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TERRIER

BOOSTER FLIGHT TEST NUMBER 5

TECHNICAL MEMORANDUM NO. 55

White Sands Proving Ground
Las Cruces, New Mexico

cy #19

[redacted]

TERRIER BOOSTER NO. 5

5 December 1952

TECHNICAL [redacted] NO.

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SECRET SECURITY INFORMATION

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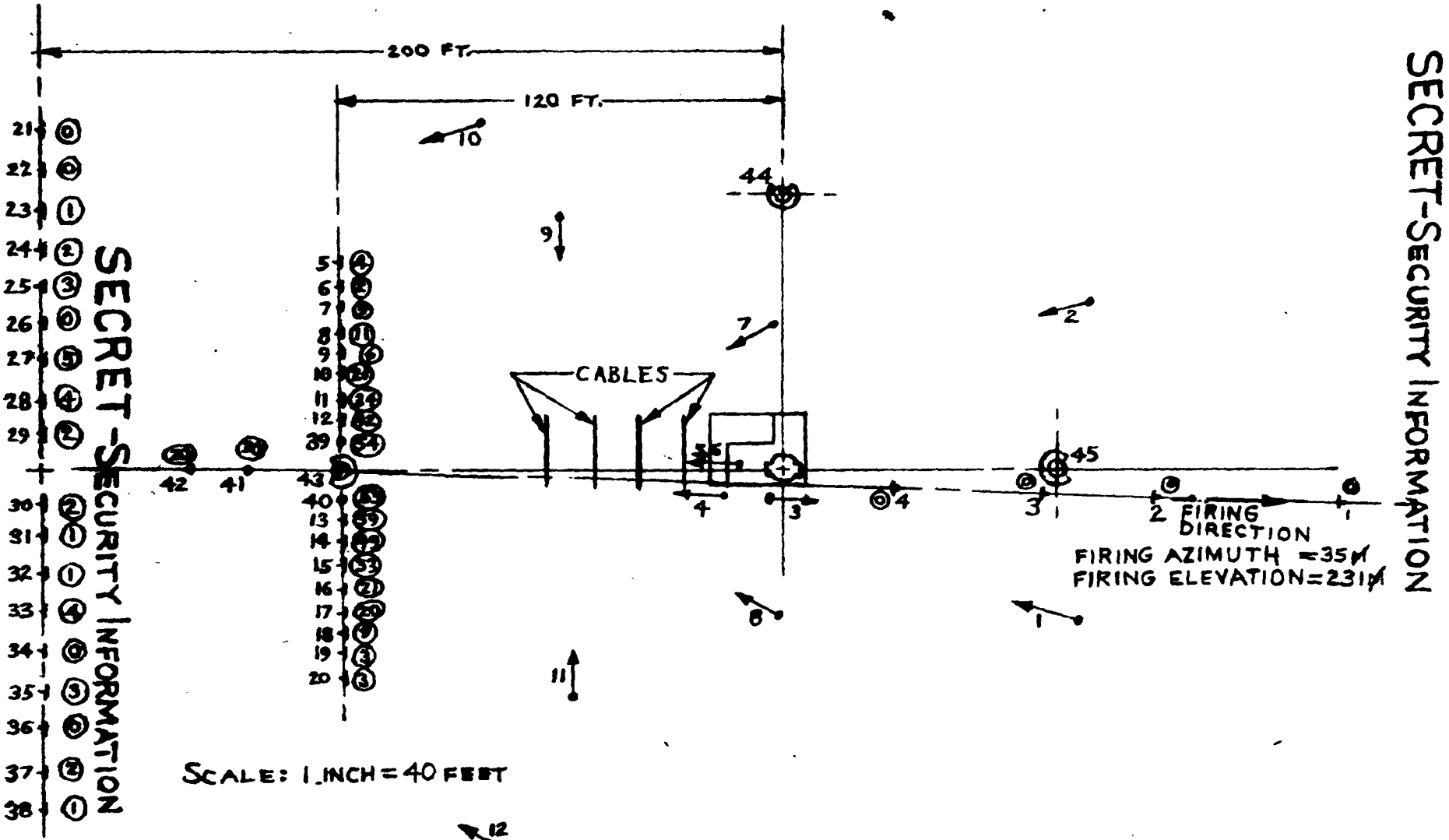

FIGURE 1:
TEST SITE LAYOUT
TERRIER BOOSTER SHOOT No. 5
1030, 7 NOV. 1952

NO.	KEY	DESCRIPTION
1-38		PISTOL TARGET. 6 FT. HIGH
39-42		IMPINGEMENT GAGE. 6 FT. POLE COVERED WITH PADDING & ROOFING PAPER.
43-45		SANDBAG BARRICADE. 6 FT. DIA. & 3 FT. HIGH.
	(2)	NO. IN CIRCLE INDICATES NO. OF ROCK HITS ON TARGET.
1-12		STILL CAMERA POSITION

INTRODUCTION

From information gathered in TERRIER Booster Rounds 1 through 5, it is apparent that the launcher will not move if there is no direct booster blast on the launcher base, and that excessive movement occurs if there is direct blast on the launcher. The minimum spacing for a launcher loaders' barricade is still open to question, as it appears that a barricade 120 feet away is marginal on account of noise level.

PURPOSE

The purpose of this firing was to determine blast effects on the launching area when the missile is fired at the lowest elevation angle normally encountered in the TERRIER System.

TEST SETUP

The test setup is shown in Figure 1, Test Site Layout. The booster plus a dummy-dummy missile (proper weight and center of gravity only) was fired from the right hand rail of the Rock Island Arsenal T121 (Pilot Model 2) Launcher at an elevation of 231 mils and an azimuth of 35 mils. The booster blast hit the ground aft of the launching pad.

A Rock Island Arsenal dummy missile was loaded on the left hand rail of the launcher and instrumented with velocity pickups.

A sound level measurement was made in Barricade No. 43 (Reference: Figure 1) 120 feet aft of the launcher center.

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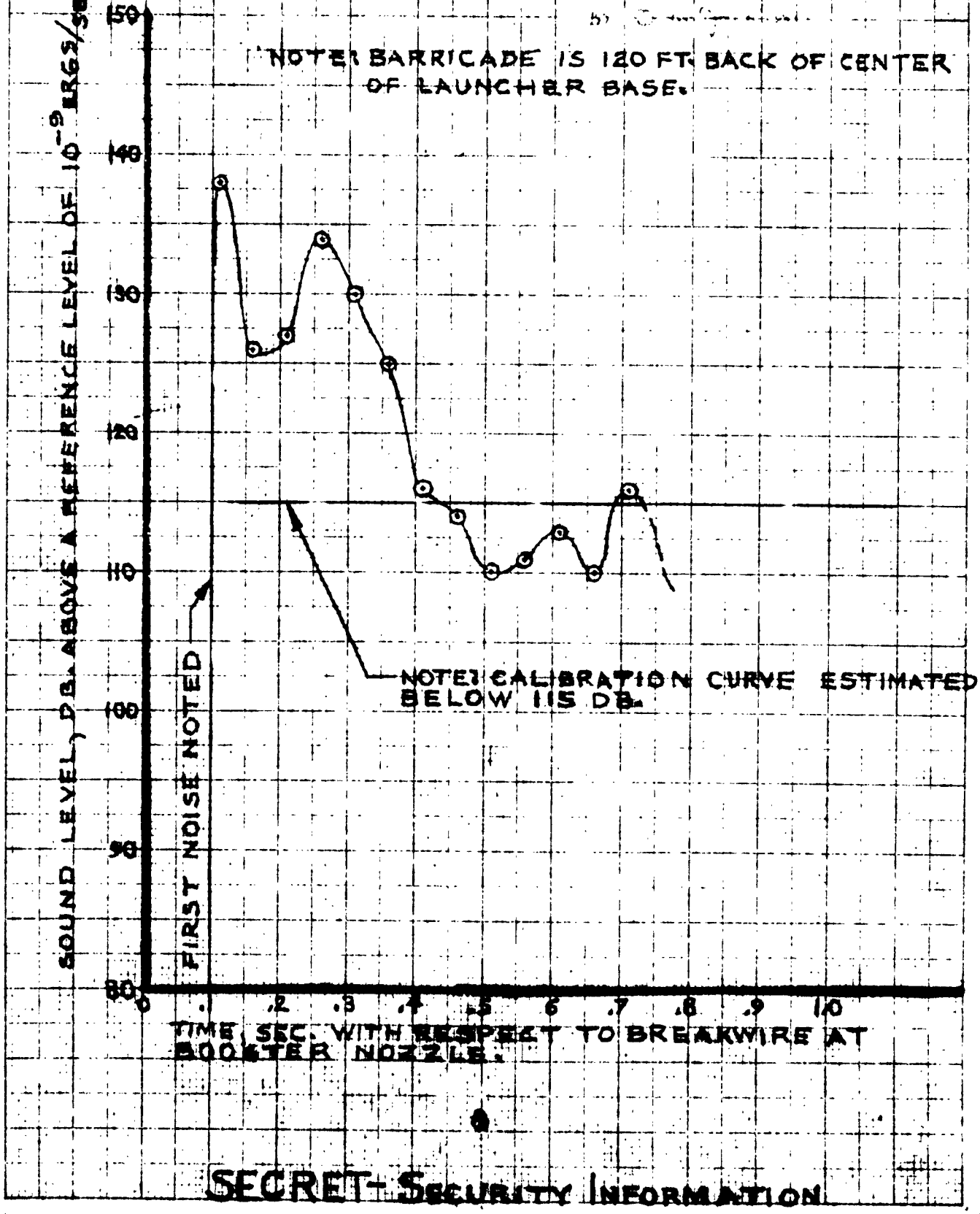
FIGURE 2:

SOUND LEVEL AT BARRICADE NO. 43

1050, 7 NOV. 1952 TERRIER BOOSTER SHOOT No. 5

NOTE: BARRICADE IS 120 FT. BACK OF CENTER OF LAUNCHER BASE.



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Impingement gages, and sandbag barricades were used as shown in Figure 1 to evaluate blast damage to the launching area.

Rocks were strewn back of the launcher to simulate debris.

TEST RESULTS

1. Launcher Movement

No launcher displacement occurred in this test. The velocity pickups on the Rock Island dummy missile indicated a fundamental vibration frequency of approximately 7.5 cycles per second which is well dampened out 1.5 seconds after firing.

2. Sound Level Measurements

Figure 2, Sound Level at Barricade No. 43, shows the sound level plotted as a function of time. A dead time of 0.1 seconds occurred before the blast noise reached the barricade which was 120 feet back of the center of the launcher base. The first peak of 138 db[1] occurred at 0.113 seconds[2], and the level varies from 134 db[1] to approximately 110 db[1] until 0.76 seconds[2].

3. Blast Damage to the Launching Area

a. The blast damage is given in detail by referring to Figure 1, Test Site Layout and Figure 3, Blast Damage.

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[1] Reference level is 10^{-9} ergs per second per square centimeter.

[2] Reference time is determined by a breakwire at the booster nozzle.

b. There is heavy damage to targets 120 feet back (Reference: Figure 1). Targets 200 feet back (Reference: Figure 1) and 22 degrees from the centerline of fire were punctured by flying rocks. Barricade No. 43, 120 feet away, had brush blown against it, but was not damaged.

Some instrumentation cables were torn loose and flung back against Barricade No. 43, and 19 conductor cable, secured to the ground back of the launcher and in the line of blast, was torn loose and strewn about. Brush and rocks were blown back on the Talos pad, and gravel was heard hitting the radar shield. Target No. 4, which was 30 feet in front, was torn to bits and strewn back as far as 130 feet by the blast.

4. Impact Data

The booster was found at an azimuth of 6° 47' 47.34" (120.8 mils) and at a ground range of 13,470.23 feet from the launcher. The dummy-dummy missile was not found.

5. Observed Events and Timing

The following preliminary statistical data (subject to reduction) is from TERRIER Booster No. 5, Preliminary Data Report No. 186, Flight Determination Laboratory:

a. Zero Time(W/R Blockhouse Timing): 10 Hours 34 minutes 25.77 seconds MST

b. Missile Lift: 0.054 seconds

c. Sequence of Events:

EVENT	TIME IN SECONDS W/R Blockhouse Timing	OTHER	SOURCE
Jet not visible	2.60 - 3.19		IGOR I
Last Jet	3.25		Bowen-Knapps
Position (W/R Launcher)	3.25	Altitude 352 ft. North 3,750 ft. East 80 ft.	N-1 and D Askanias
Velocity	3.25	2,163 feet per second	N-1 and D Askanias
Separation	3.39		

Table Number 1 - Preliminary Statistical Data

6. Booster Conditioning

The booster was conditioned for 72 hours in an ambient temperature of 77 degrees F. prior to the shoot.

7. Wind and Weather Report

Meterological data for 1035 MST, 7 November 1952 at the Desert Weather Station is as follows:

Surface Observation:	
Temperature	59.0 Dry Bulb 46.4 Wet Bulb
Dewpoint	33° F
Relative Humidity	37%
Clouds	7/10 Cirrostratus
Station Press	26.084 in. of HG

Surface wind from the North at 3 MPH

PIBAL WINDS	DIRECTION (Degrees)	SPEED(MPH)
Surface 3,991 feet	360	03
4,500	050	02
5,000	100	02
5,500	150	04
6,000	130	07
6,500	190	10
7,000	190	14
7,500	180	16
8,000	200	10
8,500	210	09
9,000	210	09
9,500	210	10
10,000	210	12

Table Number 2 - Meteorological Data

8. Booster Latch

A 35-mm Fastax camera was set up to record the action of the boooster latch during the initial launching phase in order to determine how it has been failing. The film record shows that the missile shifts forward approximately one inch relative to the booster before they leave the launcher rail. This shift shears the booster latch pin, and the latch falls to the ground. Presumably, the missile and booster are then again forced together by the thrust of the booster, but this effect cannot be observed in the limited field of view of the Fastax camera.

ANALYSIS OF RESULTS

It appears that high sound levels render marginal the use of a barricade 120 feet from the launcher. The level of pain is commonly given as 130 db, but only two pulses of short duration (Reference: Figure 2) above 130 db were noted. The necessity of further study is clearly indicated

There is some damage to targets 200 feet from the point of firing, indicating danger to personnel standing to the rear of the launcher. Targets at 120 feet are heavily peppered by rocks, but a sandbag barricade suffers no noticeable damage. At the firing elevation of 231 mils, the main force of the blast is deflected over the top of the 120 foot barricade by the ground. Targets to the front are damaged by blast pressure and not by debris. Cables must be well secured around

the launching site and protected near the launcher.

The lack of launcher movement and the vibration data available indicate that the launcher will be stable for the firing of a second missile at a two-second interval if no blast impinges on the launcher base.

The booster latch failure seems to be caused by an impact load on the missile. The source of this impact load may be the booster igniter. The latch is designed to hold the missile and booster together during loading operations only so that no operational difficulty, other than an adverse loading condition, is imposed. Further studies should be carried out to investigate the loads developed and the changes that may be necessary.

SUMMARY

1. The usage of a launcher loaders' barricade at 120 feet is marginal because of the sound level.

2. The booster latch problem needs further investigation regarding the loads involved in the initial firing of the booster.

3. The launcher seems stable enough for a salvo firing of two-second spacing.

FIGURE # 3

BLAST DAMAGE
TERRIER BOOSTER NO. 5

1030, 7 November 1952

TARGET NO.	DESCRIPTION
1	No noticeable damage.
2	No noticeable damage.
3	No holes. Target was emplaced in soft ground and was tilted 30 degrees by the blast.
4	Blown off pole. Parts found on front of launcher and 130 feet back of the launcher.
5	Three holes, one dent.
6	One hole, one dent.
7	Three holes, six dents.
8	Eight holes, three dents.
9	Three holes, three dents.
10	Twelve holes, nine dents.
11	Twenty-five holes, nine dents. Blast cracked center of target.
12	Twenty-seven holes, fifteen dents. Blast cracked center of target.
13	Forty-one holes, eight dents. Blasted backwards through 30 degree - angle
14	Thirty-four holes, fifteen dents. Blast cracked center of target.
15	Twenty-six holes, seven dents.
16	Fifteen holes, six dents. Blasted backwards through 30 degree - angle.
17	Fifteen holes, five dents.
18	Eight holes, one dent.
19	Two holes, one dent.
20	Two holes, one dent.
21	No damage.
22	No damage.
23	One hole.
24	Two holes.
25	Two holes, one dent.
26	No damage.
27	Three holes, two dents.
28	Two holes, two dents.
29	Two holes.
30	Two holes.
31	One hole.
32	One hole.

CONT'D

FIGURE #3, BLAST DAMAGE TERRIER BOOSTER NO. 5 (CONT'D)

TARGET NO.	DESCRIPTION
33	Three holes, one dent.
34	No damage.
35	One hole, two dents.
36	No damage.
37	One hole, one dent.
38	One dent.
39*	Blown over by blast. Fifty-four hits.
40*	Fifty-three hits.
41*	Thirty hits.
42*	Twenty hits.
43**	Brush thrown into barricade. No damage.
44**	No damage.
45**	No damage.

*Impingement gages.
**Sandbag barricades.
All others are pistol targets.