corps Headquarters, USMC Washington 25, D. C.	2
President, Marine Corps Equipment Board Quantico, Va.	2
Local:	
OT	1
OT2	1
OT-1	1
File	1